

NAM

S&T Newsletter



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FROM THE DG'S DESK

Warmest Greetings to all our Readers!!



With the goodwill, support and encouragement from the Focal Points of the Centre and from the scientific community in its Member Countries, the NAM S&T Centre has performed well in promoting South-South Cooperation in Science and Technology and collaborating with NAM and other developing countries in achieving collective self reliance. Over the years, the Centre has acquired a global identity for fostering effective policy dialogue and capacity-building among developing countries on international and regional STI issues.

During the second quarter of the year, the Centre has successfully organised four scientific events in virtual mode that are of significant interest to its Member Countries, namely - (i) International Training Workshop on 'Use of Analytical & Modeling Tools Tailored to Country Needs' during April 6-7 2022 jointly with the Academy of Scientific Research and Technology (ASRT), Cairo, Egypt (ii) International Workshop on "Development of Food Green Cities for Urban Sustainability" during 26-27 April 2022 jointly with the Nepal Academy of Science and Technology (NAST), Lalitpur, Nepal (iii) International Workshop on "Role of Science, Technology and Innovation (STI) in Achieving Sustainable Development Goals – 2030" during 24-25 May 2022 jointly with the Indian Ocean Rim Association (IORA) Secretariat, Mauritius and (iv) International Workshop on "Water Purification Technologies, Arsenic Removal from Groundwater and Integrated Water Management" during 28-30 June 2022 jointly with the CSIR-Central Salt and Marine Chemicals Research Institute (CSIR-CSMCRI), Bhavnagar, India. The last event was organized in Hybrid Mode.

I am happy to announce that we are soon expecting to release our new Monograph on "Extreme Natural Events: Sustainable Solutions for Developing Countries" published by Springer Nature, Singapore.

Under the controlled pandemic situation, the Centre has resumed two of its Fellowship Schemes viz. (i) Joint NAM S&T Centre-ZMT, Bremen (Germany) Fellowship on "Blue Economy in Tropical Coastal Marine Research"; and (ii) Joint NAM S&T Centre - ICCBS Fellowship on "Natural Products Chemistry, Drugs and Pharmaceuticals". Scientists and researchers from Member Countries of the Centre and Members of NAM S&T-Industry Network are invited to apply for the Fellowships. The guidelines for application and other details are available at Centre's website: www.namstct.org.

The NAM S&T Centre jointly with the Centre of Excellence in High Voltage Engineering (CEHVE), University of the Witwatersrand, Johannesburg, South Africa, in association with the Dept. of Science and Innovation (DSI), Pretoria, South Africa announces the organization of a one-day International Roundtable on "Energy Storage Systems" on September 12, 2022. Applications are invited from concerned experts and researchers in the field. Other relevant details about the event are available at Centre's website: www.namstct.org.

I am happy to inform our esteemed readers that from this issue we have started publishing highlights of developments in STI areas in our Member Countries. We hope to continue this feature in our forthcoming issues also.

I would like to thank our esteemed Member Countries and other stakeholders in developing countries for their proactive participation in scientific activities of the Centre and being a part of this remarkable journey of building a STI based resilient future for the people of the developing world.

Happy Reading!!

Amitava Bandopadhyay
(Amitava Bandopadhyay)
Director General

Centre Organised

International Training Workshop on Use of Analytical & Modeling Tools Tailored to Country Needs 6-7 April 2022 [Virtual Mode]

The world has become so interconnected that issues and concerns are no longer a single country problem; they have global characteristics that affect the world in a holistic manner. Global issues are very complex as well as interconnected and no individual discipline can claim to offer a total solution. Hence, there is the need for system analysis as well as analytical & modeling tools. Analytical tools and models are being developed

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International Workshop on Development of Food Green Cities for Urban Sustainability 26-27 April 2022 [Virtual Mode]

Globally, the urban population is increasing rapidly and thus there is a huge demand of food supply for urban inhabitants. The current food system in the cities cannot meet the growing food demand in a sustainable manner. Urban agriculture can play a significant role in sustainable food systems with environmental, social (health) and economic benefits. So the national and local governments need to become more strategic in responding to the

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International Workshop on Role of Science, Technology and Innovation (STI) in Achieving Sustainable Development Goals – 2030 24-25 May 2022 [Virtual Mode]

Science, Technology and Innovation (STI) has been recognized as one of the main drivers of economic development and environmental sustainability. STI plays an even more important role in the context of the "Global Development Agenda 2030" for achieving the Sustainable Development Goals (SDGs) and its set forth targets. Application of STI is necessary for enabling and

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International Workshop on Water Purification Technologies, Arsenic Removal from Groundwater and Integrated Water Management Bhavnagar, Gujarat (INDIA) 28-30 June 2022 [Hybrid Mode]

The Sustainable Development Goal (SDG) – 6 aims to achieve universal and equitable access to safe and affordable drinking water for all by 2030 and improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials. The Goal also calls for implementation of integrated water resources management at all levels.

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to support scientists, technologists and decision makers, bringing insights into complex problems of the real world, and their interconnectivity. They address complex global issues such as environmental pollution, climate change, sustainable development, water scarcity as well as economic stability. They also help in achieving Sustainable Development Goals (SDG). In brief, systems analysis is a very powerful tool that can adapt to meet the specific complexity of each subject. It has the flexibility to shift perspectives and has the ability to tackle complex issues resulting from the rapidly changing and linked world.

To keep abreast of the growing significance of analytical and modeling tools in scientific research and technology, to deliberate upon the need of country specific adaptations of these tools, and to impart skills and knowledge on the principles and practices on the subject, the *Centre for Science & Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre)*, New Delhi, India jointly with the *Academy of Scientific Research and Technology (ASRT)*, Cairo, Egypt organized a two days **International Training Workshop on 'Use of Analytical and Modeling Tools Tailored to Country Needs'** during **April 6-7, 2022 in Virtual Mode**. The Training Workshop was hosted by the Academy of Scientific Research & Technology (ASRT), Cairo, Egypt.

Altogether about 80 researchers, scientists, experts, academicians and policy makers from 21 countries including Austria (3), Bhutan (10), Botswana (1), Denmark (1), Ethiopia (6), India (16), Indonesia (1), Iran (2), Iraq (2), Jordan (1), Malaysia (3), Mauritius (2), Myanmar (3), Nepal (1), Nigeria (3), Palestine (4), South Africa (2), Sri Lanka (2), Tanzania (2), Zimbabwe(1), and the host country, Egypt (14) attended the Workshop.

Inaugural Session of the Workshop started with a Welcome Note by *Mrs. Abeer Mohamed Attia*, General Director, International Scientific Relations, ASRT. This was followed by a Welcome Address and Introduction by *Prof. Gina El-Feky*, Supervisor of Scientific and Cultural Relations Sector, ASRT. She emphasized on the importance of the topic of the Training Workshop to protect the interest of the developing countries. *Dr. Amitava Bandopadhyay*, Director General, NAM S&T Centre, New Delhi, in his address, welcomed the participants and briefly highlighted the importance of the topic of the Workshop, especially for the developing countries.

The overall programme of the Workshop was conducted in four Technical Sessions respectively moderated by Mrs. Abeer Mohamed Attia and *Ts. Dr. Kalaivani Chellappan*, Associate Professor, Department of Electrical, Electronics & System Engineering, Universiti Kebangsaan Malaysia; *Dr. Eman Abdelazem Abdelrahman*, Researcher / Expert GIS and Environmental Studies, Egypt; *Dr. Amr Ahmed Abdelghani Abdelwahed*, Professor of Statistics and Demography, Cairo University, Egypt and *Dr. Ganesh Naik*, Senior Scientist, Analytical Science Division, CSIR-Indian Institute of Petroleum (IIP), Dehradun, India.

There were 6 Keynote Addresses by various experts in the Workshop. The technical programme began with the first **Keynote Lecture I** delivered by *Prof. Amani El Rayes*, Vice President of Training & Consultations and Community Service, Institute of National Planning (INP), Egypt on '*The Complexity of the World Needs New Ways to Tackle Problems*'. In her lecture, she briefed about system and its types – open and close systems, and why dealing with system is important. **Keynote lecture II** was delivered by *Dr. Anil Kumar*, Scientist, Wadia Institute of Himalayan Geology, Dehradun, India on '*Luminescence Dating: Developments in Protocols, Age Models and Applications*' and he introduced everyone with Luminescence - emission of light by a substance, basics of Luminescence Dating and its importance. The **Keynote lecture III** was delivered by *Dr. Aditya Kharya*, Wadia Institute of Himalayan Geology, Dehradun, India on '*Application of Stable Isotope Systematics in the Field of Sciences*'. He talked about different stable Isotope Applications – Geology, Climate Change, Ecology, Forensic Science, Biology, Environmental, and in Agriculture. **Keynote Lecture IV** titled '*Citizen Science at IIASA*' was delivered by *Dr. Steffen Fritz*, Program Director and Principal Research Scholar, Strategic Initiatives Program, International Institute for Applied Systems Analysis (IIASA). In his lecture, he talked about long history of Amateur Science. Afterwards, he explained about Citizen Science - the practice of public participation and collaboration in scientific research to increase scientific knowledge. **Keynote Lecture V** was delivered by *Prof. Samir KC* on '*Status of Population Structure and Distribution Projection*'. He discussed various issues faced with the data and then deliberated on the Demographic factor associated with it. This was followed by the **Keynote Lecture VI** titled '*Text Mining Approach for SDGs Inter-Linkages*', delivered by *Prof. Hassan Rabie*, Lecturer, Planning Techniques Center, Institute of National Planning (INP), Egypt. In his lecture, he briefed about SDGs – adopted by UN Member States in 2015 as a universal call for action to end poverty, protect planet, and ensure that all people enjoy peace by 2030. He mentioned that understanding and highlighting inter-linkages is vital to breaking down vertical silos. He elaborated on Inverse Document Frequency (TF-IDF) and has identified the three keywords - Women, Economic, and Technology which were found interlinked in 12 SDGs.

There were **19 Plenary lectures** throughout the **4 Technical Sessions** during the Workshop. Six of them delivered during Technical Session I were on: '*Application of Extended Isogeometric Analysis (XIGA) in the determination of Stress Intensity Factor (SIF)*' by *Dr. Migbar Assefa Zeleke*, Senior Lecturer, Faculty of Engineering and Technology, University of Botswana, Botswana; '*Role of geospatial technology in enhancing efficacy of health risk assessment related to water contamination*' by *Dr. Deeksha Katyal*, Assistant Professor, USEM, GGSIPU, Delhi, India; '*Lattice Boltzmann Modelling: An Alternative to Conventional CFD*' by *Dr. Dipankar Chatterjee*, Sr. Principal Scientist, CSIR- Central Mechanical Engineering Research Institute (CMERI), Durgapur, India; '*Kinetic modelling of thermo-analysis data for ceramic processing and its validation*' by *Dr. Kausik Dana*, Principal Scientist, CSIR-Central Glass & Ceramic Research Institute, Kolkata, India; '*Mathematical Modeling of Blood Flow through Minor Stenosis in the Presence of Clot*' by *Dr. M.G. Sumithra* and '*Geospatial assessment of land surface temperature in Nagpur, India: an impact of urbanization*' by *Er. Saurabh Sakhre*, Scientist at National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram, Kerala, India.

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Titles of three plenary lectures during **Technical session II** were '*Rapid Prediction of Wall Temperature and Thermal Stress in Multilayer Coated Scramjet Intake for Hypersonic Applications*', '*The use of COMSOL Multiphysics Simulation Software in Plasmonic Technology*' and '*The Deployment of the DOAS Instrument Coupled with Dispersion Modeling for Estimating the Emission Rates of Air Pollutants: The case of Sohar Industrial Port, Sultanate of Oman*' respectively delivered by Mr. Gopinath NK, Centre of Excellence in Hypersonics, Department of Aerospace Engineering, Indian Institute of Science, Bangalore, India; Dr. Maithem Sabri Jaber, Head of Industrial Communication Department, Ministry of Science and Technology (Office), Iraq and Dr. Amin Nawahda, Assistant Professor, Palestine Technical University-Kadoorie (PTUK), Palestine.

Technical Session III comprised 5 Plenary Lectures delivered by Dr. Tiang Tow Leong, Senior Lecturer, Universiti Malaysia Perlis, Malaysia; Dr. Eman Abdelazem Abdelrahman, Researcher/Expert GIS and Environmental Studies, General Organization for Physical Planning; the Academy of Scientific Research & Technology (ASRT), Egypt; Dr. Madhvee Madhou, Research Coordinator, Mauritius Research and Innovation Council, Mauritius; Ms. Aradhna Goury, Ag. Scientific Officer (Conservation), Government of Mauritius, Mauritius and Professor Zingiswa MM Jojo, Department of Mathematics Education, South Africa. The topics respectively discussed by them were '*GA Optimization for Regression Modeling of Electromagnetic Performances Predicted by a Sub-domain Model for SMPMSM in an Electric Vehicle*'; '*Climate Change Model and Smart Climate Tools*'; '*Indicators for Research and Innovation Policy: Potential use of Analytical and Modelling Tools*'; '*Evaluation of the Coastal Ecosystem at Bras D'Eau National Park*' and '*Supporting Primary School Mathematics Teachers with Innovative ICT Teaching Skills*'.

In addition, 5 more Plenary Lectures were delivered by Dr. Maulid Hussein Bwabo, Lecturer, Moshi Co-Operative University, Tanzania ; Dr. Mwema Felix Mwema, Lecturer, School of Materials Energy, Water and Environmental Sciences, the Nelson Mandela African Institution of Science and Technology, Tanzania; Mr. Thandiwe Bongani Radebe, Lecturer, School of Engineering, South Africa; Mrs. Tewodaj Adane Esatu, Information and Infrastructure Security Administrator, Ministry of Innovation and Technology, Ethiopia and Dr. Rawia Awadallah, Department of Computer Science, Faculty of Information Technology – IUG, Palestine Technical University, Palestine. The topics respectively discussed by them were on '*Hello World: Application of Machine Learning Technique towards Sustainability of Dairy Micro-firm in Tanzania*'; '*PestTox: An object oriented model for modeling fate and transport of pesticides in the environment and their effects on population dynamics of non-target organisms*'; '*Application of Computational Fluid Dynamic Techniques in the Refrigeration Industry*'; '*Digital Ethiopia*' and the last Plenary Lecture was on '*Recommendations for Adopting FAIR and Open Research Data in Palestine*'.

The Training Workshop ended with a short **Concluding Session** by exchanging views on the learnings and experiences and also summarizing key takeaways from the Training Workshop.

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challenges and opportunities posed by rapid urbanization by formulating a national urbanization strategy and better coordinated actions by all the stakeholders involved including the private sector. For urban areas to produce food itself, the concept of “**Food Green City (FGC)**” is to be implied i.e. by integrating urban agriculture with urban planning and management; for addressing socio-economic and environmental issues.

