

REPORT

Two days International Knowledge Sharing Workshop on “Cross-border Innovation, Acceleration and Challenges in International Transfer of Technologies” jointly organized by DSIR, CSIR, APCTT of the UN-ESCAP on 14th – 15th November 2022 at CSIR Science Centre, New Delhi

An International Knowledge Sharing Workshop on “Cross-border Innovation, Acceleration and Challenges in International Transfer of Technologies”, was jointly organized by Department of Scientific & Industrial Research (DSIR), Ministry of Science & Technology, Government of India, Council of Scientific & Industrial Research (CSIR), in association with Asian and Pacific Centre for Transfer of Technology (APCTT) of the United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP) from 14th – 15th November 2022 and coordinated by CSIR-Human Resource Development Centre (CSIR-HRDC) at CSIR Science Centre, New Delhi in Hybrid Mode. Out of around 350 participants registered for the programme 36 were international participants from 17 countries vis Bangladesh, Cambodia, Iran (Islamic Republic of), Indonesia, Jordan, Lebanon, Malaysia, Nepal, Pakistan, Philippines, Republic of Korea, Sri Lanka, Thailand, Trinidad & Tobago, Uzbekistan who joined both online & offline. Around 70 participants joined physically.



Fig. 1 : Group photo of physical participants in the workshop on Day 1

This international workshop was envisaged to strengthen capacity of innovators and promote regional cooperation between innovators from India and member States of APCTT through cross-learning from experience and good practices, identifying potential collaboration opportunities and strategies for cross-border technology transfer. It Increased knowledge and awareness on the challenges, mechanisms and good practices of innovation, transfer and diffusion of technologies in the Asia-Pacific Region. It explored innovative strategies and modalities to strengthen regional cooperation for cross-border transfer and diffusion of

technologies; the workshop panellists made recommendations on addressing the critical challenges for strengthening regional cooperation for innovation and technology transfer.

The Workshop was inaugurated online by Dr. N. Kalaiselvi, Secretary, Department of Scientific & Industrial Research (DSIR) and Director General, Council of Scientific & Industrial Research (CSIR). While delivering the inaugural address, she emphasized about the importance of technology transfer, cross border innovation and the concerted efforts of CSIR in developing the technologies and transferring them to industry. She advised the participants to develop technologies that can ultimately reach the society. In this direction she commended the Workshop where innovators, industry, R&D labs, academia, MSME, Start-ups, Big Industries, Incubation centres, Policy makers and other stakeholders have been brought on a common platform to discuss about the roadmap for achieving the goals under SDG 2 SDG 7 and SDG 9.



Fig. 2 : Group photo of physical participants in the workshop on Day 2

Shri Surinder Pal Singh, Joint Secretary, DSIR; Dr Preeti Soni, Head of APCTT-ESCAP; Dr Rama Swami Bansal, Head of CSIR-International S&T Affairs Directorate (ISTAD); Dr. P.K.Dutta, Scientist 'G' & Head, PRISM, DSIR, New Delhi; Dr. Parvinder Maini, Scientific Secretary, Office of Principal Scientific Advisor, Govt. of India; Dr. Ajay Mathur, Director General, International Solar Alliances, Dr. Katja Lasch, Director, DAAD Regional Office and DWIH, New Delhi; Ms. Rebecca Fairbairn, Head of Science and Innovation, UK Research & Innovation (UKRI), UK Government; Dr. Habibar Rahman, International Livestock Research Institute (ILRI) Regional Representative, South Asia; Prof. Jamuna Duvvuru, Vice Chancellor, Sri Padmavati Mahila Visvavidyalayam, Tirupati, Dr. Bhaskar Balakrishnan, Former Ambassador of India & Science Diplomacy Fellow, Research and Information System for Developing Countries (RIS), New Delhi; and Dr R. K. Sinha, Head of CSIR-HRDC also graced the occasion in person.

Shri Surinder Pal Singh, Joint Secretary, DSIR told, "this workshop will provide a strong platform for APCTT Member States including India to share their needs and identify opportunities on Cross-border Innovation, possibilities on acceleration of International Collaboration and Challenges in International Transfer of Technologies.



