



S&T Newsletter

FROM THE DG'S DESK

SEASON'S GREETINGS to all our Readers and a very Happy and Joyous New Year 2022!!



The last year 2021 remained extremely challenging and still the shadow of Pandemic with its new strains of virus is hovering all over the world. However, in spite of the pandemic, the NAM S&T Centre was able to sustain its high level of performance this year also by successfully organizing a number of scientific events virtually; and a few new projects have also been planned for the near future. We are thankful to our devoted team at the NAM S&T Centre and also to the Focal Points of the Centre and the scientific community in our Member Countries.

I am pleased to mention that the NAM S&T Centre has signed a Memorandum of Understanding with the leading Educational Group of India - the JSS Academy of Higher Education & Research (JSS AHER), Mysuru for collaboration in regard to organizing joint S&T programmes and offering joint Fellowships and Scholarships for researchers and students from our Member Countries.

On the scientific activity front, during the last quarter of the year, the Centre successfully organised two important events virtually, (i) International Workshop on "Application of Ocean Science and Technology for the Practice of Sustainable Blue Economy in Developing Countries" during 8-9 November 2021 jointly with the Scientific Committee on Oceanic Research (SCOR), Newark, Delaware (USA); and (ii) International Workshop on "Technology Transfer and Commercialization", during 7-8 December 2021 jointly with the National Research and Innovation Agency (BRIN) of the Republic of Indonesia, Jakarta. The immense popularity of the programmes organised by the Centre all over the world is evident from the fact that a large number of experts and professionals from so many countries had participated in these events. In the first event, more than 200 scientists from 37 countries had participated, whereas there were 322 participants from 14 countries in the second programme.

I am also happy to announce that our book on "Dryland Agriculture" will be published soon by Springer Nature, Singapore and expected to be released in February 2022.

I am happy to mention that NAM S&T Centre has initiated the execution of its "Senior Visiting Fellowship Programme". Professor Dr. Ahmed Mohamed Khalil from Egypt has availed this Fellowship for which he had visited the University of Jordan, Amman during December 10-19, 2021.

The Centre has announced two more scientific events to be organized in the beginning of the year 2022 through online platforms- (i) International Workshop on 'Industry 4.0 and Energy Management' in cooperation with the Society of Energy Engineers and Managers (SEEM), India, and (ii) International Workshop on 'Gender Issues in Water Management in Developing Countries and Sustainable Development' in cooperation with the JSS AHER, Mysuru, India and the Scientific Committee on Problems of the Environment (SCOPE), Amstelveen, the Netherlands. We look forward to active participation of scientists, technologists, policy makers and other stakeholders from our Member Countries and other developing countries in these important events.

I would like to thank all our readers and stakeholders for their encouragement and unconditional support and for being a part of our remarkable journey.

Happy Reading!!

Amitava Bandopadhyay
(Amitava Bandopadhyay)
Director General



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

VOL. 31, No. 3
OCTOBER - DECEMBER 2021

Centre Organised

International Workshop on
APPLICATION OF OCEAN SCIENCE AND TECHNOLOGY FOR THE
PRACTICE OF SUSTAINABLE "BLUE ECONOMY" IN DEVELOPING COUNTRIES
8-9 November 2021
(Virtual Mode)

The ocean, with its huge water volume and covering 71% of Earth's surface, plays a major role in the life of humans, even those who live far from the coast. Humans benefit from the products harvested from the ocean ("goods") as well as "services" supplied by the ocean. Both goods and services from the ocean yield benefits that can be quantified in economic terms, although it is difficult to quantify and track economic benefits from the services.

A useful definition of Blue Economy is that used by the World Bank for a Sustainable Ocean Economy: "the sustainable use of ocean resources for economic growth, improved livelihoods and jobs while preserving the health of ocean ecosystems."

Advancement in scientific knowledge through research and observations is needed to maximize blue economic benefits in a sustainable manner. Ignoring science can lead to resource extraction that is not sustainable, damaging the resource, the

(Contd. on page 2)

International Workshop on
TECHNOLOGY TRANSFER AND COMMERCIALIZATION
7-8 December 2021
(Virtual Mode)

In recent years, there is a great emphasis on transferring inventions and technologies originating from non-profit research institutes such as universities and state owned research centers to industry through technology transfer/licensing or commercialization. The main objectives of this technology commercialization include leveraging R&D outcomes and intellectual assets, raise the accessibility of scientific outcomes to a broad range of consumers, development of new services and products ready for commercialization, and last but not the least, to intensify industrial competition.

Considering the importance of the subject, the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi, India jointly with the National Research and Innovation Agency of the Republic of Indonesia, Jakarta organized an International Workshop on "Technology Transfer and Commercialization" during 7-8 December 2021 in Virtual-Mode.

(Contd. on page 4)

(Contd. from Page 1 - Blue Economy)

natural environment, and human society in ways that may reduce the benefits available. To sustain blue economies, adequate observing systems must be deployed and capacity for science and observations must be built in countries that rely on blue economies.

Considering the importance of the subject, the Centre for Science and Technology of the Non-Aligned & Other Developing Countries (NAM S&T Centre), New Delhi, jointly with the Scientific Committee on Oceanic Research (SCOR), Newark, Delaware (USA) organized an International Workshop on ***Application of Ocean Science and Technology for the Practice of Sustainable “Blue Economy” in Developing Countries*** during 8-9 November 2021. The Workshop was hosted by SCOR and organized in **Virtual Mode**.

The two-day *Exposure Workshop* was primarily structured for participants from developing countries. The objective of the Workshop was to bring together policy makers, researchers and academicians active in promoting sustainable use of coastal and marine resources.

The Workshop was planned and designed in a manner to form an amalgamation of live and recorded presentations, so that the participants from countries in different time zones could benefit from the Workshop.

208 scientists, researchers, government officials, policy makers, marine-sector professionals, managers and representatives from 37 developing as well as developed countries - Bangladesh, Belize, Brazil, Cambodia, Cameroon, Chile, China, Colombia, Denmark, Egypt, France, Germany, India, Iraq, Kenya, Lebanon, Malaysia, Mauritius, Mozambique, Morocco, Myanmar, Namibia, Nigeria, Oman, Portugal, Philippines, Samoa, Saudi Arabia, Senegal, South Africa, Spain, Sri Lanka, Thailand, Turkey, Trinidad and Tobago, United Kingdom and the United States of America - participated in the Workshop.

In addition, as a follow up of the MoU that was signed between the NAM S&T Centre and Indian Ocean Rim Association (IORA), Mauritius in November 2019 on “*Application of Science, Technology and Innovation (STI) for Sustainable Development*”, IORA was invited to join the Workshop to encourage participation by experts from its Member States. More than 20 experts nominated by IORA Member States actively participated in the Workshop.

The Inaugural Session started with a Welcome Address by the Director General, NAM S&T Centre, **Dr. Amitava Bandopadhyay**. In his address, Dr. Bandopadhyay welcomed the participants and provided an “*Overview about the NAM S&T Centre*”, describing the organizational structure and major scientific activities of the Centre. Further, he explained in detail how the Workshop was planned in anticipation of the upcoming Monograph of the Centre on ‘**Blue Economy - An Ocean Science Perspective**’ being published through Springer Nature, Singapore.

Executive Director of SCOR, **Dr. Patricia Miloslavich**, and the Chair of SCOR Capacity Development Committee, **Dr. Claudia Benitez Nelson**, spoke about “*SCOR Activities and Engagement Opportunities*”. They explained that SCOR is an international non-governmental organization engaged in advancing ocean sciences across disciplines and through international cooperation. SCOR's mission is to address global and multidisciplinary oceanic issues. SCOR promotes international cooperation through planning and conducting oceanographic research. SCOR also promotes capacity building in ocean science and technology for developing countries.

Following the SCOR Presentation, the Coordinators and Organizers of the Workshop - **Dr. Edward R. Urban Jr.**, Former Executive Director, SCOR; and **Dr. Venugopalan Ittekkot**, Former Director, Leibniz Center for Tropical Marine Research (ZMT), Bremen, Germany gave a detailed “*Introduction to the Workshop*”. They highlighted the goals of the Workshop which were (i) to explore the use and benefits of science and technology for promoting blue economy; (ii) to serve as a capacity development exercise for participants from the NAM and SCOR countries; and (iii) to gather additional inputs from the global community on the topics of book chapters that were presented during the Workshop. The expected outcome was to assess how well these goals were met through a feedback survey.

Afterwards, Dr. Urban gave a detailed presentation on “*Why it is Important to Consider the Role of Ocean Science and Technology in the Blue Economy*”. He explained how ocean science and technology are significant for using natural resources sustainably and to reduce the negative effects and threats related to the coastal resources.

On November 8, **Session-1** started with a presentation on “*Coral Reefs and Blue Economy*” by **Dr. M.F.M. Fairoz**, Dean, Faculty of Fisheries and Ocean Sciences, Ocean University of Sri Lanka, Sri Lanka. In his presentation, Dr. Fairoz highlighted that there is a need for good science to protect coral reefs, as we move towards a blue economy. Also, application of technology (like artificial intelligence) in coral reef science has much to offer to ocean/coral reef managers.

The topic on “*Mangroves and Seagrass*” was addressed in presentations by Dr. Marília Cunha Lignon, Universidade de do Estadual Paulista; Dr. Luis Américo Conti, University of São Paulo and Dr. Karine Matos Magalhães, Universidade Federal Rural de Pernambuco, Brazil.