In view of the above, to develop the concept of “Food Green City” combining urban agriculture with urban planning and management; and to provide socio-economic and environmental benefits in the cities, the *Centre for Science & Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre)*, New Delhi, India jointly with *Nepal Academy of Science and Technology (NAST)*, Lalitpur, Nepal organized two days comprehensive **International Workshop on 'Development of Food Green Cities for Urban Sustainability'** during **April 26-27, 2022**. The Workshop was hosted by NAST and organized in **Virtual-Mode**.

There were 97 scientists, experts and other professionals, representing the governments, academia, research institutions and S&T agencies of various NAM Member and other developing countries namely: India (7), Indonesia (1), Iran (4), Malaysia (12), Mauritius (1), Myanmar (3), Nepal (61), Nigeria (1), Palestine (2), Sri Lanka (3), Togo (1) and Turkey (1), participated in the Workshop.

The **Inaugural Session** was facilitated by Mr. Pawan Kumar Neupane, NAST. The Welcome Address was given by Dr. Kanti Shrestha, Chief, Faculty of Science, NAST followed by the Opening Remarks by Director General, NAM S&T Centre, Dr. Amitava Bandopadhyay. The **Inaugural Address** was delivered by Hon'ble Devendra Paudel, Minister for Education, Science & Technology, Government of Nepal. In his address, Mr. Paudel highlighted that the global urban population is increasing rapidly in the developing countries. Therefore, proper urban planning and management, adopting integrated food system approaches and alternative farming techniques for food production is of paramount importance for ensuring food security in urban cities. The session ended with **Closing Remarks** by Dr. Sunil Babu Shrestha, Vice Chancellor, NAST. He highlighted that in context of the current national drive for “*Prosperous Nepal and Happy Nepali*”, it is necessary to connect science and technology to solve people's problem for transformation of the society.

There were **3 Technical Sessions** during the Workshop; respectively chaired by Prof. Sudha Shrestha, Institute Of Engineering, Nepal, Dr. Amitava Bandopadhyay, Director General, NAM S&T Center and Dr. Alireza N. Namaghi, Iran.

During the Workshop **5 Keynote Lectures** were delivered, one each in Technical Session I, II and three in the Technical Session III.

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Keynote Lecture I was delivered by *Dr. Sunil Babu Shrestha*, Vice-Chancellor, NAST, Nepal, on “*Concept of Food Green City: Concept and Consequences*”. The **Keynote Lecture II** titled “*Innovating Food Green Cities in Asia: The Sustainability Nexus*” was delivered by *Dr. Bindu Lohani*, Former Vice-President, ADB. During Technical session III; **Keynote Lecture III** titled “*Concept of Food Green Cities: Opportunities and Challenges*”, **Keynote Lecture IV** titled “*Status Paper on Policy Related to Urban Sustainability*” and **Keynote Lecture V** titled “*Effects of Green Walls on Building Energy Conservation*” were respectively delivered by *Dr. Vithal Balavant Kudachikar*, CSIR-Central Food Technological Research Institute, India; *Er. Ganesh Shah*, Former Minister of Science and Technology, Nepal and *Dr. Varuni Jayasooriya*, University of Sri Jayewardenepura, Sri Lanka. There were 21 scientific papers presented across the three Technical sessions. The three presentations from Iran were by *Dr. Rouzbeh Abbaszadeh*, *Dr. Alireza N. Namaghi* and *Dr. Farhad Abbasi*; who respectively presented papers entitled “*Salvage Water and Bring Nature to your Life*”; “*Use of Urban Watershed Management and Agriculture in Sustainable Development in Cities*” and “*Global Knowledge Map of Value Chain of Agricultural Products*”. *Mr. Tharinda Dasun Denagama* from Sri Lanka presented a paper titled “*Major Barriers in Implementing Integrated Solid Waste Management System in Sri Lanka*”. *Dr. Esan Adewale Michael* from Nigeria, presented a paper titled: “*Comparative Effects of Gibberellic Acid, Salicylic Acid and Bacillus Subtilis on Oxidative Stress marker and Antioxidant Potential of Musa Sapientum Linn*”. From Malaysia, four papers entitled “*Urban Farming Technology & Innovation for Food Security in Malaysia*”; “*The Effect of LED-Light Wavelengths on the Growth and Accumulation of Secondary Metabolites in Green and Purple Red Brassica Grown in Hydroponic Vertical Farming*”; “*Biochar as a Hydroponic Substrate Enhances the Vegetable Production for Urban Sustainability*” and “*Agroecology Meets the City*” were respectively presented by *Mrs. Masnira Mohammad Yusoff*; *Mrs. Rosniza Binti Kassim*; *Dr. Rosazlin Abdullah* and *Dr. Aega Cheng*. *Mrs. Shoon Lai Toe* from Myanmar presented a paper titled “*Current Food Consumption Pattern of Myanmar*”. *Dr. Kpotchou Koffi* from Togo delivered a lecture on “*Soy Consumption and Health in Urban Areas in Togo*”. *Mr. Kowlessur Kamal* from Mauritius delivered a talk titled “*Multi-Sectorial Opportunities in Food Green Infrastructure for Urban Development*”. *Dr. Lingaraju HG* and *Ms. Vibha Gopal*, India delivered a joint presentation titled “*Effect of Fermented Liquid Manure (Jeevamrutha) on Growth and Yield Parameters of Tomato (Solanum lycopersicum L.) Crop*”.

Eight speakers from Nepal were *Dr. Kanti Shrestha*; *Er. Kishor Thapa*; *Dr. Indira Parajuli*; *Mr. Prakash Amatya*; *Mr. Prabin Dawad*; *Mr. Maheswar Ghimire*; *Dr. Deegendra Khadka* and *Dr. Matina Joshi* and their respective presentations were entitled: “*Implementation Status of Food Green City for Urban Sustainability*”; “*Relevance of Food Green City in Urbanizing Nepal*”; “*Use of Organic Fraction of Solid Waste in Urban Agriculture to Promote Food Green City*”; “*Entrepreneurs in Urban Development related to Food Green City*”; “*Nutritional Value and Antioxidant Properties of Diospyros malabarica (Desr.) Kostel Fruit from Mid-Hills of Western Nepal*”; “*Quality Assurance for Urban Organic Products*”; “*Digital Platform for Food Green City*” and “*Legal Status of Food Act in Nepal*”.

Subsequently during the Panel Discussion comprising of four Panel Members: *Dr. Amitava Bandopadhyay* (NAM S&T Center); *Dr. Suresh Prasad Acharya* (Former Secretary, GoN, Nepal); *Prof. Sudarshan Raj Tiwari* (IOE, Nepal) and *Dr. Kanti Shrestha*, (Chief, Faculty of Science, NAST, Nepal) viewpoints were exchanged among the experts on the subject and in response to the questions from the participants.

The Workshop successfully came to an end with a Concluding Session and **Adoption of Resolution**. It was concluded that the Governments and other stakeholders of the NAM and other developing countries should recognize the importance of “Food Green City” for achieving urban sustainability as well the necessity for adequate mechanisms to support sustainable food production in urban areas which will significantly address the food security issues of the urban cities. The Resolution was adopted unanimously by the participants during the Concluding Session.

Resolution

ON

“Development of Food Green City for Urban Sustainability”

**NAST, Khumaltar, Lalitpur, Nepal and
NAM S&T Centre, New Delhi, India
(26-27 April 2022)**



Resolution adopted by the participants of the International Workshop on “**Development of Food Green City for Urban Sustainability**” organized jointly by the Nepal Academy of Science and Technology (NAST), Nepal and the Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre), New Delhi; held virtually from 26 to 27 April, 2022;

We, the participants of the International Workshop on “**Development of Food Green City for Urban Sustainability**” representing the governments, academia, research institutions and S&T agencies from Nepal, India, Malaysia, Iran, Sri Lanka, Nigeria, Mauritius, Togo, and Myanmar as well as other pertinent allies.

Perceiving that Food Green City is a prominent concept that addresses to greening urban spaces applying urban agriculture technologies like kitchen gardening, roof top gardening, hydroponic, aeroponic, and planting the fruits trees on the unutilized and vacant spaces of the city premises to enhance the quality of life, reduce carbon, emission and improve food security to the city dwellers;

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Understanding the Food Green City as an ecocity that integrates urban agriculture with urban planning plays a significant role not only in improving quality of life but also supplying fresh fruits and vegetables that immensely addresses food security issues of the cities;

Reiterating the goals of the workshop: (a) to disseminate the concept of Food Green City in the connection with its advantages; (b) to create a nexus among the experts, professionals and the policy makers from the developing countries in the domain of food green city; (c) to facilitate in developing a Food Green City by providing information, techniques, and sharing experiences and (d) to solve the arising problems while transforming a city to a Food Green City;

Reasserting that empowering the program Food Green City should stand as one of the main agenda of local government for accelerating urban economy with better urban environment amid the pandemic in view of its potential to boost the quality of life of the city dwellers;

Realizing the necessity for developing countries to motivate urban agriculture and formulate adequate mechanisms for enhancing food production in urban areas;

Unanimously resolve and recommend the following:

- Government and all stakeholders should motivate to develop a Food Green Cities in developing countries by adapting eight guiding **P-L-E-A-S-U-R-E** Principles of Food Green City which are: Plenty of Food Green Space (Urban Productive Greening), Living and Working Together, Ensuring minimum consumption of resources, Attaining sustainable neighborhood through Public Private Partnership, System of 3B's (Boot, Bike and Bus), Use of energy efficiency and eco-friendly technologies, Restructuring the cities through Community participation and local resources, and Effort for Zero Waste Emission integrating urban agriculture with urban planning and mobilizing the urban agriculture activities such as kitchen gardening, roof top gardening, hydroponic, aeroponic, container gardening and planting fruits trees in barren fields in a city.
- Government should adopt the concept of Food Green City for managing urbanization process including the application of hydroponics technology for producing food and providing green spaces in the urban areas.
- For the sake of accomplishing the Food Green City program, stakeholders should be connected nationally and internationally through the use of Food Green City digital platform developed by member countries for sharing their knowledge, experiences, research findings, and providing their technical support to address their problems.
- Wise, strategic and systemic schemes along with supportive government programs are necessary to realize Food Green City by using innovating urban agriculture approaches.
- Government as well as local communities must promote eco-friendly techniques for converting the waste materials to organic fertilizers.
- A robust mechanism among scientists, young researchers, and academia should be established for capacity building and technology transfer on urban agriculture.
- Young generation should be encouraged to promote food green city not only for reducing food shortage issues but also for creating a livable urban environment.
- Trainings, workshops, and conferences should be organized to the interested city dwellers in disseminating various urban agricultural techniques.
- Sharing of knowledge, experiences, and information among academia, scientists, and professionals should be encouraged.
- Governments should formulate innovative policy that fully supports greening urban areas by adopting smart agriculture techniques to increase quality and quantity of food products.
- Governments should establish Department of Urban Agriculture in central and local levels of the country to promote urban agriculture activities in the urban and peri-urban areas.
- Requisite subsidies should be provided by the governments to the urban farmers for enhancing production and securing market for their products.
- The international financial institutions shall be approached for launching projects in the priority areas as well as building capacity for urban agriculture research, innovation and technology development. For this purpose, cooperation and collaboration should be sought in the field of smart agriculture from a) SADC, AU, UN, African Development Bank etc. and (b) Other inter-governmental and non-governmental technological organizations including FAO, UNESCO, UNDP, WHO, Afro-Asia Rural Development Organization, Asian Development Bank etc.
- Internationally connected active digital platform with high-speed internet facility should be made available for sharing the experts' knowledge to address urban agricultural issues.
- Implementation of the Food Green City program using urban farming for promoting food safety and food security should be made mandatory.
- The concept of Food Green Cities shall be adopted as an effective tool for achieving the Sustainable Development Goal (SDG 11) that aims to create safe, sustainable, resilient and inclusive cities, and human settlements.

That this resolution is submitted to the Heads of State and Governments of NAM Member States and other Developing Countries for appropriate actions.

THUS, UNANIMOUSLY RESOLVED AND ADOPTED VIRTUALLY ON THIS DAY, THE 27th OF APRIL 2022, AT NEPAL ACADEMY OF SCIENCE AND TECHNOLOGY (NAST), KHUMALTAR, LALITPUR, NEPAL.

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accelerating global transformation towards prosperous, inclusive and environmentally sustainable economies. In the context of the SDG framework, the implementation of the Goals is replete with a number of challenges for which a close collaboration between the policy makers, STI communities and other development professionals and stakeholders is required. For effective implementation of most of the 17 SDGs and achieving their set targets, it is necessary that STI has to be directly and indirectly applied with appropriate focus, especially in the Emerging Economies (EE), Least Developed Countries (LDCs) and Small Island Developing States (SIDS).

In order to deliberate on the role of STI in achieving SDGs and to discuss the dynamics of STI systems as well as the challenges and opportunities in accelerating STI-driven development in the NAM and IORA Member Countries, the *Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre)*, New Delhi, jointly with the *Indian Ocean Rim Association (IORA) Secretariat*, Mauritius, organised an **International Workshop on the “Role of Science, Technology and Innovation (STI) in Achieving Sustainable Development Goals – 2030”** during **24-25 May 2022**. The Workshop was hosted by the IORA Secretariat and organised in **Virtual-Mode**.

The Workshop took place under the auspices of the NAM S&T Centre and IORA Memorandum of Understanding (MoU) that was concluded in 2019 in Abu Dhabi, UAE.

139 scientists, academicians, researchers, technologists, engineers, consultants, policy-makers, S&T practitioners, international organisations and NGOs from various NAM and IORA Member Countries participated in the Workshop to promote academia-industry interactions and public-private partnerships in achieving SDGs with the application of STI.

The **Opening Session** was facilitated by Director, IORA Secretariat, *Mr. Gareth Rees*. The Opening remarks were given by *H.E. Dr. Salman Al Farisi*, Secretary General, IORA. During his remarks, he said that it was a privilege for the IORA Secretariat to host this important event in collaboration with the NAM S&T Centre under the MoU between the two that was signed in 2019. He added that IORA is an apex regional organisation in the Indian Ocean Region consisting of 23 Member States and 10 Dialogue Partners promoting international partnership and STI cooperation. He also appreciated the NAM S&T Centre's commitment to support the strategic goals on STI to develop capacity of NAM Member Countries. In support of the above, a presentation on “IORA” was made by Mr. Rees, highlighting the establishment of a sectoral working group in IORA dedicated to enhancing cooperation in Science, Technology and Innovation. Following this, *Dr. Amitava Bandopadhyay*, Director General, NAM S&T Centre welcomed the participants and provided an overview about the NAM S&T Centre, describing the organizational structure, objectives and major scientific activities of the Centre. With a commonality of interest of working towards sustainable development of the countries from the Global South and Island States, he expressed hope that the collaborative relationship between the two organisations – NAM S&T Centre and IORA will be strengthened to meet their respective objectives. A Vote of thanks was given by Mr. Rees which marked the end of the opening session.