Fig.3: Inaugural session of the Workshop

Dr. P.K.Dutta, Scientist 'G' & Head, PRISM, DSIR told, "Innovators need to consider not only Technology Readiness Level (TRL) but also Business Readiness Level (BRL) in order to success in their business ventures".

Dr. Preeti Soni, Head, APCTT told, "The current event topic is very relevant for Asia and -Pacific region in the present situation of Covid times. Covid-19 and Climate Change has slowed down the progress and posed challenges to achieve sustainable development goals. Asia and Pacific region is not on the track of any of the 17 goals SDGs that have been agreed upon for all countries to work on. The latest SDG report of Asia Pacific Region for the Year 2022 of UN-ESCAP actually shows there is a slow progress of all the 17 SDGs and in the current situation, we can achieve only by 2065. That means there is lot of work we have to do collectively and technologies in that play a very important part. Global Innovation Index presented by WIPO last year shows that many sectors have shown remarkable resilient especially in digitalization, technology and innovation. In this workshop would discuss developing countries in Asia Pacific also face no. of constraints in accessing and scaling up new technologies and cleaner technologies. Few of the barriers noted by APCTT are low financial investments capabilities due to high cost of technology, development, upscaling and commercialization, shortage of skilled technical personnel specially new and emerging technologies like AI etc. There are some mechanisms and strategies to address these limitations which are regional cooperation, transfer of technologies, collective and collaborative efforts is needed.

Panelists were from International Organizations including FAO, ILRI, ISA, DWIH, UKRI, RIS; Indian National Organizations like CSIR-NBRI, IITD, SPMVV, CSIR-NCL, Venture Centre, Government departments including Office of PSA, MoE Innovation Cell,

Public sectors like NRDC, excellent Industries such as International Tractors, IOCL, TATA Power Company Limited, Ankur seeds and Mahyco Pvt. Ltd.; Innovation eco-system partner like Research Parks, Incubation Centres, Start-ups, Member Country dignitaries and participants from National Organizations like NIT, Arunachal Pradesh, PRISM-TOCICS like GSBTM, CSIR-NEIST, CSIR-CSIO, CTAE, Udaipur, CSIR-NAL, IGNOU, Shiv Nadar University, University of Delhi, IITD, IIT Mandi, IIT Roorkee, IIT Indore, several Incubation Hubs, DSIR, CSIR HQ, CSIR-IIP, CSIR-NIScPR, NRDC and APCTT.

The workshop aimed to identify the challenges for achieving the goals in SDG 2 (Zero Hunger), SDG 7 (Affordable and Clean Energy), SDG 9 (Industry-Innovation and Infrastructure).

Under the Session, “Emerging technologies for climate-resilient agriculture and animal husbandry to support SDG 2”, moderated by Dr Anand Mohit, Principal Scientist, CSIR-ISTAD, productive agriculture and animal husbandry through integrating emerging technologies like Internet of Things (IOT), robotics, drones, energy resilient preservation and biotechnology for better selection, yield improvement, disease resistance, precision farming, precision nutrient deliveries, Innovation and Policy perspectives were discussed. A constructive discussion was held particularly on smart and climate resilient agriculture, crop breeding technology for productive agriculture, precision farming, precision nutrient deliveries, animal husbandry and innovation – including Global and India’s perspectives.

Dr. Samir V. Sawant, Chief Scientist, CSIR-National Botanical Research Institute presented “An overview on emerging technologies for Smart & Climate-resilient Agriculture & Animal Husbandry: CSIR Perspectives”. He explained why Smart & Climate-resilient Agriculture is needed and briefed about some of the emerging technologies such as Satellites (Weather Tracking), Big Data (AI), Smart Crop Monitoring (Sensors), Drones, GPS-Tracking, Closed Ecological, System, Vertical Farming, Hydroponics, Aquaponics, Biotechnology (Precision Agriculture, SDN Technologies, Speed Breeding, Double Haploid, Mini chromosome). He presented various government initiatives such as “Pradhan Mantri Kisan Urja Suraksha Utthaan Mahabhijan (PM-KUSUM) scheme, Rashtriya Krishi Vikas Yojana (RKVY), National Mission for Sustainable Agriculture (NMSA), Pradhan Mantri Krishi Sinchai Yojana (PMKSY), National Food Security Mission (NFSM), Pradhan Mantri Suraksha Bima Yojana (PMSBY), National Mission on Agricultural Extension and Technology (NMAET), Weather Based Crop Insurance Scheme (WBCIS). He also explained about CSIR’s Agri-Nutrient Biotech (ANB) Theme which is an integrated approach of Crop Improvement, Bio-stimulant, Bio-stimulant, Value Addition, Enzymes, Farm Mechanization.