Dr. Marília Cunha Lignon delivered a talk on “*Mangroves Ecosystem Services*”. She explained how mangroves are important for providing ecosystem services such as recreational, spiritual and cultural, timber and forest products, fisheries, climate regulation, shoreline stabilization, coastal protection and water quality maintenance. She further linked these mangrove ecosystem services to Sustainable Development Goals. Adding to the economic valuation of mangrove forest ecosystems, in Jamaica, Martinique and Guadeloupe, 62% of local stakeholders use mangroves directly for their tourism businesses.

Dr. Luis Américo Conti engaged the participants' attention with his presentation on “*Blue Carbon and Mangroves – Mapping and Monitoring Approaches and Applications*”. He explained that mangrove blue carbon sequestration and storage could play an important role in climate change mitigation and in blue carbon markets.

(Contd. from Page 2 - Blue Economy)

Dr. Karine Matos Magalhães talked about “*Seagrass in Context to Blue Economy*”. She summarized that blue carbon ecosystems - seagrasses and mangroves - have a huge potential for blue economy markets; however, it is important to incorporate the ecosystem services value into the financial frameworks, map the blue carbon ecosystems and engage both the stakeholders and the community in the process of protection and restoration of these ecosystems.

Dr. Teresa Cerveira Borges, CCMAR, University of Algarve, Faro, Portugal delivered an interesting presentation on “*Coastal Fisheries*”. She emphasized “equity-focused capacity” for an equitable and sustainable blue economy. Also, the need for strengthening ocean governance, greater representation by SIDS, civil society and indigenous people in decision-making process was put into focus. She concluded that sustainable fisheries have a great potential to make long-term contributions to blue economy.

Dr. Bocho Xu, Ocean University of China, Qingdao, China, delivered a lecture on “*Groundwater Extraction and River Regulation Effects on Coastal Zones in Light of Climate Change and Anthropogenic Activities*”. Dr. Xu, in his presentation, described the effects of groundwater extraction and river regulation in coastal zones. He also emphasized conserving freshwater and coastal resources in a changing climate and the importance of S&T for better understanding and management of coastal zones.

Dr. Mridula Srinivasan, National Oceanic and Atmospheric Administration, USA given a presentation titled “*Tourism and the Blue Economy: Perspectives from the Mascarene, Caribbean and Pacific Islands*”. In her presentation, Dr. Srinivasan highlighted that wildlife tourism, especially whale watching, has become a significant and profitable attraction globally and by far the most prominent component of marine tourism. However, many short-and long-term impacts have been observed on habitats and marine animals exposed to tourism operations. Economic indicators are the main metric of tourism impacts. According to the IPCC, climate change will disproportionately impact island nations, which has implications on tourism.

Afterwards, **Dr. Ravenna L. Matos**, Universidade Federal da Bahia, Brazil talked on the topic “*Oil and Gas in a Blue Economy*”. Dr. Matos pointed out that many Oil and Gas (O&G) companies are working towards transition into a low-carbon energy system. However, these companies need to make big choices to respond to the changes in future. There is a need for international collaboration among the interdisciplinary groups for faster development and sustainable use of technology for tackling various energy and environmental problems.

The theme “*Minerals: Phosphates, Diamonds, and Placer Minerals*” was covered by Dr. Gabriel Filippelli, Indiana University-Purdue University, Indianapolis, USA; Dr. Absai Vatuva, Department of Geosciences, University of Namibia and Dr. Palaniraj Udayaganesan, Alagappa Govt. Arts College, Karaikudi, Tamil Nadu, India.

Dr. Absai Vatuva delivered a presentation on “*Blue Economy: An Ocean Science Perspective on Coastal Diamonds*”. In his presentation, he concluded that Namibia is the leading nation in marine diamond mining, but the technology is largely imported. The country must continue to develop capacity in research and innovation. National regulatory bodies must work with the international community to equip its workforce in order to implement, manage and regulate activities related to coastal mining. There is a need for institutions of higher education to strengthen research and program offerings related to marine mining, geosciences, green hydrogen, etc.

Dr. Palaniraj Udayaganesan spoke on the topic on “*Coastal and Nearshore Minerals: Blue Economy Potential and Prospects*”. He discussed the economic importance of placer deposits and highlighted that about 96% of zircon, 90% of rutile and diamonds and 30% of ilmenite and 80% of monazite produced globally are from placer deposits.

Continuing the discussion, **Dr. Gabriel Filippelli** spoke on the topic “*Phosphate Rock Resources – Is Seabed Mining in our Future?*” He emphasized the technologies for sustainable seabed phosphate mining and the legitimate concerns of seabed mining including contamination, ecosystem destruction and impacts on fisheries and local populations.

All the above presentations were followed by a General Discussion.

During November 8, **Session-2**, all the live and recorded presentations were repeated for participants from countries in different time zones.

On November 9, **Session-1** began with a talk on “*Coastal Pollution*” by **Dr. Guizhi Wang**, State Key Laboratory of Marine Environmental Science and College of Ocean and Earth Science, Xiamen University, Xiamen, China. She emphasized that global climatic changes, coupled with regional human activities are amplifying pressure on coastal ecosystems. The knowledge and capacity building gaps must be bridged for reducing and managing coastal pollution.

An interesting talk on “*Harmful Algae*” was delivered by **Dr. Elisa Berdalet**, Institut de Ciències del Mar, Barcelona, Spain and **Dr. Catharina Alves-de Souza**, University of North Carolina, Wilmington, USA. In their presentations, Drs. Berdalet and Alves-de Souza defined “*Harmful Algal Blooms (HABs)*” as naturally occurring events associated with bloom (proliferation) of microalgae, cyanobacteria or macroalgae, perceived by humans as harmful to human health and ocean ecosystems. They further described the relation of HABs to the social, economic and environmental dimensions of blue economy. Lastly, they introduced the participants to the “Global HAB Program 2016-2025” sponsored jointly by SCOR and IOC of UNESCO.

A presentation on “*Climate Change and Coastal Systems*” was given by **Dr. P.N. Vinayachandran**, Indian Institute of Science, Bangalore, India and **Dr. Denis Chang Seng**, Intergovernmental Oceanographic Commission, UNESCO. Dr. Vinayachandran highlighted the importance of coastal zones to humankind. He indicated that the deterioration of coastal systems due to impact of climate change should be expected, but mitigated. Natural and healthy coastal ecosystems (e.g., mangroves) offer better protection to coastal habitats. Systematic observations are required for proper assessment and development of strategies for mitigation.

(Contd. from Page 3 - Blue Economy)

A paper on “Role of Sustained Ocean Observations to the Society and Blue Economy” was presented by **Dr. Tammy Morris**, South African Weather Service (SAWS), South Africa. Dr. Morris highlighted the relevance and benefits of using ocean observing systems such as: marine meteorological services; safety, shipping and recreation; hazard warnings and marine ecosystem services to benefit society and promote blue economy.

Dr. Rebecca Zitoun, Geomar Helmholtz Centre for Ocean Research Kiel, Germany delivered a talk on “Developing Capacity for Ocean Science and Technology”. Emphasizing the importance of capacity building in the blue economy, Dr. Zitoun said that the current state of ocean science capacity limits the growth and benefits of the sustainable blue economy. Focus should be given on achieving SDG 14, securing economic and social stability and contributing to other SDGs. For capacity development to achieve a blue economy, we need to improve livelihoods, create jobs, preserve ecosystem health and use ocean resources sustainably.

Lastly, **Dr. Urban** and **Dr. Ittekkot** gave a presentation on “Science for Sustainability: Outlook for the Ocean”, summarizing the status of using science to develop and sustain national blue economies. Using ocean resources to fuel national economies is a well-established practice, from before the time the term “blue economy” was developed. The concept of blue economy has evolved in the literature to embrace the triple goals of economic development, environmental protection, and social equity. Implementation of the triple goals has been slow, with most emphasis on economic development, and inadequate application of ocean science and technology in most places. National commitments to, and investments in, the triple goals of blue economy have not been adequate in many countries to meet blue economy needs. Valuing resources, both tangible and intangible, is a key element of establishing blue economies. SDGs provide a global context for the implementation of blue economic approaches at national levels and the UN Decade on Ocean Science for Sustainable Development should help provide some of the necessary foundational information that will make blue economy goals more achievable.

During November 9, **Session-2**, all the live and recorded presentations were repeated for participants from countries in different time-zones.

The Workshop provided a platform for nuanced conversation and tailored discussion to catalyse blue economy. Dedicated tracks on **resources, threats, observations and capacity development** provided insights focused on coral reefs, seagrasses and mangroves, coastal fisheries, tourism, oil and gas, minerals, coastal pollution, harmful algae, climate change and coastal ecosystems, sustained ocean observations and capacity development for ocean science and technology. Pressing concerns for the ocean to seek solutions for climate change and declining biodiversity were brought into focus. It was concluded that only through appropriate scientific understanding and use of sustainable technologies, blue economy can be developed and sustained worldwide. Reframing the relationship of humans with the ocean can generate momentum to increase economic prosperity and ocean restoration in the future.

(Contd. from Page 1 - Technology Transfer)

The International Workshop was organized over 2 days period to share knowledge and best practices adopted by various NAM and other developing countries - to develop synergy, exchange knowledge and ideas on technology transfer and commercialization, and provide solutions with a broader perspective in developing countries with 24 Plenary Lectures, 6 Keynote Lectures, and Group Discussion on “Adoption of Resolution”, besides the Inaugural, and Concluding Sessions.