During the two days Workshop, there were **4 Technical Sessions** with **16 Paper Presentations**.

Technical Session I - Strategies and Means of Implementation of the SDGs in Emerging Economies (EE), Least Developed Countries (LDCs) and Small Island Developing States (SIDS) in the Indian Ocean Region (IOR)

A presentation on “*Domestication of the UN Sustainable Development Goals in South Africa*” was made by *Dr. Dumisani Mthembu*, Acting Director, Multilateral Cooperation, Department of Science & Innovation (DSI), South Africa. The study undertook to map South Africa's National Development Plan (NDP) - 2030 alongside the SDGs 2030 to assess the level of convergence and synergy between the two. The assessment revealed that the NDP and the SDGs are aligned and share similar objectives, such as reducing unemployment and eradicating poverty and inequality. It showed 74% alignment of the NDP and the SDGs; 57% of the targets of SDGs were fully addressed in the NDP while 17% of the targets were partially addressed. The study indicated concern that the plan to implement the SDGs was not fully inclusive.

Following this, a presentation on “*Mauritius as a Smart Tourism Destination: Technology for Enhancing Tourism Experience to Achieve Sustainability*” was given by *Dr. Randhir Roopchand*, Dean, Université des Mascareignes (UDM), Business and Management, Mauritius. The research provided an overview of how technology is shaping pathway for Mauritius to become a “Smart Tourism” destination. It analyzed the megatrends in digitalization and analyzed different indexes for ICT to assess the readiness of Mauritius. Different Mauritian tourism websites and metrics were used to gather data for analysis. The research showed that the hospitality industry is investing in new technological tools due to increasing customer satisfaction to achieve sustainability objectives. The *hospitality.mu* and *marideal.mu* portals are clear examples of the digitalization trends in the tourism industry with the increasing use of the internet by consumers at all levels of the value chain.

Technical Session II - Knowledge Access for the Developing Economies on the Relevant Technologies Available for Achieving SDGs

Under this session, a paper on “*Towards Blue and Green Innovation in Mauritius: Roadmap for Energizing the Future*” was presented by *Dr. Poonam Veer Ramjeawon*, Research Coordinator, Mauritius Research and Innovation Council (MRIC), Mauritius. Her paper summarized the current state of the blue and green sectors in Mauritius, including gaps and challenges and technological needs. Several strategic orientations and actions were proposed, which set the foundation for the development of a roadmap to promote economic growth through research, innovation and commercialization in the blue and green sectors of Mauritius.

Afterwards, *Ms. Mamta Bhardwaj*, Senior Scientist, DST-Centre for Policy Research, India, delivered a presentation on “*A Case Study on Role of Higher Educational Institutions in Achieving SDG-9*”. She concluded that Science Diplomacy can play a crucial role in international collaboration in S&T activities and IP/Teach transfer. The research and scientific institutions of cross border countries should work in tandem and address the real challenges; and organizations like IORA and NAM S&T Centre can play important role to promote cross border tie-ups in R&D and tech transfer.

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Following this, a presentation on “*Role of Science, Technology and Innovation in Achieving Sustainable Development Goals - Hydro Geochemical Analysis as Complement to Integrated Water Resources Management of Shallow Coastal Aquifer in Ghana*” was made by Mr. Festus Anane Mensah, Senior Research Scientist, Geotechnical and Materials Eng. Division, CSIR-Building and Road Research Institute (CSIR-BRRI), Ghana. He concluded that enhancing the capacity of data generation and research institutions for improved data collection networks and assessment techniques is imperative in achieving SDGs via STI. A well scientifically coordinated integrated water resources management can lead to appropriate combination of resources, facilities and conservation programs for the expansion of water systems to meet current and future water demand to accommodate the population growth.

A paper on “*Healthy Technologies for Sustainable Development*” was presented by Mr. Vincent Obino Orucho, Principal Research Officer, Ministry of Education, Kenya. The study highlighted the role of Research, Technology and Innovation in delivering a health care especially through early and effective diagnosis. It analyzed the effectiveness of different innovative diagnostics and response mechanisms and the role they have played to overcome the disease burden and to achieve Goal 3 of the sustainable development agenda.

Technical Session III - Capacity Building of Participating Countries for Sustainable Implementation and Related Social Innovation to Make Progress in this Field

A presentation on “*Global Pilot Project on STI Roadmap for SDGs*” was made by Dr. David Njubi, Director, Scheduled Sciences, Kenya. Dr. Njubi highlighted various aspects of the Pilot Project and summarized the outcome.

A presentation on “*Environmental Management of Coastal Areas for their Sustainable Development within the Framework of the UN Decade of Ocean Sciences (2021-2030)*” was given by Dr. Nataliya Milchakova, Head of Laboratory, Federal Research Center, A.O. Kovalevskiy Institute of Biology of the Southern Seas (IBSS), Russia. Her research study included an analysis of the status and development of national, regional and local protected areas - including marine protected areas, assessing the modern structure of natural complexes of the Crimean Peninsula and the Sevastopol Region, their biological and landscape diversity, human-induced factors and their negative effects.

Afterwards, Dr. Charu Gupta, Professor, Amity Institute of Herbal Research & Studies (AIHRS), Amity University, India delivered a presentation on “*Socio-Economic Empowerment of Rural Women through Training on Preparation of Value-Added Products for Income Generation & General Well-being*”. In her study, the rural women of villages of Western Uttar Pradesh district of Saharanpur were trained on the agro-technology and processing of medicinal and aromatic plants to produce value added products. The market linkage was also developed through the project where the rural women got returns from the sale of their plantation. This model became a success story and thus, got replicated in other adjoining rural areas of the same district.

Vice-Chancellor, Nepal Academy of Science and Technology (NAST), Nepal, Dr. Sunil Babu Shrestha, delivered a talk on “*Realizing Sustainable Urban Development through Science, Technology and Innovation*”. He explained how the knowledge application of STI in the form of sustainable urban planning, affordable housing system, productive greening, intelligent transportation system, renewable energy, smart waste management, sustainable production and consumption pattern etc. can contribute for Sustainable Urban Development (SUD). He also provided some recommendations to mobilize the role of STI for SUD and recommended the concept of Food Green City (FGC) for integrating urban agriculture with urban planning and management.

A presentation on “*Implications of Water Policy on Coastal Pollution: A Case Study of Mogadishu Coast*” was then given by Mr. Hassan Osman Hassan, Head Section of Climate Change Adaptation, Department of DRR at the Ministry of Humanitarian Affairs & Disaster Management, Ministry of Communication and Technology, Somalia. In his study, three different locations in the Mogadishu City were selected to study physical, chemical and biological characteristics of water and sediments. Based on the results, it was found that the major source of the pollution (65%) was originated from external pollutants (foreign ships). The parameters that caused the pollution in the selected locations were chemical parameters (44%) followed by biological parameters (42%). This study concluded that most of the selected locations recorded higher values that exceeded the acceptable and recommended standards of the World Health Organisation (WHO) and the Environmental Protection Agency (EPA).

Mrs. Smreetee Cyparsade, Disaster Monitoring Officer, National Disaster Risk Reduction and Management Centre, Mauritius delivered a presentation on “*Disaster Risk Reduction and Management - Mauritian Perspective*”. During her presentation, she briefed that Mauritius is working towards addressing the challenges of the climate change and has invested significantly both in its mitigation and adaptation; despite the limited resources being available to promote resilience and sustainability.

Technical Session IV - Barriers to Technology Transfer such as, High Cost of Transition towards Environmentally Sustainable Societies and Economies in the Context of South-South and North-South Cooperation

A presentation on “*Following Scientific Recommendations in Political Decision-Making: An Asset for Achieving Sustainable Development Goals*” was given by Prof. Jean Maharavo, Researcher, National Oceanographic Research Center, Madagascar. He summarized that one of the main problems that occurs with achievement of SDGs is the failure to consider scientific recommendations in the political decision making. For a country like Madagascar which is rich in biodiversity, scientific studies and technological innovations should be supported by the government to protect the natural resources.

Afterwards, Dr. W.S. Winanti, Principal Engineer, Research Centre for Environment & Clean Technology, BRIN, Indonesia gave a presentation on “*Barrier Analysis for Technology Transfer to Enhance Action of Climate Change and SDG Goals.*” She explained that Science, Technology & Innovation is one of the means of implementation to leverage SDGs as well as climate change goals. Technology transfer is important in supporting developing countries in mitigating and adapting to climate change. There are many

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barriers to technology implementation that must be overcome—such as technical, social, regulatory, financial, institutional, capacity building, IPR and social & culture barriers. These barriers need to be identified, analyzed and mapped to translate problems into recommended solutions. Activities in analyzing and enabling barriers for technology transfer require collaboration with all relevant stakeholders. It was also recommended that cooperation among and outside the NAM Member Countries needs to be strengthened by establishing a platform for collaboration through sharing of information on various S&T issues including transfer of technology.

A presentation on “*Challenges in Achieving Sustainable Development Goals related to Construction Sector in Sri Lanka*” was then given by *Mr. T.D. Denagama*, Lecturer, University of Vocational Technology, Sri Lanka. Since, construction industry is one of the biggest sectors in Sri Lanka, it mainly affects environment, economic and socio-culture aspects. Providing necessary education towards SDG's to the students & workforce, strengthening active legal framework, promoting research & innovation, proper coordination between regulatory bodies, stakeholders & general public will be effective to overcome the existing challenges towards sustainable development.

Following this, a presentation on “*Innovative Capacity in the Field of Blue Biotechnology*” was given by *Dr. Svetlana Gorbunova*, Senior Researcher, Federal Research Center, A.O. Kovalevskiy Institute of Biology of the Southern Seas (IBSS), Russia. One of the areas of IBSS scientific activity is “Investigation of biotechnological complexes and production of biologically active substances and technical products of marine origin”. The researchers of A.O. Kovalevsky IBSS have developed technologies using *Arthrospira platensis*, *Dunaliella salina*, *Chlorella* sp., *Cylindrotheca closterium*, *Phaeodactylum tricornerutum* and some other algae for production of dietary supplements and a source of valuable compounds.

It was concluded that in order to commit to achieve the laudable Sustainable Development Goals and its set forth targets; it is important to recognize STI as a key driver to implement most of the SDGs especially in Emerging Economies (EE), Least Developed Countries (LDCs) and Small Island Developing States (SIDS) in the Indian Ocean Rim (IOR) Region and other parts of the Global South. To address the global challenges, it is necessary for the NAM and IORA Member Countries to integrate “STI-SDGs Blueprint” in their national policy to achieve the set goals within the timeframe. STI policy initiatives towards - eradicating poverty; ending hunger; reducing inequalities; providing better access to quality education; access to affordable clean energy, water and sanitation; building resilient and safe infrastructure, cities and communities; sustainable production and consumption patterns; promoting sustainable industrialization; building inclusive and sustained economic growth should be effectively implemented and periodically monitored – all while working to preserve the environment and biodiversity, oceans and forests. Information on SDG good practices, success stories and challenges should be shared to strengthen the means of implementation.

This was followed by a *Working Session: An Outcome Document* - during which a **Resolution** with a set of S&T recommendations was discussed and unanimously adopted by the Workshop participants to help, advice and facilitate the NAM S&T Centre and IORA Member Countries to achieving SDGs within the set timeframe.

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In this connection, it is important to note that the use of water contaminated with Arsenic for drinking, food preparations and irrigation of food crops poses the greatest threat to public health. Its sources and effects are multiple and its diffusion in natural resources including food and groundwater requires a multipronged assessment and appropriate policy initiatives for its mitigation.

Due to the lack of awareness about the problem, the silent presence of higher Arsenic content in groundwater is left un-noticed which creates a latent magnification of the problem in the African as well as in many other developing countries. However, the sources and effects of Arsenic contamination are multiple and diffused in nature and require a detailed assessment and formulation of required policies.

In the areas where the groundwater contains unsafe levels of Arsenic, the immediate concern is to find a safe source of drinking water. There are two main options: finding a new safe source or removing Arsenic from the contaminated source. If an Arsenic safe water source cannot be established, the short-term goal is to reduce the Arsenic levels. Considering various socio-economic and literary conditions of the people of the regions, efforts should be made for improving the effectiveness of Arsenic removal, reducing the cost of the system, making the technology user friendly, overcoming maintenance problems and resolving the toxic sludge management issues.

In order to address the above issues, the *Centre for Science and Technology of the Non-Aligned and Other Developing Countries (NAM S&T Centre)* is implementing a collaborative project entitled “**Reducing Arsenic Exposure from Food and Water in Developing Countries – A Roadmap for Technological Solutions for the Future**” with *partial financial support under Perez-Guerrero Trust Fund (PGTF) of G-77*. The project aims to cope with the serious consequences of Arsenic contamination of groundwater in developing countries and provide a roadmap for low cost technological solutions for the removal of Arsenic from the groundwater in order to minimize the exposure of people to this toxic element through food and water. The implementation of the project is being monitored by the UN Office for South-South Cooperation (UNOSSC), New York.

As a part of the Project, the NAM S&T Centre organized an International Workshop on “**Water Purification Technologies, Arsenic Removal from Groundwater and Integrated Water Management**” in partnership with the *CSIR-Central Salt and Marine Chemicals Research Institute (CSIR-CSMCRI), Bhavnagar, India* during **28-30 June 2022** in **Hybrid Mode**.

The International Workshop was organized over 3 days period with an **Inaugural lecture, 8 Keynote lectures and 26 Paper presentations** by the participants. Further, around **50 e-Poster presentations** were made by young scientists and students.