Mr. Vinay Singh, National Project Manager, Food and Agriculture Organisation (FAO), India presented the “Global perspectives on emerging technologies for climate resilient agriculture”. He explained about Climate-resilient agriculture/Climate-smart agriculture (CSA) - an integrated approach to managing landscapes—cropland, livestock, forests and fisheries - that address the interlinked challenges of food security and climate change. CSA aims to tackle three main objectives such as (a) Sustainably increasing agricultural productivity and income (b) Adapting and building resilience to climate change (c) Reducing and/or removing greenhouse gas emissions. He presented that current challenges such as Place-specific nature of agrifood systems and the challenges associated with scale and timing of climate change impact Variation in Practical action to invest in specific measures, Options to strengthen the climate resilience of agrifood systems; Expected impact of climate change on elements of agrifood system, depend on the trend in hydro-meteorological hazards; The probability and

size of impact, influence the timing and scale of action to enhance resilience of agri; Large impacts lead to - producers finding alternative livelihood options within and outside of the agrifood systems. He presented that Global perspectives on CSA.

Dr. Ashwin Kashikar, General Manager (R&D), M/s. Ankur Seeds Pvt Ltd., Nagpur presented about the “Application of New Technologies in Agriculture/Seed Industry”. He presented the impact of Technologies in Agriculture. He said that Transition of Technology is taking place and IOT, Robotics, Machine Learning and Drones are playing key roles in smart agriculture. He presented the case study particularly on High throughput Phenotyping, Genomics Selection, Speed Breeding, Seed Quality Analysis in seed production. The technology played a very vital role in new way of seed production. This was applied to some crops such as cotton, paddy, chilli. He also presented about the First Hybrid in Cowpea, which improved the soil health bes suitable for crop rotation, high heterosis giving 100% more yield, which is key to global nutritional security. He finally presented that seed quality of conventional method of testing Genetic purity and AI / ML based method of testing genetic purity.

Dr. H. Rahman, Regional Representative for South Asia, ILRI, New Delhi presented Global perspectives on emerging technologies for smart and climate-resilient animal husbandry. He presented why livestock mater globally for livelihoods and demand for animal source of foods. He said that Livestock sector is primarily victim of climate change. He also presented impact of climate change on livestock sector which can be seen in different ways such as production and availability of quality feed crops and forages, animal growth and milk / meat production, diseases incidence, reproduction. These impacts are primarily due to an increase in temperature and atmospheric carbon dioxide (CO₂) concentration, precipitation variation, and a combination of these factors. He presented about the linking emerging technologies with climate smart livestock production to address global challenges of climate change. This linking of technologies may improve livestock production efficiencies, Identifying genetic opportunities to breed heat-tolerant livestock, Exploring feed additives that reduce livestock methane emissions, Managing manure for lower GHG emissions, Determining the impacts of livestock diseases on GHG emissions, Using Digital data to increase productive efficiency, better health, and reduce antibiotic use. Milk yields decline during heat stress, and heat stress is rising under climate change. The livestock research programs can address breeding ‘climate-tolerant’ animals that maintain good milk yields under heat stress while reducing their greenhouse gas intensity.

Shri Rajendra Barwale, CMD, M/s. Mahyco Pvt. Ltd., presented “An industry perspective on emerging agricultural technologies for productive agriculture, precision farming, precision nutrient deliveries, innovation and policy perspective”. He said that their business is built around finding innovative solutions to Agricultural Challenges. He presented the role of innovations in reducing the significant environmental footprint. He presented the case study of emerging crop breeding technology i.e. Genome Editing, which is a revolutionary technology for crop improvement. He presented the SDN1 and SDN2 type genomic alterations that can be used to improve various crop traits using CRISPR-Cas. He also presented the advantages of this breeding technology. He also presented the precision farming technologies such as Sensors for Crop health & Soil health monitoring, AI for quality standardization, Yield Est., Robotics for farm operations, Drones for Chemicals spraying, Crop monitoring, Land use & mapping. He also presented the role of Biological Fertilisers which is precision nutrient delivery innovation and emerging innovations in plant breeding technologies. He said that there is a need for enabling policy environment from policy makers.