The Workshop brought together scientists, researchers, and policy makers from the developing countries and other representatives from government, academia and industry to discuss ways in strengthening the ecosystem for technology research and development (R&D) as well as technology transfer and commercialization.

The Workshop was attended by 322 scientists, researchers, academicians, policy makers and other professionals from 14 countries namely; Egypt, India, Iran, Iraq, Malaysia, Mauritius, Myanmar, Pakistan, Palestine, Sri Lanka, South Africa, Zambia and Zimbabwe including the host country Indonesia.

INAUGURAL SESSION

The Workshop Inaugural Session was initiated with a Welcome Address by the Master of Ceremony, **Ms. Maftuha Rifika Auliya**.

Mrs. Nur Tri Aries Suestiningtyas, Executive Secretary, National Research and Innovation Agency (BRIN) welcomed all the participants and the experts from the NAM countries and extended her greetings to **Dr. Amitava Bandopadhyay**, Director General, Centre for Science and Technology of the Non-Aligned and other Developing Countries (NAM S&T Centre) for agreeing to conduct this international Workshop on a topic of such paramount importance.

This was followed by a welcome address by Dr. Amitava Bandopadhyay who welcomed the delegates and briefly discussed the idea behind conducting this workshop. He wished everyone a very fruitful and productive exchange of knowledge during the Workshop, and thanked **Dr. H.E Laksana Tri Handoko**, Chairman of the National Research and Innovation Agency (BRIN), Mrs. Nur Tri Aries Suestiningtyas, colleagues from BRIN, Special Invitees, Keynote Speakers, and all the participants and distinguished guests.

Dr. H.E Laksana Tri Handoko, in his opening remarks explained how this workshop is a great opportunity to acknowledge the challenges, and how the experts and researchers can overcome those challenges by discussing and sharing ideas with each other. He also pointed out how the technology played an important role during the pandemic, and what else can be done for prevention and awareness for other similar harsh situations. In the end of his remarks, he acknowledged the efforts and the inputs of the NAM S&T Centre for supporting the experts and researchers and providing them the ground to bring out the best for the improvement in society.

(Contd. from Page 4 - Technology Transfer)

TECHNICAL SESSIONS

Day 1

The first Session of **Day 1** of the International Workshop commenced with the **Keynote Lecture I** delivered by **Mr. Buti Cecil Masoka**, Director, Global Projects, Department of Science and Innovation; and Acting Chief Director, Department of Higher Education and Training, South Africa on the topic “*International Technology Transfer (ITT), Absorptive Capacity and Technological Capabilities*”. He mentioned about the history of the Non-Alignment Movement, and how crucial it turned out to be for the 'Global South' in Science engagement. He further discussed the South Africa's Policy Evolution Timeline starting from the year 1996. He also briefly discussed Economic-Developmental-Innovation, Emerging technologies in African Business, Global skills gap and highlighted some of the important issues for consideration.

Keynote Lecture II was delivered by **Prof. Ir. Gede Wenten**, Vice Rector for Research and Innovation, Institut Teknologi Bandung (ITB)/Member of the Board of Advisor BRIN, Indonesia on the topic “*Technology Transfer and Commercialization: Case Study*”. In his lecture, he talked about a few of the 15 technologies that are patented and commercialized by him during his career, some of which include: Backshock Process and Membrane Technologies, like - Carbon Nano-tube Membrane, Aquaporin Membrane, Hydrogen Membrane, etc.

Keynote Lecture III titled “*Technology Transfer and Commercialization in the context of Developing Countries - The Role of Publicly Funded Organizations*” was presented by **Dr. Sudeep Kumar**, Director - Research and Innovation, Indraprastha University, New Delhi; and Former Outstanding Scientist, Council of Scientific & Industrial Research (CSIR), India. In his lecture, he mentioned the importance of the indigenous technologies, particularly highlighting its importance on the socio-economic development especially for the developing countries. He spoke about CSIR's core strengths and explained how it connects with the Industry, referring to the importance of innovation in the real-world for the overall growth. He also explained the patent system and licensing by giving examples of few technologies developed by CSIR, like – Waterless Chrome Tanning Technology.

This lecture was followed by a comfort break after which workshop was resumed in 2 parallel sessions - Breakout Room 1 and Breakout Room 2. The attendees were allowed to choose the sessions they wanted to attend.

The **Breakout Room 1** was moderated by **Mr. Dadan Nugraha**, BRIN, Indonesia. He welcomed all the participants and gave a brief introduction about all the 6 presenters' of Breakout Room 1.

Six papers were presented in Room 1. The first paper was titled “*Incubators as Enabler Business Ecosystem for Technology Commercialization in Indonesian Growing startups*” and was presented by Prof. **Dr. Ir. Hadia Karia Purwadaria**, Professor of Food and Agricultural Product, Processing Engineering, Bogor Agricultural University (IPB); Indonesian Business Incubator Association (AIBI), Indonesia. He spoke on the Development of Technology Business Incubators (TBIs) and AIBI, Government Support and TBI Business Ecosystem, and enabling competition among Tenant Startups.

This was followed by a presentation given by **Mr. Seyed Saeed Eshraghi Naeini**, Senior Expert of Commercialization & Intellectual Property Office, Iranian Research Organization for Science and Technology (IROST), Iran on “*Challenges of Technology Valuation in Research Organization*”. He explained to everyone present about technology valuation and its significance. He also briefly explained the most common valuation methods that are used in Iran.

A paper titled “*Knowledge Management for Technology Incubation*” was presented by **Dr. Ir. Jarot S Suroso**, Associate Professor, Magister Management of Information System, BINUS University, Indonesia. In his presentation, he talked about the Knowledge Management, Incubation Technology and Mapping the Knowledge Management for technology incubation.

Thereafter, a paper was presented by **Mr. Tafirenyika Makandwa**, Principal Science and Technology Officer, Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development of Zimbabwe on “*Technology Transfer Approach for the Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development of Zimbabwe*”. He talked about the Heritage Based Education 5.0, and Strategic Objectives of Technology Transfer Department in Zimbabwe.

Dr. Cho Min Han, Director, Department of Research and Innovation, Ministry of Science and Technology, Myanmar made a presentation on “*Role of Technology Transfer Offices in University and Research Center-Industry Interactions*”. He in a few words explained about Science, Technology and Innovation Law in Myanmar and the characteristics of Industrial Partners, Research Centers, and theoretical background of research centers and industry relationships.

Following this presentation, a paper titled “*IP Analytics for strategic Planning and Technology Transfer*” was presented by **Dr. Pavan Kumar**, Senior Scientist, Patent Officer and Convener of SPBD, Centres, CSIR-IMMT, Bhubaneswar, Odisha, India. In his presentation, he underlined the importance and need to bridge the gap between IP/Technology Generation and Utilization. He also highlighted the factors of concern from IP/Technology Donor.

Parallel to this, sessions in the **Breakout Room 2** were monitored by **Dr. Amir Faisal Manurung**, BRIN Indonesia. He introduced all the 6 speakers to the participants present in Room 2, before the session began.

The first speaker was **Prof. Dr. Ni Nyoman Tri Puspaningsih**, Vice Rector for Research, Innovation and Community Development, Universitas Airlangga, Indonesia, who presented a paper on “*Maningful Triple Helix Advantages Linkage for National Innovation Development: UNAIR Case Study*”. He expound in detail about the 3 pillars of Higher Education Institutions (HEIs). He explained that ‘**SMART**’ University stands for **S**ustainability, **M**eaningful Research, **A**dvancing Innovation, **E**nterprising & Industry Linkage, **R**esponsive, and **T**echnology. After this presentation, a paper titled “*Technology*”

(Contd. from Page 5 - Technology Transfer)

Transfer & Commercialization from Higher Education Institutions in India: A Case Study of Amity University” was presented by **Ms. Meenakshi Kanaujia**, Assistant Director, Directorate of Innovation and Technology Transfer, Amity University, Noida, India. She immaculately discussed on the subject of Innovation Ecosystem. She then talked about some of the technologies developed like Herbal Mosquito Repellent, Electricity Generation and Waste Water Treatment, Herbal Hand-sanitizer, Rootonic, etc.

Dr. Peer Mohamed, Senior Lecturer, and Manager, UKM-YSD Chair for Sustainability, Faculty of Engineering and Built Environment, Universiti Kebangsaan, Malaysia then made a presentation on *“Sustainable Integrated Palm Oil Waste Biomass Management: Zero Waste Technology”*. He mentioned that Malaysia is the second-largest crude palm oil producer in the world and fulfils nearly half of all demand for the oil. Palm oil is the most important product from Malaysia that has helped to change the scenario of its agriculture and economy. Therefore, Dr. Peer emphasized on the importance of Zero Waste Management Technology for the Palm Oil Industry.

Dr. Subhendu Chakrabarti, Chief Scientist and Head, Knowledge Portfolio Management Department, CSIR-CLRI, Chennai, India gave a presentation on *“Technology Commercialization in Traditional Industry with Special Reference to Leather Sector”*. In his lecture, he described different types of knowledge. He in brief highlighted the differences between the traditional versus modern knowledge system. He explained the Commercialization Models and Trade Perspectives with the help of an example from the Leather Industry.

Followed by this, a paper titled *“SmartBite™ Maniodix HEALTH Products: An Innovative Line of Healthful, Easy-to-Use, Affordable, Low-Fat, Tasty and High-Protein Breakfast for the Mauritian Market”* was presented by **Dr. Hudaa Neetoo**, Senior Lecturer in Microbiology, University of Mauritius, Mauritius. He talked about the Mauritius Food Security and Nutrition Status. He further discussed about the role that Mauritian Universities played in transitional projects like *SmartBite*.