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Resolution



on

Role of Science, Technology and Innovation (STI) in Achieving Sustainable Development Goals (SDGs) - 2030



WE, THE DELEGATES, participating in the International Virtual Workshop on “The Role of Science, Technology and Innovation (STI) in Achieving Sustainable Development Goals (SDGs) – 2030” jointly organized by the Centre for Science and Technology of the Non-aligned and Other Developing Countries (NAM S&T Centre), New Delhi, and the Indian Ocean Rim Association (IORA) from May 24-25, 2022 at Ebene, Mauritius;

WELCOMING that the Joint Workshop took place under the auspices of the NAM S&T Centre-IORA Memorandum of Understanding (MoU) on the “Application of Science, Technology and Innovation for Sustainable Development” signed in November 2019;

COMPRISING the scientists, academicians, researchers, technologists, engineers, consultants, policy-makers and other S&T practitioners from various NAM S&T Centre and IORA Member States;

COMMITTING ourselves to achieving the laudable development goals set forth by the global community at the United Nations Sustainable Development Summit held in September 2015, which calls for an urgent action by all countries - developed and developing - in a global partnership to eradicate poverty, improve health and education, reduce inequality and facilitate economic growth – all while tackling climate change and working to preserve the environment and biodiversity, oceans and forests;

RECOGNIZING the critical role and contributions of Science, Technology and Innovation (STI) in building and maintaining national competitiveness in a global economy, addressing global challenges and promoting sustainable development;

REALIZING STI as a key driver to implement most of the SDGs especially in Emerging Economies (EE), Least Developed Countries (LDCs) and Small Island Developing States (SIDS) in the Indian Ocean Region (IOR) and other parts of the Global South;

RESOLVE AND RECOMMEND THAT -

- ◆ STI policies should comprise strategies for promoting sustainable development and achieving the Sustainable Development Goals (SDGs);
- ◆ Adequate funding mechanisms for capacity building in STI should be in place in the areas of basic sciences, R&D infrastructure, intellectual property rights (IPR), technology transfer & commercialization, incubation, and development of S&T Parks;
- ◆ A holistic measure on STI-driven sustainable development should be developed in line with the UNDP Human Development Index (HDI);
- ◆ Environmentally sound STI best practices and traditions should be encouraged and propagated;
- ◆ Realizing the importance of healthy ocean ecosystem, trends for strengthening blue economy, methods for climate change mitigation and adaptation and sustainable use of ocean resources to be promoted;
- ◆ Responsible and responsive regulatory mechanism should be developed for social, economic and environmental initiatives; taking into account all the three pillars of sustainable development;
- ◆ STI policy initiatives for implementation of SDGs should be developed at national and regional levels, effectively implemented and mechanisms should be developed to periodically monitor and evaluate its progress;
- ◆ There is a strong need to ensure women's empowerment and gender equality to facilitate successful transfer of Environmentally Sound Technologies (ESTs) at the household and community levels;
- ◆ Approaches involving technological innovations should be geared towards bridging the deepening digital divide within developing societies;
- ◆ Indigenous people should be involved to integrate indigenous knowledge systems, culture and traditional knowledge to support the implementation of SDGs;
- ◆ All developmental STI initiatives should essentially reflect the specific socio-cultural ethos;
- ◆ STI should be harnessed to develop more sustainable products and services and behavioural/attitudinal changes should be encouraged in line with current and future consumption patterns;
- ◆ Projects and programmes on STI for sustainable development should be implemented by countries individually and collectively;
- ◆ The governments of NAM S&T Centre and IORA Member countries, relevant S&T institutions and other stakeholders and communities are encouraged to rededicate themselves and act on their obligations to provide for sustainable living, meeting the developmental goals and aspirations of the people of the nations that would ensure peace and prosperity of people and planet, now and into the future;
- ◆ A pilot program on application of STI for SDGs should be explored to enhance global cooperation for a Technology Facilitation Mechanism (TFM) as envisioned in the Agenda 2030;
- ◆ SDG good practices, success stories and lessons learned in the implementation of SDGs should be shared through online digital platforms, print media and social media;

This resolution does not represent the views or positions of the IORA or NAM S&T Centre Member States, but a set of technical recommendations from the workshop participants to IORA and NAM S&T Centre Member States for their consideration. These recommendations are non-binding and may be taken up at their discretion.

THUS, RESOLVED AND ADOPTED UNANIMOUSLY ON THE 25TH MAY 2022 VIRTUALLY.

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Altogether 139 researchers, scientists, experts, academicians and policy makers from 20 countries including Bhutan, Burkina Faso, Egypt, Ethiopia, India, Indonesia, Kenya, Madagascar, Malaysia, Malawi, Mauritius, Mongolia, Myanmar, Nepal, Palestine, South Africa, Sri Lanka, Togo, the United Kingdom and Zambia had participated in the Workshop. This included invited speakers, guests, nodal officers for the G-77 project from the participating developing countries, and scientists and experts from other countries. Around 50 students and young researchers from various Indian universities and research institutions had also attended the Workshop and made their Poster presentations.

During the **Inaugural Session**, at the outset, *Dr. V. K. Shahi*, Chief Scientist/Divisional Chair, Membrane Science & Separation Technology Division, CSIR-CSMCR, Bhavnagar, India welcomed the invited delegates and other participants. He pointed out that the membrane technologies are playing a pivotal role in water purification and some of the membrane-based approaches that are currently adapted at an industrial scale include membrane based desalination (by reverse osmosis, electrodialysis, nano-filtration, or bioreactors) for production of pure water.

Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre, in his address, welcomed the distinguished speakers, special invitees, and other participants and highlighted the importance and need of conducting the Workshop. He indicated that nearly 100 million rural people are affected by exposure to Arsenic in the food chain and drinking water in Asia. The areas that have the worst documented contamination of groundwater by Arsenic are in South Asia, and the toxin poses a severe problem in Bangladesh, India and Nepal. He also pointed out the sources and effects of Arsenic contamination in groundwater on human health, and since the contamination is on the rise in the developing world, the NAM S&T Centre has taken up a collaborative project with a view to prepare a roadmap of reducing arsenic exposure through food and water as a part of the commitment to achieving "Clean Water and Sanitation for All" (SDG-6), and the Workshop is an integral part of the project.

This was followed by an address by *Dr. Kannan Srinivasan*, Director, CSIR-CSMCR, Bhavnagar, India. He emphasized the need for all the countries, especially the developing world, to become aware of the technologies available and gaps that need to be bridged regarding access to potable water which is one of the indispensable requirements for mankind's survival. He added that the problem is extremely location centric and it is necessary to know when, where and which technology should be deployed.

Prof. T. Pradeep, Indian Institute of Technology Madras, India, in his remarks said that the value of globally connected water network is estimated to be 50 trillion dollars and total wealth is estimated around 13 trillion dollars, with India's market being about 1 trillion dollars, and thus enormous opportunities are there in wealth creation through water. He emphasized on the importance of studying water as a separate branch of engineering which is now buried under environmental engineering. In this context, he said that it is also necessary to address issues of human resources and water literacy should be encouraged.

The **Inaugural Lecture** was given by Prof. T. Pradeep, Indian Institute of Technology Madras, India, on '*Affordable clean water using advanced materials*'. He elucidated on how water is neither created nor destroyed (roughly even after the molecular exchange between the Earth and the Space) whereas water is involved in everything we do. He stated that the World Health Organization (WHO) set the upper limit on Arsenic in drinking water at 50 ppb in 1963, and the U.S. Environmental Protection Agency decreased the limit to 10 ppb in 2002. However, the limited availability and high cost of remedial technologies have kept governments from implementing these standards. However, the dreams to reduce Arsenic exposure become reality with advanced materials through sustainable nanotechnology that has made substantial contributions in providing contaminant-free water to humanity. Nano-materials are now atomically precise and therefore, can solve real problems. He discussed technologies including Biopolymer-reinforced synthetic granular nano-composites for affordable water purification aid, and 'Silver' technology.

The three days workshop was comprised of eight sessions. Chairman for the respective sessions were: *Prof. D. Mohan*, Anna University, Chennai, India; *Dr. Pawan Kumar Labhasetwar*, Water Technology and Management Division, CSIR-NEERI, Nagpur, India; *Mr. Swachchha Majumdar*, CSIR-Central Glass & Ceramic Research Institute (CGCRI), Kolkata, India; *Dr. Sridhar S.*, Chief Scientist, Indian Institute of Chemical Technology, Hyderabad, India; *Dr. Kunal Kanti Majumdar*, Professor of Public Health, KPC Medical College, Kolkata; Ex Consultant UNICEF, Kolkata; Arsenic specialist, WHO (SEARO), India; *Dr. Atul Maldhure*, CSIR-National Environmental Engineering Research Institute (NEERI), Nagpur, India; *Dr. Hariom Gupta*, CSIR- Central Institute of Medicinal and Aromatic Plants (CSIR-CIMAP), India and *Dr. A. B. Panda*, CSIR-National Metallurgical Laboratory, India.

During the Workshop **8 Keynote Lectures** were delivered respectively by *Dr. Pradip K. Tewari*, Professor Chair, Department of Chemical Engineering, Indian Institute of Technology (IIT), Jodhpur, India on '*Sustainable Water: Challenges and Opportunities*'; *Dr. Dipankar Saha*, Former Member, Central Groundwater Board, Ministry of Jal Shakti, Government of India, New Delhi, India on '*Aquifer-based water supply in groundwater dependent arsenic contaminated areas*'; *Dr. Pawan Kumar Labhasetwar*, Chief Scientist & Head, Water Technology and Management Division, CSIR-National Environmental Engineering Research Institute, Nagpur, India on '*The Conundrum of Water Treatment – Reality and Priority*'; *Dr. Kunal Kanti Majumdar*, Professor of Public Health, KPC Medical College, Kolkata, India on '*Arsenic contamination of groundwater and its impact on Health*'; *Prof. David Polya*, Department of Earth and Environmental Sciences, Faculty of Science and Engineering, University of Manchester, United Kingdom on '*Groundwater Arsenic in India – Distribution, Impacts & Remediation Perspectives*'; *Dr. Neelima Alam*, Scientist - F/Director (Technology Missions), Department of Science & Technology (DST), Ministry of Science & Technology, Government of India on '*DST's water interventions and its impacts*'; *Prof. Bhaskar Sengupta*, Water Technology, School of Energy, Geoscience, Infrastructure and Society, Heriot-Watt University, Edinburgh Campus, UK on "*Soil and Water pollution from historical mining*"



Lighting of Lamp



Padma Shri
Prof. T. Pradeep

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activities in San Luis Potosi (SLP), Mexico”; and Dr. Debapriya Mondal, Global Health Centre for Clinical Education, Institute of Medical and Biomedical Education, St George's University of London, UK on “Significant health risks of food-based arsenic exposure and remediation options”.

During 8 Technical Sessions, **26 papers** were presented including 21 from India. Papers from India were on '*Emerging Membrane Technology processes in Water Desalination with reduced Carbon footprint*' by Prof. D. Mohan, Anna University, Chennai, India; '*Innovations in Membrane Science & Technology for Combating Water Scarcity and Covid-19 Pandemic*' by Dr. Sridhar S., Chief Scientist, CSIR-Indian Institute of Chemical Technology, Hyderabad, India; '*Understanding Water Safety with Focus on Membrane/Reverse Osmosis based Plants and Water ATMs for Drinking Water Supply*' by Dr. Atul Maldhure, Water Technology & Management Division, CSIR-National Environmental Engineering Research Institute, Nagpur, India; '*Feasibility and parametric studies of thermal energy driven MED and RO systems for brackish water treatment*' by Prof. Anurag Mudgal, Pandit Deen Dayal Energy University, Gandhinagar, Gujarat, India; '*Polymer Nano-film Composite Membranes for Ionic and Molecular Separation*' by Dr. Santanu Karan, Membrane Science and Separation Technology Division, CSIR-CSMCRI, Bhavnagar, India; '*Biogeochemistry of arsenic cycling- translating microbial responses towards As free potable water*' by Prof. Punyasloke Bhadury, Centre for Climate and Environmental Studies & Department of Biological Sciences, Indian Institute of Science Education and Research, Kolkata, India; '*Current researches of Arsenic removal in water – A review*' by Dr. P. S. Navaraj, Former Principal, Annai Fathima College, Madurai; '*Arsenic Removal in Groundwater*' by Dr. Lalit Mohan Sharma, Principal Scientist, Water Research and Training Water Researcher, S M Sehgal Foundation, Gurugram, India; '*Business of Poison: Willingness of rural households to have their groundwater well tested for arsenic for a fee*' by Dr. Chander Kumar Singh, TERI School of Advanced Studies, New Delhi; '*Assessing hazards of arsenic leakage in multi-layered aquifer system in a part of Middle Ganga Plains, Northern India*' by Dr. N C Mondal, Principal Scientist, Earth Process Modeling Group, CSIR – National Geophysical Research Institute (NGRI), Hyderabad, India; '*Ceramic Membranes and applications purification of ground water for decontamination of Arsenic and Iron*' Dr. Swachchha Majumdar, CSIR-Central Glass & Ceramic Research Institute, Kolkata, India; '*State-of-the-Art Technology of Advanced oxidation process using Ozone in water and industrial wastewater treatment – A first of its kind treatment system in India*' by Dr. S. Rajamani, Technical Expert - Environmental Engineering, UNIDO; Chairman - Asian International Union of Environment (AIUE) Commission, Chennai, India; '*Advances in membrane distillation system for water purification with the development of a pilot model*' by Dr. Raju Abraham, Scientist-F, National Institute of Ocean Technology (NIOT), Chennai, India; '*Transforming Waste to Wealth through Membrane Processes in an Eco-Friendly Manner*' by Dr. S. Prabhakar, Visiting Professor, SRM Institute of Science and Technology; '*The Intervention of Phytohormones to Reduce Arsenic Accumulation in Rice Grains*' by Dr. Mohan TC, Division of Biotechnology and Bioinformatics, JSS Academy of Higher Education and Research, Mysore, India; '*Arsenic in groundwater: a threat to agriculture and its mitigation measures to protect the food chain*' by Dr. Pankaj Kumar Srivastava, Principal Scientist, CSIR – National Botanical Research Institute (NBRI), Lucknow, India; '*Moving Away From Water Stress – The Road Ahead*' by Dr. Purnima Jalihal, National Institute of Ocean Technology (NIOT), Goa, India; '*Capacity building for mitigation of arsenic pollution in groundwater of Bengal basin*' by Prof. Surajit Chakraborty, Environmental Technology, Department of Environment Management, Indian Institute of Social Welfare and Business Management (IISWBM), Kolkata, India; '*Quest for arsenic remediation technology of drinking water: Initiative of CSIR-CSMCRP*' by Dr. Saroj Sharma, CSIR-CSMCRI, India; '*An energy efficient and continuous electrochemical process using halophyte derived bio-adsorbent for selective trace removal of Hg²⁺/As³⁺/5⁺ from water system*' by Ms. Prerana Sharma, CSIR-CSMCRI and on '*An integrated Nanofiltration -Membrane Distillation (NF-MD) process for the treatment of saline oily wastewater*' by Ms. J Juliana, National Institute of Technology, Calicut, Kerala, India

Other than India, there were 5 more presentations, one each from Myanmar, Malaysia, Palestine, Sri Lanka and Indonesia. Those papers were: '*Arsenic contamination in groundwater and food and remediation measures in Myanmar*' by Ms. Mya Thandar Khin, Assistant Director, Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation, Myanmar; '*Water Pollution in Malaysia*' by Mr. Zulhelmi Bin Kasim, Senior Executive, Ministry of Environment and Water, Malaysia; '*Novel Cellulose-Based Hectocycle Nanopolymers for Arsenic Removal from Groundwater*' a joint paper by Dr. Subhi Abed Al-kader Samhan, Director, Research and Development, Palestinian Water Authority, Palestine; Dr. Bayan Khalaf, Assistant Professor – Chemistry, Arab American University, Jenin, Palestine; and Prof. Shehdeh Jodeh, Professor An-Najah N University, Palestine (presented by Dr. Bayan Khalaf); '*Arsenic in Water, Soil and Food in Sri Lanka*' by Dr. A.G. Piyal Aravinna, Chemical & Environmental Section CECBLS, Central Engineering Consultancy, Sri Lan and on '*Arsenic contamination in Indonesia*' by Dr. Eng Ahmad Shoiful, Junior Engineer, Research Center of Environment and Clean Technology, the National Research and Innovation Agency (BRIN), Indonesia

In the **Concluding Session**, Dr. V.K. Shahi thanked Dr. Kannan Srinivasan, Director, CSMCRI, and Dr. Amitava Bandopadhyay, DG, NAM S&T Centre for their efforts and inputs.

