Proceeding of
Fourth IndiaLICS International Conference 2017
2nd – 4th November, 2017
and IndiaLICS International Training Workshop
1st and 5th November, 2017

Report of the Training Workshop

The IndiaLICS International Training Program 2017

Innovation for Sustainable Development: Perspectives, Policies and Practices in South Asia

1st and 5th November 2017

Organized by:

Centre for Studies in Science Policy, JNU
CSIR-NISTADS

Venue: CSIR-NISTADS and JNU, New Delhi

IndiaLICS 2017 is supported by:

ICSSR | SERB | Vigyan Prasar | Ministry of Earth Sciences

Programme Schedule
Day 1: 1st November, 2017

Venue: CSIR-NISTADS

Registration and Tea: **9:00 – 9: 30**
Inaugural Session: **9:30 - 9:45**
Opening Remarks: P Goswami (Director, CSIR-NISTADS)
About the training programme: Saradindu Bhaduri (CSSP, JNU) & Sujit Bhattacharya (CSIR-NISTADS)

Session 1: **9: 45 – 12:00**
Introduction to the Themes **Peter Knorringa**
Innovation, Sustainability and Development: Research issues and Methodological tools.
Moderator: Peter Knorringa
Roundtable on tools and issues in innovation research: Rajul Joshi, Rakesh Basant, Amit S Ray
Session 2: **12:00 – 13:15**
Social Networking Analysis: Tools and Applications
Conceptual Framework and Applications: Sujit Bhattacharya
Demonstration of Techniques: Shilpa

Lunch: **13:15 – 14:00**

Session 3: **14:00 – 15:45**

Innovating from 'Science' and Innovating from 'experience': Sharing Thoughts:
Shabuddin, Anjani Kirodiwal and Amitabha Sengupta.

Moderator: Mathieu Quet

High Tea **15:45 – 16:15**

Session 4: **16:15 – 17:30**

Practitioner Perspective: Science, Technology in International Diplomacy (Round Table Discussion):
Mrs. Friederichs Tania, (Head, Research & Innovation, Delegation of European Union to India) and Dr. Hamid Kazemi, NRISP, Iran.

Moderator: Debapriya Dutta

Day 2: 5th November, 2017)

Venue: Convention Centre, JNU

Session 1: **9:00 – 11:30**

STS and Innovation Studies: Incompatibilities and Meeting Points:
Madhav Govind, Mathei Quet, Aviram Sharma

Moderator: Prajit Basu

Tea: **11:30 – 11:45**

Session 2: **11:45 – 13:30**

Technology and Innovation in Development Policy: Researchable issues.
Thomas Thurner, Dinesh Abrol

Moderator: Mammo Muchie

Lunch: **13:30 - 14:15**

Session 3: **14:15 – 15:30**

Intellectual Property Rights: Situating the debate in the context of innovation, sustainability and development

Moderator: Sujit Bhattacharya

- Developing Research Perspective: Reeta Sony, Hemant Kumar and Sambit Mallick

Session 4: **15:30 – 16:30**

Drawing lessons from the training programme: researchable issues for scholars of innovation studies, STS and science policy

Moderator: Saradindu Bhaduri

Session 5: **16:30 – 18:30**

3rd Chris Freeman Lecture

Smita Srinivas: Evolution from the Economics of Innovation to Economic Development Plans

Chair: Prajit Basu

High Tea: **18:30 – 19:30**

Venue & Date: CSIR-NISTADS Nov 01, 2017

Dr P. Goswami, Director NISTADS welcomed the participants and apprised them of the NISTADS desire to further promote this important area of contextualizing sustainable development in innovation studies and STS research; an area in which the institute had developed competence over the years. He highlighted in the discussion the need to develop implementable strategies by demonstrating 'proof-of-concept' a direction which now the institute is taking.

In his introductory address, Prof Peter Knorringa highlighted the importance of developing research strategy. In this context, the importance of research design, not getting confined to a narrow sieve, interaction with cross-disciplinary scholars, understanding contemporary trends, etc were highlighted. Why innovation for sustainable development has become an important thesis and the importance of embedding it within the context of innovation was highlighted. Some salient aspects of sustainable development were outlined and need for incorporation of these aspects into a research proposal was stressed.