After Dr. Hudaa's presentation, Day 1 was concluded with a short Question-Answer/Comprehensive Discussion round guided by the Moderator.

Day 2

The day began with welcome remarks by **Ms. Dara**, Master of Ceremony, BRIN, Indonesia.

The **Keynote Lecture I** of Day 2 was delivered by **Dr. Wan Raihana Wan Aasim**, Vice President, Technology & Innovation Fund, Malaysian Technology Development Corporation (MTDC), Malaysia on a paper titled *“Lab to Market-Challenges, Tips and Tricks”*. She brilliantly talked about the common issues/challenges that are encountered at the time of bringing out a product from *Laboratory to Market*. Some factors that create a huge impact during the process of commercialization are - Environment, Marketing, Financing and Management. She also discussed the ideas, and suggested some tips and tricks that can be taken in account during the complete process.

Keynote Lecture II titled *“Nanotechnology Development and Commercialization in Indonesia Based on Bioresources: Case Study of Nanotechnology Transfer in Indonesia”* was presented by **Prof. Nurul Taufiqu Rochman**, Director of Research Center for Metallurgy and Materials, BRIN, Indonesia. While discussing transfer of nanotechnology from laboratory to industry, he said that Nanotechnology would revolutionize many sectors including agriculture and replace current technologies for betterment.

Keynote lecture III titled *“Delivering Innovations into Community: Practices from UGM”* was delivered by **Dr. Ika Dewi Ana**, Vice Rector for Research and Community Development, Universitas Gadjah Mada (UGM), Indonesia. During her lecture, she discussed about the various practices of UGM in delivering Innovations to Community, demand for the development of new technology, and about the different stages from making a prototype to finalizing it in Incubation Centres..

The lecture was followed by a short break. The attendees were then allowed to choose between 2 parallel sessions - Breakout Room 1 and Breakout Room 2.

The **Breakout Room 1** was moderated by **Mr. Ragil Yoga Edi**, BRIN Indonesia. He welcomed all the participants and gave a quick introduction about the 6 presenters in Room 1.

The first plenary lecture of the day, titled *“Evaluation Technology Transfer: Some Problems and Solutions”* was presented by **Dr. Ayaat Mohamed Ahmed Elmaghraby**, Researcher, City of Scientific Research and Technological Applications, Egypt. In her presentation, she explained that the “Evaluation of Technology Transfer” is an important part of the total transfer process. Further, she added, good evaluation can improve motivation, knowledge, decisions, and accountability.

Following this presentation, a paper titled *“Research, Innovation and Commercialization of Consumer Electronics Products for Futuristic Smart Cities”* was presented by **Dr. A.L.A.K. Ranaweera**, Senior Lecturer, University of Kelaniya, Sri Lanka. He talked about his commercialized patents, his on-going Consumer Electronics Product Development and establishment of Electronic Design and Innovation Centre.

Dr. Dipl. Ing. Michael Andreas Purwoadi, DEA, Head of the Electronics Technology Center, BRIN Indonesia delivered his lecture on *“Technology Transfer and Commercialization of Automatic Dependant Surveillance-Broadcast (ADS-B)”*. He discussed about the background development of International Civil Aviation Organization (ICAO), and the lessons learnt and challenges faced by the organization during the development phase.

A paper titled *“GIS-Based Information System Technology for Disaster-affected Built Environment as a Tool for Post-disaster Recovery Assessment”* was presented by **Dr. Ella Melianda S.T.M.T.**, Researcher Hydro-meteorological Hazard, Tsunami and Disaster Mitigation Research Center, Syiah Kuala University (UNSYIAH), Indonesia. She spoke on the Post-Disaster

(Contd. from Page 6 - Technology Transfer)

Recovery Assessment. She also informed everyone about the Information System in WebGIS – used for Disaster Management Assessment.

Next, a presentation titled “*Nanotechnologies Promote Petroleum and Petrochemical Industries - Stimulaton of Nano Sensor Performance by FEM*” was presented by **Dr. Riyadh Kamil Abid**, Senior Engineering Chief, Directorate of Materials Research, Ministry of Science and Technology (MoST), Iraq. In his lecture, he addressed Nanotechnology and its application in petroleum and petrochemical sector.

Dr. Hidayat, Director of Research Center for Limnology, BRIN, Indonesia presented a paper on “*Disaster Mitigation in Limnology Research*”. He talked about his study on ‘*Environmental Monitoring and Warning System*’ and found out that the constructed wetland system functions to reduce nutrients in the water body, provides micro-habitat for aquatic organisms as well as enhances the aesthetics.

Simultaneously, **Breakout Room 2** was moderated by **Dr. DwiIrmawaty Gultom**, BRIN Indonesia. She warmly welcomed the participants and gave a quick introduction about the 6 presenters in Room 2.

The session was started with a lecture on “*Application of Business Incubations Centers and Technology Parks on the Establishment of Small and Medium Enterprises and Economic Development of any Country: Case Study*” presented by **Mr. Mehtab Ahmed**, Senior Technical Officer (Marketing), OIC/Marketing and Commercialization, PCSIR Labs, Pakistan. He stated that according to the National Business Incubation Association (NBIA), business incubation catalyzes the process of starting and growing companies, providing entrepreneurs with the expertise, networks and tools they need to make their ventures successful. He highlights the silent feature of his study on Business Incubation Centers and Technology Parks for SMEs for those who wish to enter in business.

“*Escalating ideas toward innovative products and its commercialization: Case study of ITS Surabaya*” was presented by **Dr. Bambang Pamujati**, Vice-Rector for Research, Innovation, Cooperation, and Alumni Institut Teknologi Sepuluh Nopember (ITS), Indonesia. He talked about the key elements that are required for Innovation – supporting policies, government support, right strategy, human resource and environment.

This was followed by a paper titled “*Key Performance Indicators on Technology Transfer and Commercialization of Research towards Sustainable Commercial Agriculture*”, which was presented by **Mr. Prabath Abeyasiriwardana**, Deputy Director, Ministry of Skills Development, Vocational Education Research and Innovation, Sri Lanka. He highlighted the key figures of Agriculture Sector of Sri Lanka and what substitutes are taken into account to reach SDG 2030.

Dr. Ahmad Gamal, Director of Innovation and Science Techno Park/Advisor of the Smart City Research Center, UI, Indonesia, presented a paper on “*Towards Demand Driven Innovation: An Example by Universitas Indonesia*”. In his presentation, he talked about Innovation Management and its Commercial Impact.

A paper titled “*Natural Rubber by Malaysian Rubber Board (MRB): Case Study*” was presented by **Dr. Fatimah Rubaizah**, Head of Unit, Malaysian Rubber Board, Malaysia. She talked about the Malaysia Rubber Industry and further elaborated about the properties of Natural Rubber which then is modified into ‘*Pureprena*’ that has Specialty Rubber Value.

Dr. Pradeep Wishwanath Samarasekere, Senior Lecturer, Director, University Business Linkage Cell, Faculty of Computing and Technology, University of Kelaniya, Sri Lanka delivered a lecture on “*Bridging the Gap between Academia and Business*”. He briefly discussed about the technology transfer system in Sri Lanka and that the country has been continuously trying to develop business culture with the help of Universities.

A Session for **discussion and adoption of Resolution** was chaired by Mrs. Nur Tri Aries Suestiningtyas and Dr. Amitava Bandopadhyay.

Before the session began, **Dr. Bandopadhyay** explained that the *Resolution* is a set of recommendations for the developing countries - a guiding but non-binding document. The document is prepared after addressing the thoughts of various intellectuals from industries, ministries, policy makers, as well as the participants.

Extensive discussions were held, and views were exchanged for understanding the key learning's, experience and takeaways from the Workshop.

Further, after a comprehensive deliberation, a **Jakarta Resolution** on “*Role of Science, Technology and Innovation Policy for the Promotion of Technology Transfer & Commercialization in NAM and Other Developing Countries*” was unanimously adopted by the participants – with several important recommendations made for the governments, institutions, policy makers, end users and other key stakeholders.

CONCLUDING CEREMONY

In her Closing Remarks, Mrs. Nur Tri Aries Suestiningtyas thanked all the distinguished participants and other delegates, and appreciated the efforts of all the speakers and expressed her gratitude to Dr. Amitava Bandopadhyay for co-organizing this Workshop. She further mentioned that the entire proceedings of the workshop were connected on YouTube live sessions on both the days.

Dr. Bandopadhyay in his remarks thanked everyone who participated in the workshop, and specially thanked the Keynote and Plenary Speakers for sharing their knowledge. He further expressed his gratitude and appreciation for Mrs. Nur Tri Aries Suestiningtyas, Mrs. Mila Kencana, Ms. Nena Melia and other colleagues from BRIN for successfully organizing the joint workshop on such an important topic.