Dr. Amitava Bandopadhyay in his closing remarks thanked everyone who participated in the Workshop, specially the Chief Guest – Padma Shri Prof. T. Pradeep, and the Keynote and other Speakers for sharing their knowledge. He further expressed his gratitude and appreciation for Dr. Kannan Srinivasan and his colleagues from CSMCRI for successfully organizing the joint international Workshop on such an important topic.



Some of the Indian Participants

STI Developments in NAM Member Countries

MALAYSIA

TECHNOLOGY STARTUPS BOOSTING FOOD SECURITY THROUGH SUSTAINABLE AGRICULTURE

Among the 17 goals under the United Nations' Sustainable Development Goals include the 'eradication of hunger'. This particular goal seeks to end hunger in all its forms by 2030 and to achieve food security. That is less than a decade away. Food security, as defined by the United Nations' Committee on World Food Security, means that *all people, at all times, have physicochemical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life.*

Population growth in most countries, especially in developing countries such as Malaysia, poses a serious threat to food security. With the rapid population growth, demand for food is expected to increase between 70% to 100% by 2050. In 2020, Malaysia imported RM55.5 billion in food products, accumulating to RM482.8 billion over the last 10 years. At global level, Malaysia ranked 43rd out of 113 countries in the Global Food Security Index (GFSI) for 2020. The GFSI deliberates three core principal issues of affordability, availability and quality in food security measures. Therefore, Malaysia is placing serious attention to food security to reduce dependency on food imports whilst ensuring the basic needs of the population are met.

Among the factors affecting the performance of the agriculture sector are the lack of technology application in farming, and the increasing cost of raw materials and chemicals (such as fertilizers). Furthermore, the recent pandemic has also caused a severe shortage of labour that is crippling production. Other factors also include land issues that would require specific interventions and policy updates.

In Malaysia, there have been numerous and various initiatives carried out throughout the years in sourcing for solutions with regard to food security – with sustainability in mind. Since the introduction of *Skim Organik Malaysia* (SOM) certification in 2003 which was subsequently rebranded to myOrganic in 2015, there are now 253 farms with over 2,200ha up to last year. The myOrganic certification not only comprises agriculture but also apiculture, plant breeding and wild harvest and provides best practices and guidelines on sustainable farming and increasing productivity as well as providing a common branding for organic farming in Malaysia.

Malaysia is now witnessing new startups coming up offering technology solutions in agriculture that are catalysing the industry's growth, and at the same time develop new innovative and cost-effective ways to cater to the country's food consumption demands.

Maximising Space and Increasing Yield through Vertical Farming

Located within the Encorp Strand Shopping Mall in Petaling Jaya, Selangor, Malaysia; is a 1,200square foot vertical farm owned and operated by a Malaysian Agritech Startup called **FARMY**. There are a total of five grow racks that reach up to 18 feet and are able to produce up to 1.5 metric tons of leafy vegetables every month, this is equivalent to an acre of traditional outdoor farming squeezed into 1,200 square feet of urban commercial space.

While indoor vertical farms have been around in Malaysia for a while, Farmy is the only one in Malaysia located inside of a shopping mall. Starting operations in May 2021 at the height of the COVID-19 pandemic, Farmy focuses on crops such as Kale, Rocket and Sweet Italian Basil that are typically grown in colder climates overseas or in the highlands of Malaysia. The aim is to replace the need to import and to reduce long supply chains which are associated with crops such as these.

Using a hydroponic system called the Nutrient Film Technique and customized LED grow lights to replicated natural sunlight at its vertical farm, Farmy utilizes technology from Malaysia and is supported by the Ministry of Agriculture via the Department of Agriculture and the Malaysian Agricultural Research and Development Institute.

Indoor vertical farming allows Farmy to cultivate crops that are not typically found in Malaysia without the use of herbicides and pesticides. Growing vertically indoors also eliminates the risk brought about by the tropical Malaysian climate.

The Farmy System which combines LED technology, IOT and hydroponics also uses much less space, labour and water compared to conventional farming which is critical for to improve Malaysia's Food Security and Sovereignty especially given that the Food and Agriculture Organisation (FAO) projects that the world will need to produce 70% more food than it does now in the next 30 years.

By being located within a shopping mall in the middle of Petaling Jaya, Farmy is able to deliver to the entire Klang Valley within 45 minutes and this allows them to cut out middlemen and to reach consumers directly. Freshness is a key factor behind their success as traditionally farmed crops are typically only consumed 4-5 days post-harvest whereas Farmy's produce can reach customers within 45 minutes.

Kuala Lumpur like many other NAM cities is experiencing a commercial property overhang which was another reason why Farmy decided to set their farm



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up inside of a shopping mall. They hope is; this is a model that asset owners can replicate to generate yield from their underperforming assets while at the same time positively contribute to the Nation's food security and sovereignty.

FARMY's method augurs well with MOSTI's commitments on improving the food supply in the country through smart farming opportunities.

Improving Aquaculture Efficiency through Technology

GK AQUA is a pioneer in freshwater aquaculture biotechnology commercialisation and has implemented its cutting edge technology to improve freshwater prawn farming efficiency.

Macrobrachium rosenbergii. *M. rosenbergii*, commonly known as the Malaysian giant freshwater prawn is a native species in tropical regions in Southeast Asia and northern Australia (Gallo et al., 2016). This respective species has turned as a potential candidate in aquaculture due to its importance as a food source, also due to the adaptability to tolerate a wide range to temperatures (14-35°C) and 0-25 ppt salinity (Cheng & Chen, 2000). The production of farmed *M. rosenbergii* has increased 13900% in 2008 from its production of 3000 tonnes 30 years ago (Banu & Christianus, 2016). Although the global culture of giant freshwater prawn faced tremendous growth, while in parallel, Malaysia faced the major bottlenecks with inconsistent production and poor survival rate of the larvae. However, with the research methodology and established protocol, GK Aqua successfully overcome the bottlenecks with two approaches via genetic selection and nutrient manipulation.

Genetic selection is crucial element to selectively choose specific or targeted trait in cultured species to enhance the phenotypic traits such as growth, body colours and disease resistance. Giant freshwater prawn is unique species with the presence of five morphotypes of males, categorized as small claw (SM), orange claw (OC), blue claw (BC), old blue claw (OBC) and no claw (NC). Each type of male prawn possesses their own unique characteristics. However, among all, males with blue claws are generally largest and have fastest growth rate which could be the ideal candidate as an aquaculture species. Female prawns have slower growth rate compared to males and abstain varied morphotype. Considering on the quality of offspring produced, GK Aqua specifically focus on the brood prawn phenotypic selection, screened for diseases before the respective prawn were transferred to mating tanks. Further, submission of a bio-project (SAMN24815316) on *M. rosenbergii* genome in Genbank is an onward step to further this genetic selection research via genotypic level. A complete analysis through both phenotypic and genotypic selection of brood will give promising results on the post-larvae obtained in near future.

Another significant approach to enhance the quality of brood stock prawn is through feed manipulation and nutrient retention. Massive studies have been reported on the protein, lipid, herbs, insect meal, cereal and pulses. However, there is still paucity of knowledge in invention of sustainable aquafeed that meet the nutrient requirement of cultured prawn as well as be part in environmental sustainability. The preliminary research conducted by GK Aqua on putrefied *Sesbania* fed black soldier fly (BSF) meal showed higher deposition of protein (43.5%), 2-fold lesser lipid (16.7%) than the BSF meal obtained from domestic/kitchen waste substrates and significant deposition of amino acids. It was reported that conventional method of BSF rearing with agricultural by-products, domestic wastes and other organic wastes causes higher accumulation of heavy metals, such as chromium, copper, lead, zinc, cadmium and mercury. However, interestingly, the BSF meal reared on *Sesbania* showed substantial reduction in chromium (9-fold), selenium (3-fold), and mercury (undetected) content than those prepared conventionally. This particularly could solve many foods security issue, where the source of origin and hygienic condition of cultured substrate is a major consideration in the deliberation of BSF meal as possible alternative to other aquafeed ingredients (i.e. fish meal), which will be used for animal feed in turn for human consumption.

Sesbania grandiflora is a plant from family Fabaceae and massively used in agriculture as green manure to enhance the production of food crops due to their unique characteristics of rapid growth, adaptation to survive in varied types of soil and tendency to increase soil fertility. To date, *Sesbania* sp. have been evaluated for its extraordinary nutraceutical properties, as anti-inflammatory, anti-bacterial, anti-oxidant, anti-mutagenic and its capability to eliminate heavy metals. The interest in *Sesbania* began when they brought up the consideration on the circular green economy, whereby they strictly hindered the usage of marine-based ingredients instead produce a potential aquafeed constituents that promotes economic and environmental sustainability. Utilization of *Sesbania* via BSF will not only promotes the growth and immune parameters of cultured prawn, but also the plantation of *Sesbania* positively regulates the carbon neutrality and nitrogen cycle in the environment which can be a solution to many global issues such as global warming and pollutions. With this, GK Aqua believe, the exploitation of marine resources to produce aquafeed ingredients can be significantly reduced, environmental balance can be sustained and the quality and nutrient retention of brood prawns can be enhanced.



In early 2022, **GK AQUA** launched *Malaysian Udang Galah Aquapreneurs* (MUGA) to drive employment opportunities among the B40 income group while increasing the country's standing as an exporter of top-quality freshwater prawns.

MUGA equips aspiring aquapreneurs with fingerlings and feed to get started, aside from providing them with an immersion into the world of freshwater prawn farming through training and education on farming technology as well as advisory and technical supervision. The aquapreneurs will also receive three ponds (0.3 hectare in size) each, a monthly salary along with pond layout and technology application endorsements.

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MUGA aims to bring together different players from the public and private sector to help create a thriving ecosystem to help put Malaysia on the map as a prime producer of sustainable freshwater prawns.

Smart Urban Farming for the Masses

HAVVA Agrotech believes in proactive actions from the from policy makers. A 7-years urban gardening or city farming company based in Penang, Malaysia, HAVVA specialises in designing, building, and transferring modern commercial urban gardening and urban agriculture in Malaysia. HAVVA believes its farming technology could contribute and help achieve sustainability with four (4) interactive steps:

i. Education

HAVVA provides a cost-effective online and offline workshop to teach anyone who is technical and hand on inclined to use HAVVA Technology and know-how in building their own sustainable growing systems at home. They make their workshop affordable and complete to make it easy to use the technology available widely. Anyone who wants to learn, build and grow can easily jump start. At the same time, HAVVA also provides complimentary lifetime mentoring and support for the system they built. So, they are not left alone after the training.

ii. Highly effective, efficient and easy to use plug and play home system

Not everyone is handy and able to build their own system. This needs skills and some technical background to do so. In order to enable all others who don't have the skill to learn and build their own system, HAVVA design, innovate, test and supplies well designed and fully tested system for anyone to get a proven system and jump-start growing their own food at home. If everyone starts to grow their own food at home or garden, collectively, we will reduce tonnes of carbon food print generated by food miles. This will further contribute to slowing down global warming.

iii. Design, build and operate large scale commercial sustainable farms



For a large portion of the public, especially those who live in the urban cities, will not be able to grow their own food. They either don't have the time, space or passion to do so. By building more sustainable farms, especially in the urban area, they will further reduce food miles and carbon footprint. When more and more such farms in place, the urban cities are not only more sustainable but also food security issues are effectively addressed.

iv. Continual innovations, research and development



All technology innovation is an ongoing process. Although HAVVA solutions have been very complete and well-proven, continual innovation, breakthroughs and research cannot stop. HAVVA continues to innovate and make their system better, easier, and "smarter" with AI integration and simplified procedures where consistent results can be maintained. All innovative improvements and new technology will be then fed to steps 1, 2 and 3 in an iterative manner. With such progression, HAVVA believes a sustainable farming ecosystem will be in place in the near future.



HAVVA also actively works with various Malaysian government agencies; like Cradle Fund, SIRIM, Nano Malaysia, FAMA and others to have its technology implemented. In addition, HAVVA also collaborates with various higher institutions in Malaysia such as Universiti Malaysia Perlis (UniMAP), Universiti Malaya (UM) and Universiti Selangor (UNISEL) in R&D to find ways to better enhance and advance their technology.

Catalysing the Startup Ecosystem and Increasing Technology Application

Through the Malaysia Startup Ecosystem Roadmap (SUPER) 2021-2030, the growth and acceleration of startups are given emphasis which include those in the agriculture sector. The roadmap seeks to position Malaysia as a regional and global hub for startups. We welcome startups and investors

from NAM countries to participate in this exciting journey through the MYStartup portal at www.mystartup.gov.my.

The ultimate goal is to fully utilise modern technology to establish a healthy agricultural ecosystem, which consists of developed upstream, midstream and downstream sectors, in order to completely transform the sector. A lot of effort is being taken into consideration to coordinate amongst major stakeholders through the National Food Security Policy to ensure that Malaysia has sustainability of the country's food supply at all times, especially in the face of unexpected situations.

Source: Cradle Fund Sdn Bhd

Ministry of Science, Technology and Innovation (MOSTI), Malaysia

NTIS: FAST-TRACKING LOCAL INNOVATIONS TO MARKET

Innovation and technological advancement have the capability to not just change the industries and push the country to be a high tech nation and globally competitive but also change the way our society operates on a daily basis. With the introduction of new technologies in different sectors like agriculture, and healthcare, we are seeing innovations that actually make day-to-day work not just easier but also safer. For example unmanned drones are helping farmers with fertilisation and pest control. In hospitals, where patients need to be isolated, robots are being deployed to help clean the wards.

These tech advancements start with just an idea, but the potential for impact is huge. They are made possible when they are given the opportunity to be stress-tested in a live environment, coupled with facilitation in regulatory matters, capacity building and the fund to expand further. This is where the National Technology and Innovation Sandbox (NTIS) comes into action.

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The vision of the NTIS is conceived with two goals. First is to champion local innovation and to create a smoother pathway for Malaysian technology to be commercialised. The second goal is to use NTIS as a testing ground for revolutionary technologies that will allow Malaysia to address some of the concerns that have been aggravated by the pandemic.

Almost two years on, the initiative has accepted 160 innovative solutions to be accelerated to market through provision of real-life test sites, regulatory facilitation, funding and commercialisation support. Up until early this year, 4 of those companies have managed to commercialise their products.