The inaugural address set the tone of this workshop.

Session 1: Innovation Sustainability and Development: Research Issues and Methodological Tools

Amit S Ray (School of International studies, Jawaharlal Nehru University)

Focused his talk on Understanding Research Strategy. He raised the following issues:

1. What is a meaningful PhD question?
a. Questions not very well constructed.
b. Implications of research – meaningful to audience
2. Addressing PhD question research!
a. Theory –
i. Necessary for meaningful empirical research
ii. Not always a mathematical model
b. A conceptual framework which can be used to generalize outcomes of research.
c. Why is a system/property expected to behave a certain way?
3. Identifying a research question
a. From available literature – by reading and finding the gaps in the literature.
b. Observe a phenomenon and try to find out explanation for the phenomenon (Grounded theory research)

   1, 2, 3 constitutes a research puzzle. In order to make a question relevant, one needs to place it in macro view of the big picture.

Rajul Joshi (University of Technology Sydney, Australia)

Spoke on how it is important to draw attention to philosophical foundations of research.

1. What is reality?
a. Observation by senses
b. Belief
c. Construct
2. What is the purpose of research?

a. Advancement of knowledge
b. Understanding reality
3. Not to be slaves of methodology
4. Vested interest of supervisors
5. PhD is about developing a perspective about the world.
6. Research has fluid approach inherent to it with a flexibility built into the methodology.

Rakesh Basant (IIM-Ahmedabad)

Focused on key determinants that are essential elements of a good research design.

1. PhD
a. Time to learn and be trained for subsequent work to answer variety of questions
2. Literature review and Grounded theory complement each other.
3. Outline the importance and novelty of a question
a. Levels of novelty
i. Framing question
ii. Answering question
1. Conceptual Framework
2. Methodology
3. Data sets used
iii. Different conclusions – Reasons for difference even after following same methodology.
b. Methodologies = f (Data set available, Research question), f introduces constraints in research choices.

Moderator: Peter Knorringa (ISS/Erasmus University, The Netherlands)

Drew attention to salient points discussed in this session. He concluded by saying three fundamental aspects that need attention:

Various ways to go after completion depending on the intent.

Requires discipline to bring quality

Quality added when difficulties arise during research and they are addressed within the limitations of the resources.

Session 2: Social Network Analysis: Tools and Applications

Sujit Bhattacharya & Ms. Shilpa (CSIR-NISTADs & AcSIR at NISTADS Campus)

This session was introduction to the SNA focusing on how it can be a useful analytical method for enriching innovation studies, STS and related research. The session comprised of (a) highlighting the conceptual framework – key concepts, beliefs, assumptions of SNA and (b) SNA applications in innovation studies and STS (c) A working demonstration of SNA. Topics covered in (a) and (b) were done by Sujit Bhattacharya and (C) was covered by Ms. Shilpa

The conceptual framework drew attention to how different schools of thoughts attribute different meanings associated with a network, the various types of networks that are formed with roles and positions of actors acting as a key determinant in characterizing a network. SNA, how it enriches the study of the various networks in this context and its applications were discussed. Key concepts of SNA were introduced. Through examples the operationalization of SNA was demonstrated.

Session 3: Innovating from 'Science' and Innovating from 'Experience': Sharing thoughts
Speakers: Shabuddin and Amitabha Sengupta (The Northcap University**)**
Moderator: Mathieu Quet (CSSP, JNU; CNRS, France**)**
Local entrepreneurs spoke about their initiative of designing earthen vessels for day to day uses. They shared their experience with the process of brand development among local consumers and small business owners. Urging the experts to design solutions for interaction between technology developing entrepreneurs and research institutions like CSIR laboratories, Mr. Shabuddin focused on the challenges they faced in up-scaling and upgrading their technology.