Jakarta Resolution

ON

"Role of Science, Technology and Innovation Policy for the Promotion of Technology Transfer & Commercialization in NAM and Other Developing Countries"



WHILE EXPRESSING GRATITUDE to the National Research and Innovation Agency (BRIN), Republic of Indonesia; and the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi for jointly organizing (virtually) the International Workshop on **"Technology Transfer and Commercialization"** during 7-8 December 2021;

REALISING that numerous technological innovations have proven to be very vital for the economic progress of nations; and therefore, governments of the NAM and other Developing Countries must adopt appropriate policy measures to promote and facilitate Technology Transfer and Commercialization;

RECOGNISING that a large number of technologies developed by academic and R&D institutions do not get transferred to the industry for commercialization due to several barriers and challenges;

HAVING CONSIDERED that there is a need for cooperation in Science, Technology & Innovation among NAM and other developing countries on the promotion of Technology Transfer and Commercialisation;

HAVING DELIBERATED on various aspects and mechanisms of innovation, transfer and commercialisation of the newly developed technologies;

RECALLING the aims of the workshop: (1) To collect, study, and share best practices and increase participants' knowledge of various forms and possibilities of technology transfer and commercialization strategies; (2) To strengthen the analytical skills of participants on leveraging their essential knowledge that has an impact on policy formulation/development regarding technology transfer and commercialization; (3) To assist the participating government officials to appreciate how public research agencies may bring the real impact of industrial innovation in private sectors through technological licensing; (4) To illuminate instances where the governments can form new solutions in inducing the private sectors to make contributing role through their profit-oriented activities in addressing public concerns;

REAFFIRMING that capacity-building in technology transfer and commercialization should remain as one of the items on top of the agenda of an economy, as it is directly relevant with the ubiquitous public interest, including in pandemic and other disaster management, and economic development;

ALSO BEING ATTENTIVE of the necessity for the governments of the NAM and other Developing Countries to encourage technology transfer and commercialization from universities and research centres to privately-owned companies, including Small & Medium Enterprises (SMEs) as a crucial activity in their respective national innovation systems;

We, the participants of the International Workshop on **"Technology Transfer and Commercialization"**, representing the governments, academic and research institutions, and S&T agencies from Egypt, India, Indonesia, Iran, Iraq, Malaysia, Mauritius, Myanmar, Pakistan, Palestine, South Africa, Sri Lanka, Zambia and Zimbabwe; as well as other relevant stakeholders;

UNANIMOUSLY RESOLVE AND RECOMMEND the following:

- Governments and all other stakeholders should view science, technology, and innovation policy as a means to address economic and societal problems effectively and efficiently. Consequently, the policy design needs to realistically reflect the demands of the industrial sectors, and to generate collective participation of the private sectors in creating robust economic development and addressing challenges faced by them;
- While the primary objective of science, technology and innovation policy would continue to be the promotion of scientific research and subsequent development of technological products and services; Governments and all other stakeholders need to also help the creation and organisational adaptations as required to nurture innovations, namely through the support of an entrepreneurial culture in start-up firms and intrapreneurship;
- The role of various associated government arms should take appropriate policy measures in their respective domains to promote technology transfer & commercialization, and innovation – such as, research and development (R&D) tax breaks and other fiscal incentives; intellectual property rights (IPR) laws and intellectual property asset management; tax laws, product standards, environment, safety regulations, and so on – in order to help the innovating firms deal with obstacles to innovation;
- Relevant government departments should articulate their sectoral concerns to be manifested as innovation demands over new technological products for the industrial enterprises to produce – in order to facilitate technology transfer and commercialization from universities and research centres to industries for developing new or improved products/systems with quality standards as required by such sectoral government authorities;

(Contd. from Page 8 - Resolution)

- Academic and research institutions should be encouraged to adopt in-house mechanisms for technology transfer and commercialization;
- Business incubators, Science Parks and similar entities should be established to provide infrastructural facilities and other services to start-up entrepreneurs;
- A public fund similar to Venture Capital should be made available for the creation of technology based enterprises and spin-offs;
- Regional and private financial institutions should be involved in the financing of innovation processes and other activities that can facilitate the commercialization of knowledge and its adoption, thus reducing the dependence on the limited public funding sources;
- Growth of professional consultancy services sectors should be fostered to help the innovation processes viz., technology transfer, commercial information gathering, patenting, legal advice etc.;
- The Governments of the NAM countries should consider active networking and international cooperation among themselves on STI policy formulation, technology transfer & commercialization, creation of start-ups, marketing of technology based products and services, promotion of inter-firm alliances, commercially-oriented research collaborations, etc. – which would eventually help the Non-Aligned Movement (NAM) to reinvent itself in the 21st-century.

That this Resolution may be submitted to the concerned authorities in the NAM and other Developing Countries for appropriate actions.

THUS, UNANIMOUSLY RESOLVED AND ADOPTED VIRTUALLY ON THIS DAY, THE 08 DECEMBER 2021, AT JAKARTA.

Memorandum of Understanding (MoU) signed between the JSS Academy of Higher Education & Research, Mysuru and the NAM S&T Centre, New Delhi

A Memorandum of Understanding (MoU) was signed between the **JSS Academy of Higher Education & Research (JSS AHER)**, Mysuru, Karnataka, India and the **Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre)**, an Inter-governmental Organization based at New Delhi, India on **October 25, 2021**, in order to re-establish and expand their collaborative relationship on the basis of previously built contacts and mutual understanding.

Recognizing the common interest and importance of strengthening cooperation between the NAM S&T Centre and JSS AHER with the purpose of scientific and technological collaboration, exchange of expertise, and dissemination of S&T knowledge and information; the MoU was signed by **Dr. Surinder Singh**, Vice Chancellor, JSS AHER and **Dr. Amitava Bandopadhyay**, Director General, NAM S&T Centre, in the presence of **Dr. B. Suresh**, Pro Chancellor, JSS AHER at the NAM S&T Centre, New Delhi.



The objective of the MoU is to establish the basis for an organizational arrangement in order to encourage engagement in the broad fields of academic, science and technology, especially to take up joint scientific activities including organization of International Workshops, Training Workshops and Training Programmes in areas of common interest; providing fellowship opportunities to the scientists and researchers from the developing countries for working in the laboratories of JSS AHER or its designated Institutions/Centres in the fields of Science and Technology including Medical Sciences; and bringing out scientific publications from time to time through mutual assistance and cooperation. The MoU also outlines a plan for providing Scholarships for bright students from the developing world to pursue their Post Graduate Studies at JSS AHER and affiliated academic institutions.



Special Feature

COP26: Glasgow Climate Pact - Together for Our Planet

Background - The Paris Agreement

Six years ago, on 12 December 2015, The Paris Agreement - which is a legally binding international treaty on climate change - was adopted by 196 countries at the Conference of Parties (COP) 21 in Paris, and entered into force on 4 November 2016. The goal of the agreement is to contain global warming to well below 2 degrees Celsius, and preferably to 1.5 degrees. It was a major culmination of more than twenty years of diplomatic action. To achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by mid-century.

2. COP26: Together for our Planet

COP26: The 2021 United Nations Climate Change Conference referred to as **COP26**, was the 26th Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) held at Glasgow, Scotland, United Kingdom, from 31 October to 12 November 2021, formally headed by UK Presidency. The conference was the first since the Paris Agreement of COP21 that expected parties to make enhanced commitments towards mitigating climate change. Nearly 200 countries participated in the UN Climate Change Conference-COP26 which brought together 120 world leaders and over 40,000 registered participants, including 22,274 party delegates, 14,125 observers and 3,886 media representatives. **COP 26** was held to take stock of progress since Paris Agreement in 2015 and also to ramp up commitments alongside a clear plan of action for how climate action targets will be met in the short, medium, and long terms.

The outcome of COP26 – the **Glasgow Climate Pact** – is the result of intense negotiations among countries over the two weeks, strenuous formal and informal work over many months, and constant engagement both in-person and virtually for nearly two years. The world was riveted on all facets of climate change — the science, the solutions, the political will to act, and also clear indications of action. UN Secretary-General António Guterres expressed his concern by saying “The approved texts are a compromise.” “They reflect the interests, the conditions, the contradictions and the state of political will in the world today. They take important steps, but unfortunately the collective political will was not enough to overcome some deep contradictions.”

There is far more need for cuts in global greenhouse gas emissions to preserve a livable climate, and support for the most vulnerable countries affected by the impacts of climate change is still falling far short. But COP26 did produce new “building blocks” to advance implementation of the Paris Agreement through actions that can get the world on a more sustainable, low-carbon pathway forward.

Highlights of Glasgow Pact (COP26): Following are salient points of the outcomes of negotiations

- **Recognizing the Emergency:** Countries expressed “alarm and utmost concern” that human activities have caused around 1.1 °C of warming to date, that impacts are already being felt in every region, and that carbon budgets consistent with achieving the Paris Agreement temperature goal are now small and being rapidly depleted.” There was reaffirmation by the countries for the Paris Agreement goal of limiting the increase in the global average temperature to well below 2°C. They recognized that the impacts of climate change will be much lower at a temperature increase of 1.5 °C compared with 2 °C.
- **Accelerating Action:** Countries stressed the urgency of action “in this critical decade,” when carbon dioxide emissions must be reduced by 45 per cent to reach net zero around mid-century. But with present climate plans through the Nationally Determined Contributions (NDC), countries falling far short on their ambition and the Glasgow Climate Pact calls on all countries to present stronger national action plans next year, instead of in 2025, which was the original timeline. Countries also called on UNFCCC to do an annual NDC Synthesis Report to gauge the present level of ambition.
- **Moving away from Fossil Fuels:** This was perhaps the most contested decision in Glasgow, countries ultimately agreed to a provision calling for a phase-down of a) coal power and b) a phase-out of “inefficient” fossil fuel subsidies – two key issues that had never been explicitly mentioned in decisions of UN climate talks before, despite coal, oil and gas being the main drivers of global warming. Many countries, and NGOs, expressed dis-satisfaction that the issue on coal got significantly weakened by phase-out plan to phase-down and consequently, was not as ambitious as it needs to be.
- **Delivering on Climate Finance:** Developed countries came to Glasgow falling short on their promise to deliver US\$100 billion a year for developing countries. Voicing “regret,” the Glasgow outcome reaffirms the pledge and urges developed countries to fully deliver on the US\$100 billion goal urgently. Developed countries, in a report, expressed confidence that the target would be met in 2023.
- **Stepping up support for Adaptation:** The Glasgow Pact calls for a doubling of finance to support developing countries in adapting to the impacts of climate change and building resilience. This won't meet all the funding that poorer countries need, but it would significantly increase finance for protecting lives and livelihoods, which so far made up only about 25 per cent of all climate finance (with 75 per cent going towards green technologies to mitigate greenhouse gas emissions).