Malaysia Research Accelerator for Technology and Innovation (MRANTI) as the NTIS secretariat is currently planning to expand the sandbox sites to include healthtech, energy and smart city sandbox in addition to the 8 existing sandbox sites for agriculture, robotics and automation, high tech education and more.

From Knowledge to Earnings

One of the companies that has gone into commercialisation is Archtron R&D Snd Bhd which has patented the “BLUGUARD” home alarm system as the core product and it is now widely used in the local home alarm market. Bluguard-AI Series is the marriage of the Internet of Things (IoT) sensors with Artificial Intelligence (AI) and its convergence redefines the way industries and business functions. With the assistance provided by NTIA, the company succeeded in conducting four (4) field tests for Gerak Teguh “Pelangi Height”, Sri Damansara “TA Activo” GUH Anjung Gambang and IJM Seremban 2 “Saujana Duta” community project.

Through the NTIS programme, the company managed to reduce time to enter the market from conventional 24 months to 12 months and launched their product 1 year ahead of schedule. Not only were they able to execute testing and functional validation faster in designated Sandbox Sites, but they also managed to move in the commercialization phase which involves product design, moulding fabrication, product development, regulatory compliance with the support from NTIS.

For drone company Meraque, their focus has always been in developing local talent. According to the company, they were able to provide high value job opportunities to over 50 youths who come from various backgrounds from rural areas. With the help of Malaysian talent, they were able to build their own Hybrid Drone Spraying solutions for the agriculture sector and customised enterprise software solutions and bespoke services for clients such as Sime Darby Plantation, DBKL, Boustead Holdings Bhd and Pharmaniaga. Their hybrid technology consists of using fuel and battery and their drone can fly up to 1 hour without changing batteries.

Through NTIS, Meraque was able to bridge expectations in facilitating the industry's supply and demand. For them, the programme also enabled the company to expand and test their products for commercialisation not only locally but also overseas. Other than their expanding capacity of spraying roughly 2 million seedlings every month in the agriculture sector, Meraque was also announced as the world's number 19th drone company. But what they are most proud of is their ability to provide job opportunities and the to upscale talents to those with SPM, STPM and Vocational qualification in the country.

Another drone company, Poladrone aims to transform the agriculture sector in Malaysia. Their solution Oryctes, an agriculture drone is a point-to-point agriculture spraying drone built specifically for the oil palm industry. Oryctes is able to perform pesticide application work faster, cheaper, safer, and is more sustainable than traditional practices which typically rely heavily on foreign labour. Their mission is to help companies overcome difficult tasks through innovative and cost-efficient drone technology strategies. The company's mission resonates with the mission of NTIS, most specifically, the aim to reduce dependency on foreign labour and increase employment rate for Malaysians.



Oryctes, a point-to-point agriculture spraying drone

Malaysia's history. This certainly opened new doors for Poladrone to grow further.

If you have an innovative idea that you wish to be in the market, feel free to visit the NTIS website at <https://sandbox.gov.my/>.



“BLUGUARD” home alarm system



Hybrid Drone Spraying

One of their many achievements enabled by NTIS, Poladrone has been the ability to engage closely with the Civil Aviation Authority Malaysia (CAAM) where their training academy, 'Drone Academy Asia' was recently certified as the first Remote Pilot Training Organisation in Malaysia.

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Source: Malaysia Research Accelerator for Technology and Innovation (MRANTI) Ministry of Science, Technology and Innovation (MOSTI), Malaysia

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SOUTH AFRICA

LAUNCH OF INNOVATION BRIDGE PORTAL AND ENTREPRENEUR COMMUNITY PITCH EVENT TUESDAY, 17 MAY 2022

The Department of Science and Innovation (DSI) initiated the design and development of the Innovation Bridge Portal (IBP) to support the objectives of its Innovation Priorities and Instruments Chief Directorate. The main aim of the Portal was to, through the provision of relevant information, accelerate connections and collaboration within the National System of Innovation (NSI) and encourage greater interaction between innovators, industry, and government in support of the commercialisation of publicly funded research and development. The DSI awarded the Council for Scientific and Industrial Research (CSIR) a contract to lead the project and proceed with software development which commenced in 2017.

In October 2021, the DSI and CSIR entered into a funding agreement for the implementation of the technology utilisation initiatives programme. The IBP work package included, amongst others, a



desktop study to map the current landscape of comparable portals/platforms in order to identify the best suited synergies, and setting up strategic partnerships to support the IBP. Following the outcomes of the desktop study, it became apparent that the IBP platform would require an upgrade to grow and adapt to the changing environment and evolving needs of the ecosystem.

While South Africa has a vibrant entrepreneurship ecosystem, recent ecosystem analysis point towards the need to help address number of issues that include: the current fragmentation of support programs; lack of meaningful collaboration at scale; lack of inclusivity (gender and diversity of founders); weak relationships with the neighbouring nascent ecosystems; gaps in early-stage financing especially for underserved entrepreneurs; weak



data systems including monitoring and evaluation; quality of output from startup business service providers; and opportunities to strengthen the policy and regulatory environment in order to spur additional public and private investment in early stage businesses. In an effort to respond to the aforementioned ecosystem gaps, it was discussed and agreed by CSIR, DSI and World Bank that an IBP upgrade is necessary to provide a digital community for innovation and entrepreneurship collaboration, knowledge and resource sharing as well as matchmaking amongst the ecosystem actors not only in South Africa, but also Botswana, Namibia, eSwatini and Lesotho.

7TH WORLD CONFERENCE ON RESEARCH INTEGRITY (WCRI) 29 MAY TO 1 JUNE 2022

The Department of Science and Innovation (DSI) signed a Memorandum of Understanding (MoU) with the University of Cape Town (UCT) in 2019 to support the institution in hosting the 7th World Conference on Research Integrity (WCRI).

Promoting research integrity is a priority in both the 2019 White Paper on Science, Technology and Innovation, and the Decadal Plan. The DSI also viewed this event as part of preparation for the World Science Forum as research integrity is part of the science for social justice theme. The National Research Foundation (NRF) also contributed an amount of R900,000 through the Conference Fund to support the hosting of the event.

The objective of the World Conferences on Research Integrity (WCRI) is to foster integrity in research. The first WCRI was held in Lisbon, Portugal, in 2007. Six WCRI later, participation has grown from 275 participants from 47 countries in 2007 in Lisbon to 701 participants from more than 50 countries at the 6th WCRI held in 2019 in Hong Kong. Historically, these conferences have been attended by stakeholders from all over the world and produced significant outputs such as the Singapore Statement on Research Integrity. Attendance from Africa has been limited in the past, hence the organising team has offered travel grants to deserving participants from South Africa, and other African countries. Furthermore, the Cape Town Statement on Fostering Research Integrity through the promotion of equity, fairness, and diversity in all research contexts is being proposed as a major contribution to this conference.

The theme of the conference is "Fostering Research Integrity in an Unequal World". Conference sub-themes include current global research integrity discussion areas such as: Research Integrity as a driver of research excellence and public trust; Ethical best practice in authorship, publication and the use of research metrics; and Best practice in detection, investigation, and responding to research misconduct. An additional emerging sub-theme included is on "Ensuring research integrity in the context of the 4th Industrial Revolution (the convergence of the physical, biological, and digital world)".

As this conference was in Africa for the first time, the following sub-themes particularly relevant to many African and Low and Middle Income Countries (LMIC) were included: colonial legacies and research integrity: moving forward by building equity into research; counteracting plagiarism in multicultural and multilingual contexts; and institutionalising Responsible Conduct of Research (RCR) education and training, including curriculum development and implementation in low resource settings. Historical, financial and scientific resources inequalities continue to generate imbalances in research ecosystems, particularly for collaborations involving researchers and institutions in low and in high-income countries. Such systematic differentials cannot be addressed using ad hoc 'capacity building' components in individual research projects, rather, they need systemic solutions.

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The 7th WCRI generated a Cape Town Statement, focusing on fair and equitable research collaborations as a research integrity issue. The statement will explore the best way forward by all involved, to empower research systems in LMIC to decide on research priorities, partners and partnerships as an essential part to equity in development.

AFRICA DAY – SCIENCE AND INNOVATION, TACKLING THE UNEMPLOYMENT DILEMMA

On 25 May 2022, the Department of Science and Innovation of South Africa, in collaboration with the Human Sciences Research Council and the Academy of Science of South Africa held an Africa Day celebration, virtually, under the theme “Science and Innovation: Tackling the Unemployment Dilemma”. The virtual webinar sought to prospect and present the value of Science, Technology Innovation (STI), in addressing the unemployment dilemma, which has been evidently exacerbated further since the emergence of the COVID-19 pandemic.

The celebration and commitment to Pan-African collaboration, as expressed by the Deputy Director-General of International Resources at the DSI, Mr. Daan Du Toit in his opening remarks, comes with a Pan-African reflection on African unity, as also highlighted by Dr. Sithembile Mbete, Director of Programmes at Futurelect, who also moderated the discussions of the day. On 25 May 1963, Africa made history with the founding of the Organisation of African Unity (OAU), to build greater unity and solidarity between African countries and its people. Since then, May 25th has been celebrated widely across the world and particularly in Africa, to signify the continent’s fight against colonialism and apartheid, which rendered countries such as South Africa, isolated and cut off from the continent. The continent-wide fight for freedom and independence from imperialism, was centred on the ideals of African unity and Pan-Africanism. In 2002 the OAU was transformed into the African Union (AU), a move which was aimed at broadening the OAU’s mandate through the inclusion of socio-economic development, peace and security. Notably, 2022 marks 20 years since the launch of the AU.

Professor Thenjiwe Meyiwa, Vice-Principal of Research, Postgraduate Studies, Innovation, and Commercialisation at the University of South Africa (UNISA) prompted the attendees to prospect how the Higher Education sector contribute to tackling the unemployment problem, and noted that the continent and even South Africa, have the responsibility of thinking about some of the existing innovations as well as technologies that would contribute to tackling unemployment, as well as building resilient economies that are futuristic, and can contribute to the development of South Africa and the continent as a whole. As such, Africa Day, as noted by H.E. Prof Mohamed Belhocine, AU Commissioner for Education, Science, Technology and Innovation at the reminds the continent of its unity, freedom and inheritance. As such, the virtual celebration reaffirms the trust that Africa is committed to advancing STI for the attainment of developmental goals.

Evidently, STI has continuously been acknowledged as one of the key drivers for the economic development of nations. There are existing continental frameworks that seek to advance the STI agenda, such as the Science, Technology and Innovation Strategy for Africa (STISA 2024), the African Space Policy, which spells out the region’s scientific and technical priorities for driving social and economic growth and development, and even the Continental Strategy for Technical and Vocational Educational and Training (TVET) to Foster Youth Employment, which seeks to bring paradigm shifts through the development of TVET systems that will prepare and enable young people to become co-creators of employment opportunities, rather than job seekers. “Africa’s investment in STI compared to developed countries is very low, and this manifests in the declining quality of science, and engineering education at all levels of education systems, particularly the interest in mathematics at institutions of higher education”, H.E. Prof Belhocine added. In his concluding remarks, H.E. Prof Mohamed Belhocine shared that the COVID-19 pandemic has taught us the urgency in deploying scientific inventions, innovations and technological solutions at a scale to address emerging challenges and to enhance or resilience. “Our collective commitment must be followed by concrete actions to drive innovation through science, technology and research for the development of our people and our continent”.

SDG Indaba 2022: Agenda 2030 - A Paradigm Shift to Agenda 2063

The University of the Western Cape (UWC), in collaboration with the Department of Science and Innovation, held an SDG Indaba on 6 June 2022 at the Cape Town City Hall.

UWC has positioned itself as an intellectual base for solving challenges set out in the United Nations Sustainable Development Goals (SDGs), such as no poverty, good health and wellbeing, quality education, gender equality, reduced inequalities and partnerships for the goals. These are global grand challenges, but Africa is at the frontline of their impact.

The theme for this inaugural event was Agenda 2030: A Paradigm Shift to Agenda 2063. The United Nations plans to realise these SDGs by 2030. Meanwhile, the African Union has set similar goals known as Agenda 2063. This Indaba sought to highlight that these agendas do not exist independently and that it is critical to work together towards the common goal of achieving sustainable development.

The event brought together key role players, including communities, who contribute to producing high-impact, cross-cutting research through multi-disciplinary teams and approaches. Ultimately, this research will be transferred to the communities to have a meaningful impact on improving the lives of the marginalised.

“In as much as the SDGs are a global phenomenon, the issues raised by the SDGs hit different for UWC. Our university exists in a community fundamentally made up of working-class families who are often subjected to the very social ills sort to be addressed by the SDGs. According to UNESCO, higher education institutions have a critical role in contributing to the achievement of the SDGs. However, it must be noted that we don’t stand a chance if we continue working in silos and therefore, we must involve civil society, government, industry partners, interdisciplinary research and other strategic collaborations in our endeavours to truly make an impact,” said Professor José Frantz, Deputy Vice-Chancellor: Research and Innovation at UWC.

The key objectives of the SDG Indaba were to:

- Set out a foundation for partnerships;
- Develop a basis of understanding to pursue research and innovation from a multi stakeholder perspective, and
- Determine a multi-stakeholder agenda that advances sustainable development through a clear plan of action.

Science, Technology & Innovation News

HEALTHCARE & RESEARCH

Using Phage to Clear Antibiotic-Resistant Lung Infection for Cystic Fibrosis Patient

Using a virus to kill a bacterium may seem like going backward in medicine and harkens back to the early 20th century when Julius Wagner-Juarreg used malaria treatment to cure neurosyphilis. Yet, bacteriophage (phage) has evolved to attack specific bacteria. Now, for the first time, researchers have successfully used bacteriophages to treat an antibiotic-resistant mycobacterial lung infection, clearing the way for a young patient with cystic fibrosis to receive a life-saving lung transplant. The successful use of phages to treat a *Mycobacterium abscessus* lung infection was reported in a case study published in *Cell* through an article titled, "Host and pathogen response to bacteriophage engineered against *Mycobacterium abscessus* lung infection."

Phage treatment of an individual with cystic fibrosis, advanced lung disease, and *M. abscessus* infection enabled a subsequent successful lung transplant. Cystic fibrosis is an inherited disease that causes a build-up of thick mucus in the lungs, leading to repeated bacterial infections that the lungs and can cause respiratory failure. Although new treatments have greatly improved the prognosis for people with cystic fibrosis, life expectancy remains significantly reduced. *Mycobacterium abscessus* is a particularly aggressive and challenging NTM infection. Mycobacteria can spread from the lungs to the skin and other tissues, which can plague transplant recipients on immunosuppressive medications. Researcher at National Jewish Health considered phages as a potential treatment option. "Two mycobacteriophages were administered intravenously to a male with treatment-refractory *Mycobacterium abscessus* pulmonary infection and severe cystic fibrosis lung disease. The phages were engineered to enhance their capacity to lyse *M. abscessus* and were selected specifically as the most effective against the subject's bacterial isolate," In 2016, Researchers sent samples of the *Mycobacterium abscessus* from patient's lungs in search of a phage that could kill the mycobacterium. Graham Hatfull, PhD, Professor of biological sciences, University of Pittsburg, and his team screened dozens of phage candidates and identified two that efficiently killed the mycobacterium infecting patient's lungs. These were genetically engineered to optimize their potential. "This research can serve as a roadmap for future use of phages to treat patients with severe *Mycobacterium abscessus* lung infection and to save lives."