Mr Shabuddin demonstrating products developed by them

Amitabha Sengupta highlighted the challenges of building technology artifact. The building of Atomic Clock by them in CSIR-NPL was taken to draw attention to how a scientists struggles with putting science into practice drawing parallels to the struggle of an informal innovator

Session 4: Practitioner Perspective: Science, Technology in International Diplomacy

Speakers: Friederichs Tania (EU Delegation to India at the European Commission)
Moderator: Debapriya Dutta (Department of Science & Technology)
It was an interactive session with Dutta introducing the theme by citing his own experiences as Science Councilor in USA and France and as Director in CEFIPRA, New Delhi. He highlighted how international studies is an important research area wherein there are a few well thought of strategy to develop qualified manpower in India in this area. He drew attention to the increasing role of science diplomacy.
Friederichs Tania provided insights of her experience as Head of STI in India for European Union. She highlighted the various possibilities of engagement with India in STI. She called for the need of more dynamism in Indian Universities in terms of building linkages with industry and global knowledge centers, etc.

Venue and Date: JNU Convention Centre, 5th November, 2018

The first session of the day titled "STS and Innovation Studies: Incompatibilities and Meeting Points" was moderated by Prajit K Basu of University of Hyderabad, while discussants in the session included Madhav Govind (CSSP, JNU), Mathei Quet (CSSP, JNU; CNRS, France) and Aviram Sharma (Nalanda University). In the session, the panelists discussed various theoretical frameworks for looking at the debates of sustainability from the perspectives of the Global South. The panelists also highlighted, for example, how climate action debates consider narrations of the grassroots social movements related to global warming and climate change. The agenda-setting in the Global South, by the democratic governments, are supposed to be carried out in consultation with the civil societies and other ground-level stakeholders. However, these are not always the case in the developing countries such as India. Here STS scholars have greater responsibility in identifying the research gaps and get involved in the public consultation processes.

The second session of the day titled "Technology and Innovation in Development Policy: Researchable Issues" was moderated by Mammo Muchie (the Tshwane University of Technology in South Africa), while discussants in the session included Thomas Thurner (South Africa), and Dinesh Abrol (ISID, New Delhi). In the session, the panelists discussed the developmental perspectives of Science, Technology, and Innovation (STI) with suitable agenda within the framework of the SDGs. The SDGs require certain targets to be achieved with interventions of STI. However, we need to look for low-cost solutions for the affordability of the masses, and availability of lower budgetary resources in the Global South.

The third session of the day titled "Intellectual Property Rights: Situating the debate in the context of innovation, sustainability and development" was moderated by Sujit Bhattacharya (CSIR-NISTADS), while discussants in the session included Reeta Sony (CSSP, JNU), Hemant Kumar (Central University of Gujarat) and Sambit Mallick (IIT Guwahati). Hemant Kumar highlighted the plights of grassroots innovators while ensuring the protection of Intellectual Property and commercialization of developed frugal innovations. Similarly, other panelists also cited the instances when private sector enterprises are taking interests in frugal innovations. Grassroots innovators and other young innovators can take this collaborative pathway for the solutions at the local and national level. The panelists also highlighted developing research perspectives in the current scenario, while IP protection is being contested in the open innovation platforms.

The fourth session of the day titled "Drawing lessons from the training programme: researchable issues for scholars of innovation studies, STS and science policy" was moderated by Saradindu Bhaduri (CSSP, JNU), while discussants in the session included workshop participants and the resource persons. The participants highlighted how they got benefitted while being involved as discussants or rapporteurs in the IndiaLICS Conference sessions. The doctoral students attending this training workshop have also highlighted how they can integrate their learning experience from this event while the formulation of the theoretical framework and research methodology in their doctoral studies.

The final session of the day was dedicated as the Third Annual Memorial Christopher Freeman Lecture, jointly organized by the research students of CSSP in association with the 4th IndiaLICS Conference and Training Workshop 2017.

The Third Annual Memorial Christopher Freeman Lecture on "Evolution from the Economics of Innovation to Economic Development"

This special lecture was delivered by Professor Smita Srinivas, who is the Founder Director of the research platform the Technological Change Lab (TCLab) and currently an Honorary Professor at the Indian Council for Research on International Economic Relations (ICRIER). Chair of the Session, Professor Prajit K. Basu of the University of Hyderabad, introduced the speaker and briefly discussed the thematic area of the Lecture.