(Contd. from Page 10 - Special Feature)

- **Completing the Paris Rulebook:** Countries reached agreement on the remaining issues of the so-called Paris rulebook, the operational details for the practical implementation of the Paris Agreement. Among them are the norms related to carbon markets, which will allow countries struggling to meet their emissions targets to purchase emissions reductions from other nations that have already exceeded their targets.
- **Focusing on Loss & Damage:** Acknowledging that climate change is having increasing impacts on people especially in the developing world, countries agreed to strengthen a network— known as the Santiago Network – that connects vulnerable countries with providers of technical assistance, knowledge and resources to address climate risks. They also launched a new “Glasgow dialogue” to discuss arrangements for the funding of activities to avert, minimize and address loss and damage associated with the adverse effects of climate change.

3. New Deals and Announcements

There were many other significant deals and announcements – outside of the Glasgow Climate Pact – which can have major positive impacts if they are indeed implemented. These include:

- **Forests:** 137 countries took a landmark step forward by committing to halt and reverse forest loss and land degradation by 2030. The pledge is backed by \$12bn in public and \$7.2bn in private funding. In addition, CEOs from more than 30 financial institutions with over \$8.7 trillion of global assets committed to eliminate investment in activities linked to deforestation.
- **Methane:** 103 countries, including 15 major emitters, signed up to the Global Methane Pledge, which aims to limit methane emissions by 30 per cent by 2030, compared to 2020 levels. Methane, one of the most potent greenhouse gases, is responsible for a third of current warming from human activities.
- **Cars:** Over 30 countries, six major vehicle manufacturers and other actors, like cities, set out their determination for all new car and van sales to be zero-emission vehicles by 2040 globally and 2035 in leading markets, accelerating the decarbonization of road transport, which currently accounts for about 10 per cent of global greenhouse gas emissions.
- **Coal:** Leaders from South Africa, the United Kingdom, the United States, France, Germany, and the European Union announced a ground-breaking partnership to support South Africa – the world's most carbon-intensive electricity producer— with \$8.5 billion over the next 3-5 years to make a just transition away from coal, to a low-carbon economy.
- **Private finance:** Private financial institutions and central banks announced moves to realign trillions of dollars towards achieving global net zero emissions. Among them is the Glasgow Financial Alliance for Net Zero, with over 450 firms across 45 countries that control \$130 trillion in assets, requiring its member to set robust, science-based near-term

4. How will countries be made to meet their Pledges?

Most commitments made at COP will have to be self-policed. Only a few countries are making their pledges legally binding.

5. Mechanism of Progress Tracking

For tracking progress of the Paris Agreement, countries established an **Enhanced Transparency Framework (ETF)**. Under ETF, starting in 2024, countries will report transparently on actions taken and progress in climate change mitigation, adaptation measures and support provided or received. It also provides for international procedures for the review of the submitted reports. The information gathered through the ETF will feed into the Global stock take which will assess the collective progress towards the long-term climate goals. This will lead to recommendations for countries to set more ambitious plans in the next round.

During COP26, negotiations were also concluded on an ETF, providing for common timeframes and agreed formats for countries to regularly report on progress, designed to build trust and confidence that all countries are contributing their share to the global effort.

6. The Progress

Although climate change action needs to be massively increased to achieve the goals of the Paris Agreement, the years since its entry into force have already sparked low-carbon solutions and new markets. More and more countries, regions, cities and companies are establishing carbon neutrality targets. Zero-carbon solutions are becoming competitive across economic sectors representing 25% of emissions. This trend is most noticeable in the power and transport sectors and has created many new business opportunities for early movers.

By 2030, zero-carbon solutions could be competitive in sectors representing over 70% of global emissions.

www.ihrb.org

unfccc.int

www.un.org

www.bbc.com

Science, Technology & Innovation News

CLIMATE CHANGE AND BIODIVERSITY

Warming Temperature Influences Alteration in Atmosphere's Structure: Study

New research quantifies extent of rising tropopause. Climate change is having an increasing impact on the structure of Earth's atmosphere, a new international study shows. The research, published in *Science Advances*, draws on decades of weather balloon observations and specialized satellite measurements to quantify the extent to which the top of the lowest level of the atmosphere is rising. That region, the tropopause, is pushing up the boundary with the stratosphere by about 50-60 meters (about 165-195 feet) per decade. The rising is caused by warming temperatures near Earth's surface that are causing the lower atmosphere to expand. "This is an unambiguous sign of changing atmospheric structure," said Bill Randel, a scientist at the National Center for Atmospheric Research (NCAR, US) and co-author of the new study. "These results provide independent confirmation, in addition to all the other evidence of climate change, that greenhouse gases are altering our atmosphere." The international research team was led by scientists at Nanjing University in China. The satellite observations taken since 2000 verified that the height of the tropopause has increased over the past two decades.

November 8, 2021; www.sciencedaily.com

Amazonian Birds Shrinking in Response to Climate Change: Study

In a remote corner of Brazil's Amazon rainforest, researchers have spent decades catching and measuring birds in a large swath of forest unmarred by roads or deforestation. An exemplar of the Amazon's dazzling diversity, the experimental plot was to act as a baseline that would reveal how habitat fragmentation, from logging or roads, can hollow out rain-forests' wild menagerie. But in this pristine pocket of wilderness, a more subtle shift is happening: The birds are shrinking. Over 40 years, dozens of Amazonian bird species have declined in mass. "Climate change isn't something of the future. It's happening now and has been happening and has effects we haven't thought of," says Ben Winger, an ornithologist at the University of Michigan in Ann Arbor. Seeing the same patterns in so many bird species across widely different contexts "speaks to a more universal phenomenon," he says. Biologists have long linked body size and temperature. In colder climates, it pays to be big because having a smaller surface area relative to one's volume reduces heat loss through the skin and keeps the body warmer. As the climate warms, "you'd expect shrinking body sizes to help organisms off-load heat better," says Vitek Jirinec, an ecologist at the Integral Ecology Research Center in Blue Lake, Calif. All species declined in mass over this period. Species lost from about 0.1 percent to nearly 2 percent of their average body weight each decade. The motmot, for example, shrunk from 133 grams to about 127 grams over the study period. Other factors, like decreased food availability, could also lead to smaller sizes. But since birds with widely different diets all declined in mass, a more pervasive force like climate change is the likely cause, Jirinec says.

November 12, 2021; www.sciencenews.org

MATERIAL SCIENCE

Researchers have Unlocked the Secret to Pearls' Incredible Symmetry

For centuries, researchers have puzzled over how oysters grow stunningly symmetrical, perfectly round pearls around irregularly shaped grains of sand or bits of debris. Now a team has shown that oysters, mussels and other mollusks use a complex process to grow the gems that follows mathematical rules seen throughout nature. Pearls are formed when an irritant gets trapped inside a mollusk, and the animal protects itself by building smooth layers of mineral and protein together called nacre, around it. Each new layer of nacre built over this asymmetrical center adapts precisely to the ones preceding it, smoothing out irregularities to result in a round pearl, according to an analysis published October 19 in the *Proceedings of the National Academy of Sciences*. "Nacre is this incredibly beautiful, iridescent, shiny material that we see in the insides of some seashells or on the outside of pearls," says Laura Otter, a biogeochemist at the Australian National University in Canberra. A pearl's symmetrical growth as it lays down layers of nacre relies on the mollusk balancing two basic capabilities, Otter and her colleagues discovered. It corrects growth aberrations that appear as the pearl forms, preventing those variations from propagating over the pearl's many layers. The analysis revealed that fluctuations in the thicknesses of the pearls' layers of nacre exhibit a phenomenon called 1/f noise, or pink noise, in which events that appear to be random are actually connected. In this case, the formation of nacre layers of different thicknesses may appear random, but is actually dependent on the thickness of previous layers. The same phenomenon is at work in seismic activity. "These humble creatures are making a super light and super tough material so much more easily and better than we do with all our technology." Made of just calcium, carbonate and protein, nacre is "3,000 times tougher than the materials from which it's made of." This new understanding of pearls, Robert Hovden, a materials scientist and engineer at the University of Michigan in Ann Arbor adds, could inspire "the next generation of super materials," such as more energy-efficient solar panels or tough and heat-resistant materials optimized for use in spacecraft.