Under the session, “Green and low-carbon emerging technologies in energy to support SDG 7”, Material research & innovation, production technology, power electronics, energy storage and management for alternate energy (solar, offshore, wind etc.), green hydrogen, carbon-negative technologies, ocean biomass, biofuel, 5G-based smart grids, climate protection, sustainability etc. was discussed. The various challenges, research & development Innovation and policy issues concerning green & low-carbon technologies in energy sector; Green hydrogen production & storage and utilization of hydrogen as a transport fuel, blending of hydrogen in fossil fuels, smart grids, emerging Technologies like IoT, ML, CPS in power sector for energy efficiency, green energy and sustainability; power electronics such as development of various controllers (AC-DC and DC-DC) for penetrating the renewable energy and issues concerning making the existing grids resilient, etc. were also covered in the discussions.

Dr. Ajay Mathur, Director General, International Solar Alliance, New Delhi presented the global perspective on green & low-carbon technologies in energy sector. He said that we need a versatile solution that could easily plug into our current energy systems. He said that greening of the grid; electrification of energy demand; and green hydrogen are probably the technologies of tomorrow. Greening of the grid is happening – today approximately 15% of electricity is green in India – solar, wind. Hydro, nuclear, biomass. Solar is cheapest but as demand for PV panels increases, geographical diversification is essential to avoid choke points in the supply chain. Batteries are essential to reach high levels of green electricity penetration. Electric vehicles are entering the market; in India, base technologies have been purchased, and indigenised; high efficiency, high load carrying 2-wheelers will require local R&D; Industry applications are not growing largely because high temperature applications are dominated by high-temperature steam from coal-fired boilers. Integration of renewables (especially solar) in buildings requires indigenous technologies. Hydrogen manufacturing is being built on base of current electrolyser technologies. But transition from fossil fuel based to green energy based is not an easy task. We need to establish other practices such as energy efficiency and a circular economy that make the transition easier. These emerging technologies to implement, a favourable policy initiatives are much needed. These include market creation, subsidising R&D, setting technology & performance standards, price mechanisms, regulatory measures, etc.

Dr. Chinnakonda S. Gopinath, H2T Program Director, CSIR-National Chemical Laboratory, Pune presented about “Green, Low Carbon and Carbon-Negative Technologies”. He presented about the Panchamrit i.e. (i) 500 GW RE installed capacity by 2030; (ii) 50% RE contribution to energy mix by 2030; (iii) Reduce CO₂ emissions by 1 GT from now till 2030; (iv) Carbon intensity of GDP to be < 45% by 2030; (v) Achieve net zero emissions by 2070. He presented about the policies of Government of India to achieve the scale in renewable energy. He presented about the CSIR Hydrogen Technology (H2T) program with a budget outlay of Rs.100 crores. Under this program, CSIR Increased TRL for strategic raw materials, components and systems and Continuous undertaking R&D and innovation. CSIR is also creating state-of-art testing facilities for standardization, certification, quick prototyping, validation of PoCs and rapid scale-up to achieve higher TRLs. CSIR is working primarily on Mission Mode Technology projects such as Green Hydrogen Production, Storage/ Distribution / Refueling and Green Hydrogen Utilization. He briefed about the Artificial Leaf and CCU Concept for CO₂+H₂O to Methanol and/or Ethanol project.