The 3rd Christopher Freeman Lecture was built on Professor Christopher Freeman's immense legacy and considered how best to take the insights of evolutionary perspectives into the domain of economic development, one of Freeman's core concerns. The talk began with the idea of institutional variety in both evolutionary economics and a more traditional development political economy. The remainder of the talk delved deeper into what an evolutionary perspective leaves unfinished, which translate into difficult theoretical and empirical extensions to policy domains in late industrializers. Specifically, by looking at the "V" on variation and institutional variety in the VSR framework, the talk suggested ways to better frame industry analysis with examples from the health industry that enhance and advance beyond class-based perspectives.

Prof Smita Srinivas delivering the 3rd Annual Memorial Christopher Freeman Lecture

The talk concluded by discussing variety in the evolutionary economics context and its planning process and policy design implications. The materials for the Lecture were drawn on and elaborated on the arguments in Srinivas's book "Market Menagerie: Health and Development in Late Industrial States" (Stanford University Press, 2012).

In the talk, Srinivas further elaborated her research interests in the institutional explanations and plans for economic transformation and governance. Her recent work has analyzed gaps and tensions between the institutional and behavioral assumptions of evolutionary economics with those of 'late' industrial political economy and development economics. Her wider research interests include comparative development data, social policy, skills, moral philosophy and value preferences in economics and governance. She elaborated her experience in higher education reform initiatives in economics and policy-focused professional schools in the US, India, and East Africa. Srinivas has strong interests in problem-framing and –solving and the use of heuristics in economic theory in realistic development plans and policy design. She further discussed how her institution the Technological Change Lab (TCLab), which founded, deploys three-way research focuses on economic theory, policy design, and realistic development plans. Much of economic development has tended to exclude one or more of these elements.

The Lecture attracted the enthusiastic commentaries from the learned audience. Prof. Mammo Muchie of the Tshwane University of Technology in South Africa elaborated how personally and academically he benefitted from Christopher Freeman, as his doctoral supervisor and his

academic mentor. He highlighted the role of Christopher Freeman in the formation of the Globelics – a Global Research Network for Scholars of Innovation Studies.

There were other discussants such as Sujit Bhattacharya of CSIR-NISTADS and Rajeswari, Shiv Nadar University. The participants of IndiaLICS Training Workshop also interacted with the speaker in this session to broaden their research perspectives and research agendas.

The 3rd Christopher Freeman Lecture concluded with vote of thanks by Saradindu Bhaduri, Chairperson, and CSSP. He thanked the participants and resource persons for the successful conclusion of the IndiaLICS Training Workshop 2017, which was jointly organized by CSSP, Jawaharlal Nehru University, and CSIR-NISTADS.

Conference Report

The Fourth IndiaLICS International Conference 2017

Innovation for Sustainable Development: Perspectives, Policies and Practices in South Asia

2nd to 4th November 2017

Organized by:

Centre for Studies in Science Policy, JNU

RIS and CSIR-NISTADS

Venue: India Habitat Center and Convention Center, JNU, New Delhi

IndiaLICS 2017 is supported by:

Programme Schedule

Day 1: Thursday, 2nd November, 2017 **Registration and Tea** **Venue: Convention Centre, JNU**	**8:30–9: 00**
Inaugural Session: **Chair: K.J. Joseph (**President Globelics; Centre for Development Studies, Thiruvananthapuram) **About IndiaLICS:** Lakhwinder Singh **(**Coordinator, IndiaLICS) **About IndiaLICS 2017:** Saradindu Bhaduri; Sujit Bhattacharya **Welcome Remarks:** M. Jagadesh Kumar (Vice-Chancellor, JNU) **Special Remarks**: – P. Goswami (Director CSIR-NISTADS) – S. Chaturvedi (Director General RIS)	**9:00 – 10:30**