November 10, 2021; www.sciencenews.org

RESEARCH & HEALTHCARE

Efficacy of Wolbachia-Infected Mosquito Deployment for the Control of Dengue

Indonesian scientists have discovered a means to combat mosquito-borne diseases like dengue by multiplying a species of insect carrying particular bacteria that prevents viral replications. Wolbachia is a prevalent bacteria that are naturally present in 60% of insect species, including few butterflies, dragonflies, moths, fruit flies, and mosquitoes. Nonetheless, it does not occur in dengue-bearing *Aedes aegypti* mosquitoes, based on the research by the non-profit WMP (World

(Contd. from Page 12 - STI News)

Mosquito Program), which promoted the study. WMP community cadre, Purwanti stated that they are breeding good mosquitoes. These good ones or Wolbachia mosquitoes are created by allowing the mosquitoes bearing Wolbachia to mate with mosquitoes bearing dengue. Even if these good mosquitoes bite healthy individuals, they won't transmit the disease. Ever since 2017, the collaborative research by WMP at Gadjah Mada University, Indonesia & Monash University, Australia has been letting out the lab-bred Wolbachia mosquitoes in Yogyakarta, Indonesia, particularly in some dengue fever red zones. The study findings were published in the journal, NEJM (New England Journal of Medicine) in June. This study demonstrated that releasing Wolbachia mosquitoes lowered hospitalization by around 86% and the incidence of dengue infection by around 77%.

November 2, 2021; www.biotechnika.org

WHO: Triple Elimination of Mother-to-Child Transmitted Infections

WHO has updated its Global guidance on criteria and processes on validation: elimination of mother-to-child transmission (EMTCT) of HIV, syphilis and hepatitis B virus. This third version of global guidance incorporates EMTCT of HBV towards validation of triple elimination and provides standardized processes and criteria to both validate EMTCT of HIV, syphilis and HBV, and to recognize high burden countries that have made significant progress on the path to elimination (PTE). The similarity of the critical interventions necessary to prevent transmission adds to the feasibility and benefit of an integrated approach to EMTCT of all three infections as triple elimination. Building on an integrated maternal and child health platform, WHO has moved to operationalize universal health coverage in the context of integrated communicable disease prevention. The guidance strongly emphasizes country-led accountability, rigorous analysis, intensive programme assessment and multilevel collaboration, including the involvement of communities of women living with HIV or HBV, or affected by syphilis. A harmonized approach to triple elimination is encouraged within a public health, rights-based and person-centred approach but depending on readiness, countries may choose to pursue validation of single, dual or triple EMTCT. The two previous editions for this guidance document supported the standardization and formal approach to EMTCT validation, including criteria, indicators and targets to be achieved. The third version was developed by WHO and the Global Validation Advisory Committee. "With renewed focus to end the epidemics of HIV, viral hepatitis and sexually transmitted infections, we are convinced that setting the bar high for validation will result in the best results for all and, in particular, for women and children at risk for HIV, syphilis and HBV," said Dr. Meg Doherty, Director of WHO's Department of Global HIV, Hepatitis and STI Programmes.

November 26, 2021; www.who.int

BIOTECHNOLOGY

Scientists Discover the Mode of Action of Essential Proteins Involved in Cancer and Alzheimer's Disease

The proteins that belong to the Histone acetyltransferases (HAT) family are essential for life as they transport amino acids across the cell membrane. Their specialization determines their involvement in specific functions, such as cell growth or neuronal functions, and consequently in related diseases like cancer or neurodegenerative conditions such as Alzheimer's disease. What confers this specificity and diversity of functions? This is one of the questions asked by researchers at the Spanish National Cancer Research Center (CNIO) and the Institute for Research in Biomedicine (IRB Barcelona), who led the study, and one whose answer has been published this week in the journal Proceedings of the National Academy of Sciences (PNAS). Thanks to the latest high-resolution structural technologies such as cryo-electron microscopy, combined with computational modeling and the design of mutants of these proteins, the researchers have been able to observe the structure of one of the members of this protein family in atomic detail and decipher its function. The results of the study show how only a few residues—located in defined regions—of this family of proteins select the specific amino acids to which they will bind and are therefore responsible for the protein to participate in specific physiological functions. Armed with this information, the researchers now face the challenge of finding new therapies and diagnostic tools for diseases that involve the HAT family of transporter proteins, with a particular interest in those conditions that pose serious health problems, such as cancer and neurodegenerative disorders such as Alzheimer's disease.

November 29, 2021; www.scitedaily.com

Antimicrobial Resistance Threatens Development, SDGs: Tripartite Report

Antimicrobial resistance (AMR) could have significant effects on a range of SDGs, according to guidance published by the World Health Organization (WHO). AMR is when bacteria, viruses, fungi, and parasites no longer respond to medicines effectively, making it harder to treat infection and increasing the risk of disease spread, severe illness and death. The guidance document '**Antimicrobial resistance and the United Nations sustainable development cooperation framework: guidance for United Nations country teams**' has been prepared by the three organizations that form the "Tripartite" on AMR: the Food and Agriculture Organization of the UN (FAO), the World Organisation for Animal Health (OIE), and the World Health Organization (WHO), as well as the UN Environment Programme (UNEP) under the coordination of the Tripartite Joint Secretariat on AMR. The publication makes recommendations for UN country teams to address this interlinked threat through the UN Sustainable Development Cooperation Framework. The advocacy brief released in October 2021 notes that the 2030 Agenda contains two indicators on AMR, as part of SDG 3 (good health and wellbeing). The authors highlight AMR's broad effects on SDG 3, including that as AMR increases treatment costs, universal health coverage will be unattainable for many countries. In addition, reducing child and infant mortality relies on effective antibiotics. Each year, 200,000 newborns die each year from drug-resistant infections. Beyond Goal 3, AMR is central to several other SDGs. For example, on SDG 1 (no poverty), AMR could cause an additional 28.3 million people to be pushed into extreme poverty by 2050 due to high costs of treatment and chronic infections. On SDG 2 (zero hunger), animals harmed by AMR affects farmers' livelihood and broader food security. On SDG 8 (decent work and economic growth), as

(Contd. from Page 13 - STI News)

AMR increases mortality and morbidity, labor supply will decline and could cause a decrease of 1-3% in global economic output by 2030, amounting to losses up to USD 3.4 trillion. Given all of these inter linkages, the guidance notes the need for coordinated action among UN and national actors to tackle AMR. The authors suggest that the One Health approach should be applied; this refers to a “collaborative, multisectoral, and transdisciplinary approach that recognizes the interconnections between people, animals, plants and their shared environment.” The authors also call for including AMR in the UN Sustainable Development Cooperation Framework, which is the agreement between the UN and each host government where the UN has a country team. The AMR guidance argues that Cooperation Frameworks can underline the urgency of addressing AMR by noting the linkages with broader development issues, including pandemic preparedness, universal health coverage, sustainable food systems, and the environment.

December 9, 2021; www.sdg.iisd.org

Bharat Biotech in Pact with GSK, PATH to Manufacture World's Only Malaria Vaccine

The Hyderabad-based vaccine company, Bharat Biotech India Ltd. (BBIL) will manufacture a part of the world's first malaria vaccine – developed by pharmaceutical giant GSK. The vaccine recently got approval from WHO. Though, it may take few years before the vaccine is launched to the market. In January 2021, Bharat Biotech announced a product transfer partnership with the pharmaceutical company GSK for its malarial vaccine, RTS, S/AS01E1. As part of this collaboration, GSK would transfer RTS production technology to Bharat Biotech to manufacture the S antigen component of the malaria vaccine. GSK will retain to manufacture the vaccine adjuvant (AS01E) and supply it to Bharat Biotech. BBIL was chosen through a thorough, competing means conducted by GSK and PATH in association with the WHO. Under the Malaria Vaccine Implementation Programme, the RTS, S/AS01E malaria vaccine has been piloted in the regions of Ghana, Kenya, and Malawi. It was developed by GSK for over 30 years and in association with PATH since 2001. Recently, WHO endorsed the extensive use of malaria vaccines amongst kids in sub-Saharan Africa and other areas with medium to high transmission of *Plasmodium falciparum* malaria. The endorsement is based on the findings of continuing pilot programs in Ghana, Kenya, and Malawi that have reached over 800,000 kids since 2019. It further stated that GSK has guaranteed to give up to 10 million RTS, S/AS01E dosages for use in the pilot project, and to give up to 15 million dosages yearly till 2028 if the product is approved for broader use by WHO. It is anticipated that by 2029, Bharat Biotech will be the only supplier of the vaccine, with GSK providing the adjuvant.

October 12, 2021; www.biotechnika.org

Prolonged Trips in Space Can Cause Potential Brain Damage: Study

Five space travelers had elevated levels of proteins in the blood often seen in people with head trauma and neurodegenerative diseases. Over the past several years, scientists have published research suggesting that people's brains change after spending longer than a few months in space. These studies started because astronauts experienced issues like vision problems and swollen optic nerves upon returning to Earth after long missions. In a new study of five male cosmonauts (Russian astronauts), researchers looked at levels of different proteins in the blood that are often also seen in people with some sort of head trauma or brain disease. They found that on average, the cosmonauts had higher levels of some of the proteins in the three weeks following the mission than before. In the last couple of years, brain imaging has also revealed a loss in volume of grey matter, which contains the cell bodies of neurons, and an increased volume of cerebrospinal fluid. To look for evidence of brain injuries, zu Eulenburg and his colleagues measured the levels of five different proteins in the blood of five male cosmonauts both before and after approximately six-month trips to the space station. These proteins are biomarkers that “can tell us about the status of the brain without opening up the brain,” said Keisuke Kawata, a neuroscientist at Indiana University Bloomington. Kawata, who studies repetitive head impacts and did not contribute to the study, said that the best fluid for studying biomarkers is cerebrospinal fluid in the brain and spinal cord, but accessing it requires an invasive spinal tap. The biomarkers in the study can be used “to indirectly evaluate the extent of damage” due to neurodegeneration or a traumatic injury, said zu Eulenburg, who is a neurologist and professor of neuroimaging at the German Center for Vertigo and Balance Disorders. Neurofilament light chain, for example, is a structural protein that maintains neurons' axons, which transmit signals to other neurons. In a healthy person, “you shouldn't be detecting much of those structural proteins in the blood,” Kawata said. But if someone has a neurodegenerative condition, the proteins dislodge from the neurons and can get into the bloodstream.