Dr. Ganesh Das, Chief-Collaboration & Innovation, Tata Power Company Ltd., Mumbai said that Tata Power is the largest integrated power company in India. The company’s

belief is driving the green initiative in the country. He briefed about the different technologies which are evolved over a time in the power sector, how does start-up ecosystem which has really evolved, how can partnership / cooperation / collaboration at national level / international level between various organisations / agencies which help us to drive the entire journey of technology and the application of the technology in the eco-system. Two years back it used to be predominantly electrical energy technology based ecosystem and then evolution of SCADA, Distribution Management System (DSM), GIS, AMR, etc. Over a period of time, concept of smart grid has been emerged in a very big way. Smart Grid put lot of emphasis on two way communication and many new technologies under development for deployment of smart grids. India played a significant role in developing AI and machine language based technologies. As we moved into the renewable energy transition, lot of emphasis on energy generation through solar, wind, biomass and non-conventional energy sources. Solar energy played a key role in development of renewable energy in India. While technology played a significant role but the cost and affordability has always been a challenge. Earlier, India predominantly largely depend on importing of technology and localize the technology to use in India. Now various technologies have been developed by industry, academic institutions with government support. Research activities in private and public agencies has improved drastically. Start-ups are also contributing to developing technologies for power sector. Tata Power has been working very closely with various academic institutions, R&D Labs and Start-ups for developing various technologies. Industry and start-up partnership, industry – institution partnership, Indian industry partnership with multiple countries such as Mission Innovation programme should be looked at extensive level for developing clean and sustainable which does not cost any negative impact on the climate change.

Dr. Sukumar Mishra, IIT Delhi presented the “Green Emerging Technologies in Energy to Support the Grid (Energy Management)”. He presented the impact of PV on AC Grid system. He said that due to proliferation of PV—which has intermittent resource characteristics that vary the power output throughout the day and requires inverters for DC-AC conversion imposes various challenges utilities. Also, due to the variability caused by passing clouds, PV can significantly affect volt/VAR control, power quality, and system operation. Some of these impacts can only be investigated through dynamic/transient studies that include the time-varying behavior of fast-acting generation (inverters), load, and automatic voltage-control devices on the feeders. The severity of these impacts varies with the penetration level, the location of the PV, and the electrical characteristics of the distribution systems. He also presented the concept of smart charging for optimization of a controlled charging while satisfying the mobility need through bidirectional communication link and Vehicle-to-Grid - Bidirectional smart charging.

Mr. Dhananjay Sahoo, Dy. General Manager, Indian Oil Corporation Ltd., New Delhi presented about the Industrial perspective on future energy technologies via-vis economic feasibility. He presented the details of the largest cattle dung based Compressed Bio-Gas (CBG) plant, which has been setup by IOCL at Hingonia Cattle Rehabilitation Centre, Gaushala, Jaipur. The plant is based on Cattle Dung Feedstock which has a capacity of 100 tons per day. This technology has been indigenously developed with a project cost of Rs.30.00 crores. He presented the initiatives of IOCL on Hydrogen, which is India’s 1st Hydrogen Fuel cell Fork lift. The technology is based on CO tolerant fuel cell technology and IOCL in partnership with IIT Kharagpur developed first indigenous Type-3 Hydrogen Cylinder. He also presented the initiatives of IOCL on Battery development. He explained about the bi-polar lead acid battery developed by them, which is superior to conventional lead acid battery. Indian Oil Corporation (IOC) aims to achieve net zero carbon emission target by 2046.

Under the Session, “The process and key constraints in innovation, technology promotion and commercialization to support SDG 9”, deliberations on the opportunities, challenges, and guidance on how countries can accelerate the technology formulation and adoption cycles were held. Various topics on innovation ecosystem, opportunities, and challenges in India, Germany and UK and Member countries of APCTT were discussed.

Dr. Parvinder Maini, Scientific Secretary, Office of Principal Scientific Advisor (PSA) to Government of India underscored, “Innovation is essential for boosting survival, competitiveness and market power despite being risky and prone to failure”. She said that the Government of India has been funding research and development efforts at academic institutions. However, the mapping of facilities based on availability and distance was not available. The government aims at bridging the gap, by converging information on facilities developed through government support and researchers who are qualified to utilise these facilities for research work. Hence, PSA has created a facility called I-STEM is a National Portal, which assists researchers to locate the specific facility(ies) they need for their R&D work. The portal also assists in shortlisting and identifying the facilities based on distance and time of availability. She gave an overview of India’s policy and a few focus areas i.e. R&D expenditure from industry should increase; Foreign Direct Investment (FDI) in R&D; Increase in R&D exports; R&D by Central Public Sector Enterprises; Corporate Social Responsibility guidelines for spending in R&D, for boosting Technology transfer and start-up ecosystem.