Inaugural Address: – **Mammo Muchie (Tshwane University of Technology in Pretoria, South Africa)** | Developing a shared understanding of 'innovation research' across continents: the mandates and the experiences of GLOBELICS – **Vote of Thanks:** Anup Kumar Das	**9:50 – 10:20**
Plenary Session **Chair: D.K. Ghosh (Former Vice President and Board Member, Siemens, India)** **Plenary Talk:** – **Amit S Ray, JNU | Channels of Knowledge Transfer from Universities: Does One Size Fit All?**	**10:30– 11:20**
Session 2: Innovation in the Informal Economy **Chair : D. Sengupta (CSIR)** **Invited speaker:** – **Rajul Joshi (University of Technology Sydney, Australia) |** Phenomenological Approach for Innovation Research **Paper presenters:** i. Possible Determinants of Grassroots Innovations | Sazzad Parwez (Indian Institute of Health Management Research, Jaipur) **Discussant:** Sohan Prasad Sha **Rapporteur:** Maneesh Dubey	**11: 30-12:45**
Lunch and proceedings of the Conference at India Habitat Centre. **Bus Pick-up at Convention Center at 12:45** **Conference Venue: Silver Oak, India Habitat Centre**	**12:15 - 14:45**
Session 3: Responsible Research and Innovation **Venue: Silver Oak, Indian Habitat Centre** **Chair : Sachin Chaturvedi (RIS)** **Invited Speaker:** – **Robert Braun** (Institute for Advanced Studies, Austria) | The Concept and Application of Responsible Research and Innovation in India and Europe – **Hossein Sheykh Rezaee (NRISP, Iran) |** Feyerabend on Ethics of STI **Paper Presenters:** i. Responsible Research and Innovation (RRI) in Indian Contexts | Amit Kumar (RIS, New Delhi) ii. Role of Open Science in Addressing Responsible Research and Innovation (RRI) | Bidyarthi Dutta (Vidyasagar University, W.B.) and Anup Kumar Das (CSSP, JNU) **Discussant:** K.J Joseph **Rapporteur:** Priti	**14:45-16:30**
Walk in Tea Break	**16:30-17:30**
Session 4A: Indicators for Science, Technology and Innovation **Venue: Silver Oak, Indian Habitat Centre** **Chair: Parveen Arora (DST, Government of India)**	**16:30-18:00**

Invited Speaker – **Pradosh Nath (Centre for Knowledge, Ideas and Development Studies(KnIDS))**| Findings from the Indian Innovation Survey: Understanding Disconnect in Indian NSI – **Prabir G. Dastidar (MoES) |** An Investigation into Social Biology of Penguins of Antarctica **Paper presenters:** i. Who Spends More on Innovation in India? Public versus Private Sector Enterprises and the Effect of External Borrowing | Ritika Jain (CDS, Thiruvananthapuram) ii. Social Network Analysis of Indian Research Cooperation with France and Germany in Water Sciences | Shilpa & Sujit Bhattacharya (CSIR-National Institute of Science Technology and Development Studies) **Discussant:** Amitkumar Singh Akoijam **Rapporteur:** Rajiv Kumar	
Session 4B: Indicators for Science, Technology and Innovation **Venue: Casuarina, Indian Habitat Centre** **Chair: Sujit Bhattacharya (CSIR-NISTADS)** **Invited Speaker** – **Sonu Verma** and O.P. Wali **(IIFT, New Delhi) |** Emerging and Contemporary R&D and Innovation indicators in National S&T System and Policy Implications: Key Findings **Paper presenters:** i. Trends in Informal Sector Innovations Research: A Scientometric Analysis of Publications Across the Globe | Hemant Kumar (Centre for Studies and Research in Science, Technology and Innovation Policy, Central University of Gujarat, Gandhinagar) ii. Social and Technological Indicators of Innovation in Small Scale Industries: A Comparative Analysis | Deepmala Baghel (National Law University Nagpur) **Discussant:** Yogesh Suman and Antara Chakraborty **Rapporteur:** Sadhna Sahu	**16:30 – 18:00**
Special Session: Screening of Documentary Films on Sustainable Development **Venue: JNU Convention Centre, JNU** – **Small millets: For Better Nutrition and Income (22")** – **Agro Biodiversity: From Despair to Hope (18")** **Discussant:** Dinesh Lakhanpal **Rapporteur:** Debashree Roy	**19:00 – 20:00**
Interactive Dinner **Venue: JNU Cafeteria**	**20:00 -**
End of day 1 programme	
Day 2: 3rd November, 2017 **Plenary Session** **Venue: Silver Oak, Indian Habitat Centre** **Chair: Rakesh Basant, IIM Ahmedabad** **Plenary Talk:** – **Peter Knorringa (ISS/Erasmus University, The Netherlands) | India and the Contested Relevance of Global Value Chains and Private Standards for Frugal Innovation**	**9:00 -10:00**
Session 5A: Global Value Chains and Innovation Systems **Venue: Silver Oak, Indian Habitat Centre**	**10:00 -11:30**