May 16, 2022; www.genengnews.com

Genetic Variants in Epilepsy Gene Identified

Investigators have discovered a new method to determine whether individual genetic variants in the epilepsy-associated gene SZT2 cause a neurodevelopmental disorder, according to a Northwestern Medicine study published in the journal *Brain*. Pathogenic variants in SZT2 have been associated with the development of different neurodevelopmental disorders, including early-onset epilepsy and developmental delays. Additionally, the SZT2 protein plays an essential role in the mTORC1 signaling pathway, which helps promote cell growth and proliferation. Meanwhile, many SZT2 missense variants—variants where a single amino acid is replaced by another—have been increasingly detected through clinical genetic testing but classified as variants of uncertain significance, or variants that do not have a clear association with disease. Classifying these variants as either likely benign or pathogenic, however, has remained a challenge due the large size of SZT2—it contains more than 3,400 amino acids as well as its lack of crystal structure and functional domains. "There are many different amino acids that can be mutated and become missense variants, so it's very challenging to tell which are pathogenic and which are benign. That's why high-throughput studies like this are so important," said Gemma Carvill, Ph.D., assistant professor in The Ken and Ruth Davee Department of Neurology Division of Epilepsy and Clinical Neurophysiology and senior author of the study. For the current study, Carvill's team recruited twelve individuals who carried biallelic SZT2 variants of which one or more were classified as variants of uncertain significance. Using CRISPR-Cas9 genome editing, the investigators engineered cells to contain patient-specific missense SZT2 variants and performed a functional cell assay that separated cells based on whether the mTORC1 signaling pathway was active or inactive. The investigators then used next-generation sequencing to determine which SZT2 missense variants retained function and which lost function and were likely to be pathogenic. Ultimately, they discovered a recurrent in-frame deletion—when one amino acid is deleted out of the protein and was determined to be a loss-of-function variant and reclassified as likely pathogenic. This recurrent variant is also a founder variant, a genetic variant that occurs more prevalently in individuals with similar or the same ethnicity. In this case, the founder variant is more prevalent in individuals of Ashkenazi Jewish ancestry, and this variant should be included in targeted panels for individuals interested in prenatal testing, according to Carvill. The current approach is applicable to other neuro developmental disorders that are rooted in the mTOR pathway, according to the authors. Furthermore, mTOR inhibitors may benefit patients with genetic variants affecting mTOR function. Only recently has SZT2 been associated with this particular pathway, as compared to other epilepsy-associated mTOR genes, warranting a need for future clinical trials and high-throughput cell assays. "In the future, it is key that we design trials where we specifically enroll individuals that have a positive genetic test in mTOR pathway genes to see if those patients may benefit from mTOR inhibition," said Jeffrey Calhoun, Ph.D., research assistant professor of Neurology Division of Epilepsy and Clinical Neurophysiology and lead author of the study.

June 7, 2022; www.medicalxpress.com

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BIOTECHNOLOGY

Smart Vaccine Manufacturing Technologies

“Smart” Vaccine Manufacturing Technologies, i.e., systems that gather and exchange process data, have been vital in the battle against COVID-19. The availability of higher quality data helped industry accelerate process development and start making billions of doses of vaccine less than a year after SARS-CoV-2, the virus that causes COVID-19, was sequenced.

To put this in context, before 2019, vaccine development, from discovery, through clinical trials, process development, and manufacturing, took an average of 10 to 15 years, according to an analysis by the International Federation of Pharmaceutical Manufacturers & Associations (IFPMA), a trade association. For Vishnu Kumar Ph.D. from Pennsylvania State University, the speed with which the vaccine industry adopted smart manufacturing technologies was the most impressive part of its response to the pandemic: It was recognized, quite early, by the healthcare experts that vaccines were the best way out of the crisis,” he says. “As a result of the pandemic, biopharma firms quickly adopted novel biotechnology platform-based techniques for vaccine manufacturing such as mRNA and viral vector platform-based vaccines.” And technologies adopted as a result of COVID-19, particularly those used to make mRNA vaccines, are here to stay, points out Kumar, who examined the impact of the pandemic vaccine manufacturing in a recent research paper.

Messenger RNA platform-based vaccines emerged as winners. “Messenger RNA platform-based vaccines have emerged as a winner partly as a result of smart vaccine manufacturing technologies. And, in the future, use of these systems will continue to grow as industry develops vaccines for a wide range of contagious diseases, continues Kumar. “These vaccines can be produced faster, have quick turn-around, are customizable to specific viruses, and hopefully cheaper.” His view takes in keeping with a recent survey of 95 vaccine makers by the Coalition for Epidemic Preparedness Innovations (CEPI), which found that the majority plan to invest in mRNA and or DNA vaccine production capacity over the next five years. “In the context of the biopharma industry, smart manufacturing would mean the adoption of smart devices to capture, store, and transmit data and services to facilitate connections between devices during each stage of the vaccine development and manufacturing process,” he tells GEN. “However, there are a few barriers that firms usually face: economic constraints, limitations with technology infrastructure, ambiguity with the ownership, privacy, and security of data. These issues need to be considered.”

April 27, 2022; www.genengnews.com

New Blood Test to Diagnose Tuberculosis and Monitor Treatment

Researchers have developed a new highly sensitive blood test for tuberculosis (TB) that screens for DNA fragments of the *Mycobacterium tuberculosis* bacteria that causes the deadly disease. Researchers at Tulane University School of Medicine have developed a new highly sensitive blood test for tuberculosis (TB) that screens for DNA fragments of the *Mycobacterium tuberculosis* bacteria that causes the deadly disease. The test could give doctors a new tool to both quickly identify TB and then gauge whether drug treatments are effective by monitoring levels of DNA from the pathogen circulating through the bloodstream, according to a new study published in the journal *The Lancet Microbe*. Tuberculosis is now the second most deadly infectious disease in the world, behind only COVID-19. Most TB tests rely on screening sputum, a thick type of mucus from the lungs. But collecting sputum from patients suspected of having TB can be difficult, especially for children. TB can also be harder to diagnose in immune compromised HIV patients and others where the infection migrates outside of the lungs into other areas of the body. In these extra pulmonary cases, patients can have little bacteria in the sputum, which leads to false negatives using current testing methods, said lead study author Tony Hu, PhD, Weatherhead Presidential Chair in Biotechnology Innovation at Tulane University. "This assay may be a game-changer for TB diagnoses that not only provides accurate diagnosis results but also has the potential to predict disease progression and monitor treatment," Hu said. "This will help doctors rapidly intervene in treatment and reduce the risk of death, especially for children living with HIV. Researchers tested preserved blood samples from 73 adults and children with presumptive TB and their asymptomatic household contacts in Eswatini, Africa. The test identified adult TB with 96.4% sensitivity and 94.1% specificity and pediatric TB with 83.3% sensitivity and 95.5% specificity. Researchers also tested 153 blood samples from a cohort of hospitalized children in Kenya. These were HIV-positive patients who were at high risk for TB and presented with at least one symptom of the disease. The new test picked up all 13 confirmed TB cases and almost 85% of unconfirmed cases, which were cases that were diagnosed due to clinical symptoms and not existing gold standard testing methods. The CRISPR-based test uses a small blood sample and can deliver results within two hours. “The level of *Mycobacterium tuberculosis* cell-free DNA in HIV-infected children began to decline within a month of treatment, and most of the children's blood was cleared of the bacteria DNA fragments after treatment, which means that CRISPR-TB has the potential to monitor treatment and will give physicians the ability to better treat worldwide TB infections. A highly accurate, rapid blood test that could be used anywhere would benefit millions of people living in resource-limited areas with a high TB burden," Hu said.

June 1, 2022; www.sciencedaily.com

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TECHNOLOGY, INNOVATION & BUSINESS

Digitization Changing the way of Car Manufacturing

The auto industry is undergoing rapid change in all areas but even in manufacturing which has seen incremental changes for decades, the pace of that change is accelerating. Impetus for the adoption of Industry 4.0 comes largely from the Electric Vehicles startups. Areas where they are leading and others are looking to follow include digitalization, large-scale die-casting, Cell to Pack (CTP) and Cell to Chassis (CTC) battery technology. Real-time data is the key to digitalization which then enables processes to be optimized and automated. By doing so, production not only becomes more efficient but also makes it more sustainable, helping companies move towards carbon neutrality; waste can be cut and resources used more efficiently.

While digital technology has been used on the R&D side of car production for a long time, integration into the actual manufacturing process is far newer. Previously cars would take around four to five years to go from design board to production. These times are getting cut across the industry with some Chinese producers managing times of less than two years. The use of digital twins plays a crucial role in cutting times by predicting and solving problems before they appear on the shop floor with the production of body panels. The next step is to focus on the end result by optimizing the single part production for the assembly of the final car body, through a seamless digital process twin. A German carmaker has succeeded to cut the body shop ramp-up time by six months through this integrated approach.” Production is simplified as there are no longer numerous parts needing to be joined, which means fewer robots. For the car, it means greater rigidity, which increases safety. However, for legacy OEMs the change that this would bring not just from a technical perspective but an organizational one is enormous.” Battery Packs Batteries while crucial to EVs create problems both for production and design due to their volume and more importantly weight. Cell-to-Pack (CTP) as used by BYD with its Blade battery along with CATL does away with the intermediate stage of putting cells into modules before the pack. Doing so can reduce the volume and weight of the battery pack. The next stage though appears to be either cell-to-chassis (CTC), or cell-to-body as outlined by Tesla in its 2020 Battery Day. Current battery packs produce a weight that needs to be borne by the car's structure. Tesla's approach sees the glue, which would normally act as both an adhesive and flame retardant to glue the cells and plates of the battery pack together, take on the additional task of strengthening so that the pack becomes load-bearing. Chinese EV startup Leapmotor claims its recently unveiled C01 sedan is the world's first car to come with CTC. Chinese EV startup Leapmotor claims its recently unveiled C01 sedan is the world's first car to come with CTC where the battery, chassis, and underbody are integrated together. Leap says this leads to a 15kg reduction in weight and 20% fewer components. However with battery packing technologies and die-casting, there are questions regarding their long-term use as Spreitzer cautions, “The simulation models are pretty advanced, but they're not reality. There is always a gap between our theoretical models and reality; we just don't know what will happen after ten or fifteen years of use.”

June 1, 2022; www.emag.directindustry.com

Digital Multinationals are Transforming Global Trade and Investment

The international production footprint of digital Multinational Enterprises (MNEs), which was already expanding, has grown even faster during the COVID-19 pandemic. UNCTAD's Global Investment Trends Monitor published on 27 April unveils new rankings of the top 100 digital MNEs. The report also looks at the impact of the world's largest digital MNEs on trade and investment. “Digital MNEs can provide a boost to competitiveness across all sectors, new opportunities for business and entrepreneurial activity and new avenues for market access and participation in global value chains,” said James Zhan, UNCTAD's director of investment and enterprise development.

Digital multinationals 'highly dynamic'

Firms such as Uber, Twitter and Meta are large, publicly listed global companies with core business in one of four digital economy segments: platforms, solutions, content or e-commerce. The inherent dynamism of digital companies, coupled with accelerating adoption of digital solutions driven by the pandemic, has fuelled significant changes to the top 100 list. Over past five years, 39 new companies have joined the ranking, replacing others that were acquired or outranked. During that time, the number of internet platforms on the list has risen from 11 to 15, with nine new names. The digital solutions segment, which has the most companies on the list, is followed by digital content, which accounted for 31% of the total revenue of the top 100 in 2021. E-commerce is the segment with the highest share of revenue, with just two big firms Amazon from the United States and Alibaba from China making up 34% of the top 100's total revenue.

Geographical distribution 'very concentrated'

The ranking is still dominated by companies from developed economies, mostly from the U.S. and Europe. But geographical diversity has improved, with companies from China, Southeast Asia and Latin America entering the top 100. As for the e-commerce segment, local knowledge is proving to be an important factor, as evidenced by the higher share of non-American MNEs on the list.

More greenfield investment

Digital MNEs can reach overseas markets with little or no investment in physical assets. Since 2016, their foreign asset

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footprint has decreased, while foreign sales have grown. The ratio between the latter and the former is up by 11%, with most of the rise taking place in 2021 due to the spike in sales during the COVID-19 pandemic. However, the pandemic has pushed some digital MNEs to invest in overseas operations. E-commerce MNEs, in particular, shored up greenfield investments – mostly in logistics and distribution projects – by 120% in 2020 and a further 10% in 2021. “Digitals are a very dynamic group of companies that, based on firm-specific advantages in intangibles, network effects and digital assets, can reach scale in a short time and expand abroad seamlessly,” Mr. Zhan said. “As such, the global expansion of digital MNEs is highly relevant for the development strategies of host economies,” he added. UNCTAD's current ranking of the top 100 digital MNEs updates the first edition published in 2017.

May 16, 2022; www.unctad.org

Algae-Powered Computing: Scientists Create Reliable and Renewable Biological Photovoltaic Cell

Researchers have used a widespread species of blue-green algae to power a microprocessor continuously for a year and counting using nothing but ambient light and water. Their system has potential as a reliable and renewable way to power small devices. Researchers have used a widespread species of blue-green algae to power a microprocessor continuously for a year -- and counting using nothing but ambient light and water. Their system has potential as a reliable and renewable way to power small devices. The system, comparable in size to an AA battery, contains a type of non-toxic algae called *Synechocystis* that naturally harvests energy from the sun through photosynthesis. The tiny electrical current this generates then interacts with an aluminium electrode and is used to power a microprocessor. The system is made of common, inexpensive and largely recyclable materials. This means it could easily be replicated hundreds of thousands of times to power large numbers of small devices as part of the Internet of Things. The researchers say it is likely to be most useful in off-grid situations or remote locations, where small amounts of power can be very beneficial. "The growing Internet of Things needs an increasing amount of power, and we think this will have to come from systems that can generate energy, rather than simply store it like batteries," said Professor Christopher Howe in the University of Cambridge's Department of Biochemistry, joint senior author of the paper. He added: "Our photosynthetic device doesn't run down the way a battery does because it's continually using light as the energy source." In the experiment, the device was used to power an Arm Cortex M0+, which is a microprocessor used widely in Internet of Things devices. It operated in a domestic environment and semi-outdoor conditions under natural light and associated temperature fluctuations, and after six months of continuous power production the results were submitted for publication. The study is published today in the journal *Energy & Environmental Science*. "We were impressed by how consistently the system worked over a long period of time -- we thought it might stop after a few weeks but it just kept going," said Dr. Paolo Bombelli in the University of Cambridge's Department of Biochemistry, first author of the paper. The algae do not need feeding, because it creates its own food as it photosynthesises. And despite the fact that photosynthesis requires light, the device can even continue producing power during periods of darkness. The researchers think this is because the algae process some of its food when there's no light, and this continues to generate an electrical current. The Internet of Things is a vast and growing network of electronic devices -- each using only a small amount of power -- that collect and share real-time data via the internet. Using low-cost computer chips and wireless networks, many billions of devices are part of this network -- from smart watches to temperature sensors in power stations. This figure is expected to grow to one trillion devices by 2035, requiring a vast number of portable energy sources. The researchers say that powering trillions of Internet of Things devices using lithium-ion batteries would be impractical: it would need three times more lithium than is produced across the world annually. And traditional photovoltaic devices are made using hazardous materials that have adverse environmental effects. The work was collaboration between the University of Cambridge and Arm, a company leading the design of microprocessors. Arm Research developed the ultra-efficient Arm Cortex M0+ testchip, built the board, and set up the data-collection cloud interface presented in the experiments.