Dr. Katja Lasch, Director, DAAD Regional Office, New Delhi and Director, DWIH, New Delhi presented about the Innovation ecosystem in Germany. She presented that German Government has invested an amount of 106 billion Euros in R&D to support higher education institutions, non-university research institutions and majority for industrial research. Germany is spending 303% expenditure on R&D on GDP. The German Government is providing support for startups, Research & Innovation funding for SMEs, entrepreneurial and innovation activities at research and higher education institutions and creation of networks and clusters. She said that 492 projects funded to incubators and innovation projects at HEIs, 103 projects for idea, technology and knowledge transfer on a regional level. They have three major programmes such as Industrial Collective Research (IGF) which pre-competitive research by industrial research associations, Central Innovation Programme for SMEs which supports R&D project carried out by SMEs and their partners, KMU-Innovativ is a cutting edge research carried out by SME in predefined research fields.

Prof. Jamuna Duvvuru, Vice-Chancellor, Sri Padmavati Mahila University (SPMVV), Tirupati, Andhra Pradesh made presentation on “Techno Commercial and Socio-Economic Perspective of Innovation: An Engine for Economic Empowerment of India”. She presented the details of “National Education Policy 2020 (NEP)” and scope for innovation and creativity at Higher Education Institutions. The aim of the NEP is to identify and foster the unique capabilities of promoting creativity and critical thinking to encourage logical reasoning and innovation. It is emphasising HEs for knowledge creation and innovation thereby contributing to a growing national economy; HEs to focus on setting up start-up incubation centers, Technology development centers, and Centers in frontier areas of research; HEIs to develop specific hand-holding mechanisms & competitions for promoting innovation among student groups. The role of HEIs to determine the innovation ecosystems are Research Investment, Education Policy, Researcher Density, No. of Patents Registered, Publication Output, Start-Up Environment. He explained how to address the social and economic challenges through innovation. She also presented the case study of Incubation Model at SPMVV, Tirupati. She finally concluded with the way forward for successful innovation and entrepreneurship.

Dr. Rebecca Fairbairn, Director UKRI India presented the Research and Innovation ecosystem in UK. UKRI was formed in April 2018 to convene, catalyse and invest in a UK research and innovation system that connects discovery to prosperity and public good. UKRI brings together the 7 thematic UK research councils, Innovate UK and Research England, working closely with partner organisations across the UK. She explained about the scheme viz. Innovate UK is the UK's national innovation agency which supports business - led innovation in all sectors, technologies and UK regions. UK help businesses grow through the development and commercialisation of new products, processes, and services, supported by an outstanding innovation ecosystem that is agile, inclusive, and easy to navigate. She informed that they have five themes namely Future economy, Growth scale, Global opportunities, innovation ecosystem, government levers. She conveyed the approach of UK which is understand the opportunities and obstacles; agile partnership for coordinated, visible, systemic change; focus on innovators not just innovations; equality, diversity, inclusion; appraisal and evaluation.

Finally, panel discussions on “Pathways and constraints in techno-commercial value assessment, techno-economics, marketability, and affordability of innovative technologies” was held. Various innovators from countries like Cambodia, Nepal, Uzbekistan, Thailand, India discussed about their start-ups as case studies.

Dr. Dipan Kumar Sahu, Asst. Innovation Director, Innovation Cell, Ministry of Education, India presented about the culture of innovation in all Higher Education Institutions (HEIs) across Pan India and constraints faced by the innovators and indicative solutions to the same. He presented the Indian Education System and Indian Innovation System. As described Indian is 3rd largest Startup ecosystem and more than 72000 startups registered so far. India moved to 40th position in Global Innovation Index. India is also 3rd largest education system i.e. 63000 HEIs and 40 million graduates per year. He presented that National Education Policy (NEP), 2020 which primarily focuses on Research, Innovation and Entrepreneurship. He presented about the challenges for innovation and entrepreneurship ecosystem development in HEIs.

Mr. Kishan Kumar Tewari, President & CTO, M/s. International Tractor (Sonalika) Ltd., India presented about the innovative ideas to prototype development to standardization and commercialization – An Indian Perspective. He informed that 126/146.5 million Indian farmers are small and marginal category with fragmented land. The commercially available tractors are heavier and bigger in size with limited intercrop functionality. Investment on these tractors doesn't justify these farmers return of investment. He discussed about industry approach & challenges for innovating idea to commercialization.