Chair : Keshab Das (GIDR, Gujarat) **Invited Speaker:** – **Mammo Muchie (Tshwane University of Technology in Pretoria, South Africa)** **Paper presenters:** i. Exploring the Role of Enterprises in Nepal Innovation System: Drawing Selectively the Lessons from East Asia | Sohan Prasad Sha (Martin Chautari, and Presidential Business School, Kathmandu) ii. A Review of R&D and Sectoral Incentives in Manufacturing in Industrialised and Emerging Economies: Lessons for 'Make in India'| Sabyasacchi Saha(RIS, New Delhi) **Discussant:** Anwesha Borthakur **Rapporteur:** Umang Gupta	
Session 5B: Global Value Chains and Innovation Systems **Venue: Magnolia, Indian Habitat Centre** **Chair: Debapriya Dutta (DST, Government of India)** **Invited Speaker:** – **Saon Ray (ICRIER) |** Global Value Chains and Innovation Systems – The Role of the Lead Firms **Paper presenters:** i. Diffusion of Innovations: A Case for Audience Capability| Uma Shankar Pandey (SNCW, University of Calcutta, W.B.) ii. Mainstreaming Collaborative Consumption Systems: Role of Values Across Varying Group-Contexts | Sahil Patni (TERI University, New Delhi) **Discussant:** Nimita Pandey **Rapporteur:** Vandana Verma	**10:00-11:30**
Interactive Tea Break	**11:30-11:45**
Session 6A: Climate Change, Adoption, Mitigation and Resilience **Venue: Silver Oak, Indian Habitat Centre** **Chair: Ram Boojh (UNESCO, New Delhi)** **Paper presenters:** i. Diffusion of Climate Smart Technologies in Agrarian South Bihar, India: A Case of Solar Based Water Pumps | Aviram Sharma (Nalanda University, Bihar) ii. Green Entrepreneurship in the Renewable Energy Sector - A Case Study of Gujarat | Stuti Haldar (Central University of Gujarat) iii. Efficient Energy Consumption and Sustainable Development: A Footstep Towards Global Change | Anushtha Srivastava & Aastha Ananya (College of Legal Studies, University of Petroleum and Energy Studies, Dehradun) iv. Research Education in India: Challenges for Innovation and Sustainable Development | Rajeev B (University of Kerala) v. Innovations, Linkages and Knowledge Production in Indian Renewable Energy Sector: A Comparative Study of Solar and Wind Energy | Amit Kumar Singh Akoijam (CSSP, Jawaharlal Nehru University, New Delhi) **Discussant:** Sandhya Wakdikar and Rujita Shenoy **Rapporteur:** Rashmi Kulranjan	**11:45-13.30**
Session 6B: Gender Technology and Innovation **Venue: Magnolia, Indian Habitat Centre** **Chair: Tabassum Jamal (CSIR-NISTADS, New Delhi)**	**11:45-13.30**