May 12, 2022; www.sciencedaily.com

INTERNET OF THINGS

The 10 Best IoT Industry 4.0 Use Cases for Manufacturing

Organizations in the business 4.0 area face constant requests to be quicker, more astute, less fatty, and more productive. The Internet of Things (IoT) has demonstrated altering organizations across all sectors' potential. No big surprise it's the really main thrust behind Industry 4.0 – what has been portrayed as the “fourth modern” unrest. Industry 4.0 alludes to the course of computerized change in assembling/creation and related ventures to make more worth. Industry 4.0 is worried about how assembling can change, by utilizing outsider stage advancements, development gas pedals, and IT/OT (functional innovation). This implies integrating state of the art innovations across network protection, enormous information, AR/VR, distributed computing, robotization, AI and IoT, to change traditional cycles and capacities carefully. The objective is to make organizations more brilliant and quicker as well as stronger and coordinated.

Here are a portion of the top Industry 4.0 use instances of IoT innovation: Big Data and Analytics; Autonomous Robotics; Simulations and Digital Twins; Horizontal and Vertical System Integration; Industrial IoT (IIoT); Cyber Security Technology; The Cloud; Additive Manufacturing (AM); Artificial Intelligence and Manufacturing; Augmented Reality and Virtual Reality

May 26, 2022; www.iotechnews.com

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Cloud-Based IoT Software for the Future of Security

Cloud-based IoT software is changing the nature of both digital and physical security, allowing both security elements to be merged and used to leverage data better. So, what does cloud-based IoT software mean for the future of security? Central to this advancement, IoT technology is facilitating changes in many sectors on a global scale, and revolutionising daily operations for many businesses. Data is key to success in just about every industry, and security is no different. You can integrate cloud-based solutions to house all information on one interface to get a clearer picture of what's happening in your business. For instance, integrating cloud-based access control systems with a security camera feed allows for visual identity verification in real-time. You can also integrate cloud-based solutions with analytics and AI-enhanced software that allow security staff to identify potential security threats more efficiently. Leveraging cloud-based IoT technology also enables swift responses and improves productivity. Another way IoT and cloud-based security systems can be optimised is by combining digital and physical security, also known as security convergence. Cybersecurity software is necessary to protect a cloud-based physical security system from online vulnerabilities and breaches. Similarly, physical security measures help guard data and confidential information from falling into the wrong hands. Converging cyber and physical security teams results in a more holistic, collaborative strategy. Future-proofing your technology requires keeping up-to-date with current versions of the technology you are employing in your security strategy. Keeping all software up-to-date is essential to ensure no vulnerabilities in your cloud-based system could leave your organisation open to cybersecurity threats.

With cloud-based software, updates can be automated, and performed remotely, meaning that it requires minimal effort to keep your software up-to-date. In today's increasingly flexible and connected work environment, cloud-based IoT security software allows employees to operate security tools using their mobile devices remotely. Plus, the mobile app features a convenient remote unlock option to grant guests entry once they've identified themselves. This ensures no security incidents occur due to misappropriated access credentials. Because misappropriated access credentials are one of the main concerns associated with access control, having integrated video feed and access information on one interface can help mitigate these concerns. With a fully remote access dashboard, cloud-based systems like Openpath allow security staff a faster means for verifying identity and ensuring access credentials belong to their authorised users. If you're adopting cloud-based IoT solutions in your security strategy, you have the opportunity to create a future-proof security system. Cybersecurity is a significant concern when businesses adopt IoT technologies, but by merging physical and digital security, you can ensure your cloud-based system is well-protected from vulnerabilities. Integrating physical and digital security concepts will help your security and IT teams handle the changing security landscape.

May 3, 2022; www.iottechnews.com

WATER TECHNOLOGY

Disinfecting Water without Chemicals

Water treatment specialist Best Water Technology (BWT) France has launched a new water disinfection solution that removes the need for chemicals and reduces harmful by-products in manufacturing waste. Having a solid waste management system is crucial to industrialists. It is indeed a high-level tool for the control of the impacts of an activity on the environment. How do they take care of waste products? How do they manage water contamination? How do they clean and disinfect wastewater? These are some of the questions that they have to ask themselves. Usually, their answer is to resort to chemical disinfection. But using chemicals for waste disposal is not without effect on the environment and industrialists are increasingly taking this risk in consideration. This is why new chemical-free solutions are emerging. Romain Jombart, Director of Innovation and R&D, explains BWT ECO-UV consists of two technologies that have been brought together to enhance water quality without using chemicals. "We were looking for a disinfection process that limited the use of chemicals and this solution involves the use of UV lamps and hydrogen peroxide. The UV has a specific length of 254 nm which can destroy the DNA of bacteria and most of the microorganisms in water. We emerge the lamps in the manufacturer's installation and also add some H₂O₂ (hydrogen peroxide) which is really effective on biofilm. A subsidiary of the Best Water Technology group, BWT France provides a range of full solutions in the field of water treatment, including equipment, chemicals and services. BWT ECO-UV is suitable for any industry where water disinfection is part of the manufacturing process, particularly food and beverage. "The UV lamps are switched on and disinfect the water as it flows through, then, from time to time; H₂O₂ is injected to vaccinate the system. It is very safe and efficient and is easy to use. It also requires minimum maintenance." When used correctly and with effective pre-treatment and good monitoring, the process provides 99% efficiency, the level required of any disinfection process, says the company. "ECO UV is very efficient but if you start with a very bad quality of water, then have bad maintenance and follow-up of the installation, it will be less effective. This is why we also offer pre-treatment, follow-up and maintenance to our clients." The plan now is to start testing much larger installations, those dealing with volumes of water greater than 50cbm. The company is also looking into the creation and use of biochemicals from living plants and the technology of electrolysis. "Our aim is to continue to focus on really strong disinfection of water," M Jombart concludes. At the same time, we want to change people's mentality towards water treatment, encouraging processes and products that are much more respectful to the environment."

April 25, 2022; www.emag.directindustry.com

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

Meeting with the Vice President (Mauritius), NAM S&T Centre Governing Council

Dr. Amitava Bandopadhyay, Director General, NAM S&T Centre met Mrs. Shabina Lotun, Permanent Secretary, Ministry of Education, Tertiary Education, Science & Technology, Government of Mauritius and Vice President, NAM S&T Centre at her office on 25th May 2022 during his visit to Mauritius in connection with the organisation of the International Workshop on “Role of Science, Technology and Innovation (STI) in Achieving Sustainable Development Goals – 2030” which was jointly organised by the Centre in collaboration with the Indian Ocean Rim Association (IORA) Secretariat, Ebene, Mauritius. The meeting was attended by Prof. Kiran Bhujun, Director (Tertiary Education), Mr. Vedanand Bhurosah, Asst. Director and other colleagues from the Ministry, and Mr. Sunil Kumar, Accounts Manager, NAM S&T Centre.



During the meeting, Dr. Bandopadhyay thanked Mrs. Lotun for her kind support to the NAM S&T Centre for S&T collaboration between Mauritius and the Centre. Dr. Bandopadhyay apprised her of current activities of the Centre including International Workshops, Training Programmes, Publications and Fellowship Programmes. As planned earlier, Dr. Bandopadhyay requested Mrs. Lotun for her in-principle approval for hosting and organising the 16th Governing Council (GC) Meeting of the Centre in physical mode which was agreed by her and it was decided to hold the GC Meeting in Mauritius tentatively in July 2023.

In addition, Dr. Bandopadhyay also requested the Permanent Secretary to consider organisation of a joint International Workshop hosted by Mauritius during 2023-24. This proposal was also approved by the Permanent Secretary. The dates and topic of the Workshop will be finalised through mutual consultation. Dr. Bandopadhyay further suggested that Mauritius may initiate a joint Publication Project with the NAM S&T Centre on an appropriate topic. Prof. Bhujun and Mr. Bhurosah took keen interest in regard to the International Workshop as well as the proposed Joint Publication and suggested that both these activities may be discussed further to take them forward.

Dr. Bandopadhyay took this opportunity to invite Mrs. Lotun and other officials for a visit to the NAM S&T Centre Secretariat in New Delhi at a mutually convenient time.

Meeting with the Secretary General, Indian Ocean Rim Association (IORA)



Dr. Amitava Bandopadhyay, DG, NAM S&T Centre met H. E. Dr. Salman Al Farisi, Secretary General, Indian Ocean Rim Association (IORA), Mauritius on 23rd May 2022 at his office in the IORA Secretariat, Ebene, Mauritius during his visit to Mauritius in connection with the organisation of the International Workshop on “Role of Science, Technology and Innovation (STI) in Achieving Sustainable Development Goals – 2030” from May 24-25, 2022. The meeting was also attended by Mr. Gareth Rees, Director, IORA; Ms. Kritika Nuckchady, Project Officer, IORA; Mr. Sunil Kumar, Accounts Manager (NAM S&T Centre) and Ms. Jasmeet Kaur Baweja, Programme Officer (NAM S&T Centre).

Dr. Bandopadhyay thanked the Secretary General for his kind support in organising the International Workshop and apprised him of various activities of the NAM S&T Centre towards South-South S&T cooperation as well as the Centre's efforts towards building North-South S&T cooperation. He proposed that the Memorandum of

Understanding (MoU) which was signed between the IORA and NAM S&T Centre in November 2019 may be renewed further so that a few more collaborative projects may be initiated under the MoU.

The Secretary General appreciated the good work being done under the MoU so far and agreed to the suggestion for the renewal of the MoU for another term of three years. The MoU renewal process has now been formally initiated through the IORA Secretariat.

Dr. Bandopadhyay took this opportunity to invite the Secretary General; Mr. Gareth Rees, and other IORA officials for a visit to the NAM S&T Centre Secretariat at a mutually convenient time.

Centre Announces

JOINT NAM S&T CENTRE - ZMT BREMEN (GERMANY) FELLOWSHIP ON "BLUE ECONOMY IN TROPICAL COASTAL MARINE RESEARCH" CALL FOR APPLICATIONS FOR 2023

The NAM S&T Centre invites applications from suitable candidates for the **Joint NAM S&T Centre - ZMT Bremen (Germany) Fellowship on "Blue Economy in Tropical Coastal Marine Research"** for 2023.

This Fellowship Scheme was initiated in January 2008 for affiliation of the scientists from the developing countries with the Leibniz Centre for Tropical Marine Research (ZMT), Bremen, Germany [www.leibniz-zmt.de] for a period of up to 3 months to work with its senior researchers and faculty members for upgrading research skills in the fields related to Ecology, Biogeochemistry, Geology, Theoretical Ecology and Modelling, Social Sciences and Tropical Coastal Marine Systems, and undertaking short-term Joint Research Projects at ZMT, Bremen. This year, proposals in the area of Blue Economy are highly encouraged in order to strengthen research on solutions. Depending on the research topic, the selected Fellows can also benefit from the ZMT's association with Bremen University and other well-established marine research institutes in Bremen.

The Fellowship will be awarded to the scientists only from the Member Countries of the NAM S&T Centre and Members of the NAM S&T-Industry Network. Only one scientist will be selected from a particular Member Country/Network Member. The NAM S&T Centre will sponsor up to five scientists each year. While the Centre will cover the international airfare of the selected Fellows from its **eligible Member Countries/ Network Member Organisations**, ZMT will provide a monthly subsistence allowance of Euro 1250 to meet the accommodation and other expenses during the stay in Bremen.

The last date for submitting application for the Fellowship is Friday, 30 September 2022. Guidelines for the Fellowship and the other details along with the application form are available at the **Centre's Website: www.namstct.org.**

JOINT NAM S&T CENTRE – ICCBS FELLOWSHIP ON "NATURAL PRODUCTS CHEMISTRY, DRUGS AND PHARMACEUTICALS" CALL FOR APPLICATIONS FOR 2022-23

The NAM S&T Centre invites application from eligible candidates for the **Joint NAM S&T Centre - ICCBS Fellowship on "Natural Products Chemistry, Drugs and Pharmaceuticals"** for 2022-23.

This Fellowship is offered to scientists and researchers of the Member Countries of the NAM S&T Centre and the Members of its NAM S&T-Industry Network for affiliation with the International Centre for Chemical & Biological Sciences (ICCBS), H.E.J. Research Institute of Chemistry, and Dr. Panjwani Center for Molecular Medicine and Drug Research, University of Karachi, Pakistan [http://www.iccs.edu/] for a period of up to ~3 months. The Fellowship will provide opportunity to work in the ICCBS Laboratories in the areas of Drugs Research and Development including Natural Products Chemistry and Herbal Medicines; Drugs, Pharmaceuticals and Nutraceuticals; Molecular Medicine, Medicinal Chemistry, Computational Chemistry, Structural Biology, Nanotechnology, Proteomics and Genomics, Clinical Research etc. in order to enhance their research skills, facilitate exchange of information and contacts and create a network between the scientists and researchers from Pakistan and other developing countries. Under this scheme, the NAM S&T Centre will pay the return international airfare for the selected Fellows from the home country to Karachi. Applicants only from those Member Countries of the NAM S&T Centre or Members of the NAM S&T – Industry Network, which have no outstanding dues towards the annual membership subscription to the Centre should apply for the Fellowship. The ICCBS will provide free furnished accommodation and a monthly subsistence allowance of **PKR 35,000/-** to the selected Fellows for the duration of the Fellowship.

There is no last date for submission of applications. Selection will be made on first-cum-first basis and strictly based on the professional details of the applicant, plan of work to be carried out and mutual research interests of the applicant and ICCBS. Guidelines for the Fellowship and the other details along with the application form are available at the **Centre's Website: www.namstct.org.**

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