Dr. Premnath Venugopalan, Head, NCL Innovations, CSIR-NCL, Pune and Director, Venture Center, Pune, India presented about the pathways, constraints and possible solutions in Indian ecosystem. He presented the examples of Venture Center incubated technologies and their impact. He presented the typical issues for startups. He presented the case study of incubator incubated in Venture Center i.e. MyLab Discovery Solutions which has developed indigenous Covid diagnostic kit. He presented the possible solutions to the present ecosystem.

Dr Bijay Kumar Sahu, HoD-Technology Innovation Support Centre & Intellectual Property Facilitation Centre, NRDC presented about the contribution of National Research Development Corporation (NRDC), a PSU under DSIR, Government of India, New Delhi in technology commercialization. He also briefed about gaps and challenges in technology

development. He also briefed about issues at macro-level, micro-level, meso-level in technology commercialization and factors influencing technology commercialization. He defined Innovation Readiness Level (IRL) which includes Technology Readiness Level (TRL), IPR Level (IPRL), Market Readiness Level (MRL), Consumer Readiness Level (CRL), Society Readiness Level (SRL). He mentioned about the technology transfer challenges which are research / new invention should focus on commercial viability; limited platforms to promote marketing of technology; limited knowledge of organization on commercialization of technology; technology should be in response to the market needs. The above can be categorized as organizational barriers, technical barriers, human barriers, information barriers.

The representatives of Member States from Dr. Selim Reza, Bangladesh, Dr. Yasamin Bide, Iran (Islamic Republic of), Mr. Khagendra Bahadur Basnet, Nepal presented about the efforts of their respective countries on Innovation, technology transfer and possible collaboration with other member states.

Shri Vivek Pandey, Co-founder and Chief Technology Officer, M/s.Ecozen Solutions Private Limited, Pune and Dr. Sandip Patil, Director, M/s.E-Spin Nanotech Pvt. Ltd. and M/s. Indeema Fibres Pvt. Ltd., Kanpur, the successful start-ups graduated from DSIR scheme, TePP and PRISM represented India during Panel discussion. They have presented the journey of their enterprise, challenges faced by them during this journey and how they overcome these challenges into opportunities. They acknowledged the contribution of timely support of DSIR for realizing their dreams. They emphasized that there is a need of Government support for startups to really turn their startups into unicorns.

Dr. N. Kalaiselvi, Secretary, DSIR and Director General, CSIR, Ministry of Science and Technology, Government of India addressed the audience at the valedictory session. She discussed the outcome of the Workshop especially on critical challenges on cross border technology transfer and possible recommendation and envisioned couple of successful technology transfers/start-ups as an outcome of the Workshop in near future. UN sustainable development goals were framed every dimension of the human requirement has been given more than enough thought process and therefore we as a responsible researches we have to really put in our synergised our efforts to see that all the sustainable development goals are getting their priority through our lab driven research and through our industry collaboration. When each and every country is coming up with the technology lead in one particular area we have to make that particular technology lead to get its disseminated to other countries also so that the entire globe is getting the benefit out of science and technology. Science is universal, science is common to all, science will not disappoint anybody, science will not change, science is always stable and it is sustainable. We strongly believe that we can really handshakes, hand pooled and we can travel with all the 53 Members state countries and we can make this APCTT progamme in a very successful manner. We should talk to each other in a very open transparent manner and share our knowledge. Knowledge is one very important and beautiful parameter while sharing it is getting multiplied. This is one great opportunity, golden opportunity, great platform and ideal platform wherein let us talk to each other in a much more transparent way let us talk our extreme science and technology, let us share not only the knowledge but also technology.



Fig.4: Deliberations during Day 1 and Day 2 of the workshop

The programme ended with closing remarks and brief summary of deliberations by Dr Preeti Soni, Head, APCTT-UNESCAP and Dr. Ramanuj Banerjee, Scientist F, DSIR and National Focal Point (India) for APCTT of UNESCAP, followed by Vote of Thanks to all dignitaries, panellists, speakers and participants from India and APCTT Member states, presented by Dr Vinay Kumar, Principal Scientist, CSIR-HRDC.