Invited Speakers: – **Akram Ghadimi (NRISP, Iran) |** Innovation: The New Realm of Women's Activities in Iran **Paper presenters:** i. Challenges Faced by Women in Entering into the Area of Innovation with an Emphasis on Traditional Societies | Maryam Ghadimi (NRISP, Iran) ii. Changing Gender Patterns of the Informal Economy of 'Muga' Weaving Industry of Assam | Antara Chakrabarty (Jawaharlal Nehru University, New Delhi) iii. Scientific Temper, Skill Development and Innovation in Select Industrial Training Institutes (ITI) in India: A Gender based Perspective| Subhash Kumar (Jawaharlal Nehru University, New Delhi) **Discussant:** Nimita Pandey **Rapporteur:** George Paily	
Lunch	**13.30-14:15**
Session 7A: Innovation in Healthcare and Pharmaceuticals **Venue: Silver Oak, Indian Habitat Centre** **Chair: Ravi Srinivas (RIS)** **Invited Speaker:** – **Girish Kumar (Director, BIIC, Mahatma Gandhi University, Kottayam, Kerala) |** Innovation Divide in Access to Health Technology: A Case Study of Cancer Medication in India **Paper presenters:** i. Molecular Diagnostics Innovation System Development in India: Role of Indian Science Base | Nidhi Singh (CSSP, Jawaharlal Nehru University, New Delhi) ii. Innovation in Healthcare and Pharmaceuticals: A Boon or a Bane | Aditi Chopra (Amity Law School, Delhi) **Discussant:** Mathieu Quet **Rapporteur:** Navtika	**14:15-16:00**
Session 7B: Innovation in Healthcare and Pharmaceuticals **Venue: Magnolia, Indian Habitat Centre** **Chair: Ritu Priya (Centre of Social Medicine and Community Health, JNU)** **Invited Speaker:** – **Dinesh Abrol (ISID, New Delhi) |** Indian Pharmaceutical Industry's Trajectory Post 2000: Developing or Hollowing out? **Paper presenters:** i. Breast Cancer Management in India: Examining Deficiencies in R&D, Policy and Diagnosis Measures | Priyanka Kumari (Central University of Gujarat) ii. Impact of Rural Sanitation on Water Quality and Water Borne Diseases | Sunil Goyal (Department of PG Studies and Research in Sociology and Social Work, Government College, Anjad, District Barwani, Madhya Pradesh) **Discussant:** Rahul Mane **Rapporteur:** Abhinav Jha	**14:15-16:00**
Interactive Tea	**16:00-16:15**
Session 8A: Sanitation and Waste Management **Venue: Silver Oak, Indian Habitat Centre**	**16:15-17:45**

Chair : Madhav Govind (CSSP, Jawaharlal Nehru University, New Delhi) **Invited speaker:** – **Keshab Das (GIDR, Gujarat) |** Scaling Up Sanitation in Indian Villages: Innovation Challenges **Paper presenters:** I. Emergence of Bioremediation Based Waste Water Treatment: An Intervention through Eco-Innovation | Jyoti (CSSP, Jawaharlal Nehru University, New Delhi) II. Sustainable Disposal of the Dead: The Case of New Cremation Technologies in India | Vishwambhar Nath Prajapati (CSSP, Jawaharlal Nehru University, New Delhi) III. Status of Urban Solid Waste Management in Delhi and Imphal | Mirinchonme Mahongnao and Madhav Govind (CSSP, Jawaharlal Nehru University, New Delhi) **Discussant:** Kasturi Mandal **Rapporteur:** Anjali C. Lakum	
Session 8B: Sanitation and Waste Management **Venue: Magnolia, Indian Habitat Centre** **Chair : K J Joseph (Centre for Development Studies, Thiruvananthapuram)** **Paper presenters:** i. Waste an Opportunity: Innovative Methods For Tapping The Potential in Municipal Solid Waste Across Indian Metro Cities | C Babu Gurucharan S H (Retd) & Priyanka Kaushal (Teri University, New Delhi) ii. Environmental Impacts of Waste Management and Sanitation Deficiencies and Health Issues: A Imperial Study in The City of Delhi | Atul Ratna & Sumit Kumar Mishra (Central University of South Bihar) iii. A Priority Based Growth of South Asia for Sustainability in Relation with Hygiene & Sanitation | Partha Sarathi Sarkar (Ramakrishna Mission Vivekananda University, West Bengal) iv. Electronic Waste Management Practices in Urban India: A Study from STS Perspective | Anwesha Borthakur & Madhav Govind (CSSP, Jawaharlal Nehru University, New Delhi) **Discussant: Anwesha Borthakur** **Rapporteur:** K Chandra Shekar	**16:15-17:45**
End of day 2 programme	
Day 3: Saturday, 4th November, 2017 **Session 9: Session in Honour of Ashok Parthasarathi** **Venue: Silver Oak, Indian Habitat Centre** **Chair: Sachin Chaturvedi** **Special lecture:** – **Ashok Parthasarthi** (Retired Professor, Center for Studies in Science Policy, JNU) **|** **Down the Memory Lane: Recalling India's Nation Building Exercise**. **Comments and Observations:** Dinesh Abrol, KJ Joseph, Saradindu Bhaduri **Rapporteur:** Anwesha Borthakur	**9:00-10:00**