November 3, 2021; www.insidescience.org

AGRICULTURE

Resolute Scientific Work Could Eliminate Wheat Disease within 40 Years

Wheat and barley growers know the devastating effects of Fusarium head blight, or scab. The widespread fungal disease contaminates grain with toxins that cause illness in livestock and humans, and can render worthless an entire harvest. In a new analysis, University of Illinois researchers say those efforts have paid off. Over the past 20 years, critical resistance metrics have improved significantly. And, they say, if breeding efforts continue, vulnerability to Fusarium head blight could be eliminated within 40 years. “I don't think anybody realizes it's possible we could eliminate Fusarium head blight as a problem. Forty years sounds like a long time, but by the time I'm retired, the threat of disease could be gone. That would make a huge difference,” says Jessica Rutkoski, assistant professor in the Department of Crop Sciences at Illinois and co-author on the new paper. Rutkoski and her colleagues examined 20 years of data from nine university breeding programs spanning 40 locations in the eastern U.S. That's a whopping 1,068 wheat genotypes. In each year and each location, researchers inoculated wheat plants with Fusarium spores. They evaluated both test entries and check cultivars for various resistance traits. The long-term check cultivars act as a kind of barometer, accounting for agronomic practices and environmental factors. The researchers looked at disease incidence, severity, Fusarium-damaged kernels, and deoxynivalenol content—the main toxin of concern in Fusarium-contaminated grain. And over 20 years and 1,068 lines, all

(Contd. from Page 14 - STI News)

the resistance traits improved. "It basically shows that everyone's making progress, and that the investment in public breeding programs is paying off." When Rutkoski analyzed the impact of germplasm introductions from Chinese wheat lines, they weren't responsible for boosting resistance. In other words, progress over the past 20 years was mostly due to breeders exploiting native resistance—the locally adapted wheat's inherent genetic capacity to resist disease—rather than introducing resistance from exotic sources. Rutkoski notes it's important to try to identify major-effect genes because often they can help breeders achieve their goals faster. Ultimately, Rutkoski hopes her results justify and encourage investments in public breeding programs. "Nobody really notices the progress that's being made. I think there's some skepticism and suspicion that breeding isn't that important. Or people think we need to focus more on genome editing or finding more exotic sources of resistance," she says. "A lot of public breeding programs are getting shut down, and we risk losing all that progress. So, I was gratified to show that the improvement is very consistent over time. And if you just stick to this kind of strategy, you will have guaranteed results. It's not risky."

December 2, 2021; www.newsconcerns.com

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

Visit to CSIR–Central Leather Research Institute (CSIR–CLRI), Chennai, India



Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre visited CSIR- Central Leather Research Institute (CLRI), Chennai during December 9-10, 2021 for discussion on future collaboration in the area of "*Leather Science and Technology*". The NAM S&T Centre had organized a Training Workshop during January 28-31, 2019 in Chennai in the area of "Sustainability of Leather Sector". Dr. Bandopadhyay had a very fruitful and productive discussion with Dr. K. J. Sreeram, Director, CLRI; Dr. P. Thanikaivelan, Senior Principal Scientist, CLRI and other senior colleagues. Dr. Bandopadhyay proposed that the NAM S&T Centre and CLRI may jointly organize an International Training Workshop on a relevant topic in the area of "Leather Science

& Technology" around July/August 2022. Dr. Sreeram readily agreed to the idea and the event will be hosted by CLRI, Chennai.

Dr. Bandopadhyay also proposed that CLRI may consider bringing out a comprehensive Monograph jointly with NAM S&T Centre on "Leather Technology" to be published by the end of 2022 with special emphasis on the developing countries. Dr. Sreeram also accepted the idea for taking it forward. In addition, it was agreed during the discussion that the NAM S&T Centre will facilitate S&T collaboration between CSIR-CLRI and the Shoe and Leather Research Institute, Ha Noi, Vietnam.

Visit to JSS Academy of Higher Education & Research (JSS AHER), Mysuru, India

Dr. Amitava Bandopadhyay, DG, NAM S&T Centre visited JSS Academy of Higher Education & Research (JSS AHER), Mysuru during December 28-29, 2021 for discussion with Prof. Basavana Gowdappa, Principal, JSS Medical College, Mysuru and his senior colleagues in regard to the proposed Monograph on "*Non-Communicable Diseases in Developing Countries: Facts, Realities and Way Forward*". The JSS Team has made very good progress and the draft chapter structure was discussed and reviewed. Further details in regard to taking the matter forward were also discussed.



Dr. Bandopadhyay also met Dr. Surinder Singh, Vice Chancellor and Dr. Vishal Gupta, Deputy Director (Academics), JSS AHER and reviewed proposed joint activities planned under the JSS AHER – NAM S&T Centre Memorandum of Understanding (MoU). Dr. Bandopadhyay also proposed that JSS AHER and the NAM S&T Centre may work towards bringing out a Monograph on "*Generic Drugs*" which has significant importance in the context of the developing world. Dr. Singh accepted the idea for which further details will be worked out. During the visit, the plans for the International Workshop on "*Gender Issues in Water Management in Developing Countries and Sustainable Development*" being jointly organized by JSS AHER and NAM S&T Centre during 22-24 February, 2022 were reviewed.



Centre Announces

International Training Workshop on GENDER ISSUES IN WATER MANAGEMENT AND SUSTAINABLE DEVELOPMENT

**February 22-24, 2022
[In Virtual-Mode]**

Billions of people in rural and urban communities around the world have difficulty in accessing clean and safe water resources. The WHO estimates that more than 5 billion people may live in prolonged water shortage and water-stressed areas in 2025 and that the situation may further worsen in many developing countries. Water has strong gender dimensions both in accessing clean water and water utilization in various household, agricultural and industrial sectors. According to UN-Water, in many countries, the presence or absence of safe and sufficient water supply and improved sanitation facilities has a disproportionate effect on the lives of women and girls.

A critical prerequisite for achieving the United Nations' Sustainable Development Goals (UNSDGs) No. 5 (Gender Equality), No. 6 (Clean Water), and No. 8 (Decent Work and Economic Growth) is a better understanding of the status of the role and engagement of women in the safe use and management of water resources and their empowerment. According to the WHO report on a gender perspective, women's participation in water sectors other than at the household level is considerably less than that of men. Women are also less acquainted with and exposed to the available scientific, eco-friendly water management strategies and technologies. This gender discrimination varies from region to region.

The Sustainable Development Goals (SDGs) focus on universal access to safe drinking water, basic sanitation, and hygiene (WASH) especially to address shortcomings widespread in low-and middle-income nations and for vulnerable people. In general, WASH-related challenges among women must be handled optimally to achieve gender equity goals. Despite these gender-related shortcomings, research on the intersection of gender and water is extremely limited, and addressing gender-water disparities will necessitate focused resources to fill up the gaps. It is also noted that gender approaches are not being adopted at the policy and implementation level. Therefore, the water-gender interlinkages need to be carefully examined and, subsequently, integrated into the policies.

Considering the importance of the subject, the Centre for Science and Technology of the Non-Aligned & Other Developing Countries (NAM S&T Centre), New Delhi; in partnership with the JSS Academy of Higher Education and Research (JSS AHER), Mysuru, Karnataka, India and the Scientific Committee on Problems of the Environment (SCOPE), Amstelveen, the Netherlands jointly announce the organization of an International Workshop on Gender Issues in Water Management in Developing Countries and Sustainable Development during February 22-24, 2022. The Workshop will be hosted and organized by JSSAHER in Virtual-Mode.

Researchers, scientists, government officials, policy makers, marine-sector professionals, managers and representatives from industry and non-government organizations from various NAM and other developing countries as well as developed countries who are engaged in R&D, generation, promotion and policy making on various Water Management & Gender Equality sub-sectors are expected to participate in this Virtual-Workshop.

The last day for submission of application is February 1, 2022. For further details, please contact the NAM S&T Centre (Email: namstcentre@gmail.com) or visit our Website: www.namstct.org

NAM S&T Centre Senior Visiting Fellowship 2019-20

Dr. Ahmed Mohamed Khalil, Professor, Photochemistry Department, Chemical Industries Research Division, National Research Centre (NRC), Giza, Egypt, was sponsored by the NAM S&T Centre under its Senior Visiting Fellowship 2019-2020. Dr. Khalil was hosted by Professor Dr. Fawwaz Khalili, Chemistry Department, the University of Jordan, Amman for 10 days starting from 10/12/2021 to 19/12/2021. His visit was focussed on getting experience in 'Recycling Polymers and Environmental Applications for Waste Polymeric Materials Toward Living in Greener Environment'. During his visit, he also delivered a lecture in the Department of Chemistry, the University of Jordan.

The NAM S&T Centre provided full financial support to Prof. Khalil for his visit including his international travel and a subsistence allowance.

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