Session 10A: Innovation in the Informal Economy **Venue: Silver Oak, Indian Habitat Centre** **Chair : Peter Knorringa** (ISS/Erasmus University, The Netherlands) **Invited speaker:** – **Thomas Thurner (University of Cape Town, South Africa) |** Communities of Practice in Emerging Markets: Finding Ways to Identify Innovative Capacities and Means to Unleash Their Innovative Power **Paper presenters:** i. Informal Sector Innovations and Formal-Informal Economy Linkages: Exploring Interaction at Knowledge, Resources and Institution Level | Birendra Singh (CSSP, Jawaharlal Nehru University, New Delhi) ii. Role of Design in the Social Shaping of Grassroots Innovations | Gautam Sharma (Central University of Gujarat) iii. Role of Mass Media in Adoption and Diffusion of Agricultural Innovations: A Comparative Study of Print and Online Media used by Farmers in Western Maharashtra | Rahul Mane (Member of Bhavtal magazine on Science and Environment, Pune) **Discussant:** Aditi Chopra **Rapporteur:** Sheeraz Alie	**10:00-11:30**
Session 10B: Innovation in the Informal Economy **Venue: Magnolia, Indian Habitat Centre** **Chair: Hemant Kumar, Central University of Gujarat** **Paper presenters:** **i.** "Shodh Yatra" and Communication of Innovations in Informal Settings: An Empirical Study of Grassroots Innovation in India | Rachan Daimary (CSRSTIP, Central University of Gujarat) ii. Exploring Diffusion of Grassroots Innovations in Gujarat | Anjali C. Lakum (Central University of Gujarat, Gandhinagar) iii. Interaction of Small Growers with Formal and Informal Institutional Arrangements: Case of Dissemination of Knowledge in Tea and Natural Rubber | Namrata Thapa (CDS, Thiruvananthapuram) **Discussants:** Naresh Kumar and Abhinav Jha **Rapporteur:** Anurag Kanaujia	**10:00-11:30**
Interactive Tea (Walk in)	
Session 11A: Innovation for Sustainable Agriculture **Venue: Silver Oak, Indian Habitat Centre** **Chair : Pranav N. Desai (CSSP, Jawaharlal Nehru University, New Delhi)** **Invited Speakers:** – **K J Joseph (Centre for Development Studies, Thiruvananthapuram)**| Interrogating Innovation System from a Small Farmers' Perspective: India and China) **Paper presenters:** i. Sustainable Agriculture in Rainfed Area of West Bengal Through Hapa Irrigation System | Amartya Pani (Indian Institute of Technology Kharagpur) ii. Scientific Knowledge and Science Policy: Technological Shift in Agriculture Sector | Diwakar Kumar (Central University of Gujarat)	**11:30-13:30**

iii. Sustainability in Crop Research and Agricultural Models: Promoting Reliance On Neglected and Underutilized Species | Abhinav Jha (Central University of Gujarat) **Discussants:** Mohammed Rais and Ritika Jain **Rapporteur:** Rajni Gupta	
Session 11B: Innovation for Sustainable Agriculture **Venue: Magnolia, Indian Habitat Centre** **Chair: Piyush Verma (LM Thapar School of Management)** **Invited Speaker:** – **Tawheed Reza Noor (**Dhaka School of Economics, University of Dhaka, Bangladesh) **|** Seed Systems and Seed Security of Rice Plantation under the Light of Seed Security Framework: A Case Study from Stress-Prone Eastern Nepal) **Paper presenters:** i. Right to Food in Bangladesh: Experience from Urban Poor | Sonia Sultana Ashrafee (Unnayan Bhabna, Bangladesh) ii. Agricultural Innovation System and Sustainability: A Case of Horticulture Sector of Kashmir Valley, India | Sheeraz Ahmad Alaie (Central University of Gujarat) iii. Role of Space Technologies in Wetland Mapping | Ramnath Reghundhan (School of International Relations & Politics, Mahatma Gandhi University, Kottayam, Kerala) iv. The GM Crop Debate in India: Identification of Stakeholders and Regional Variations in their Interests | Anurag Kanujia & Sujit Bhattacharya (CSIR-NISTADS &AcSIR) **Discussants:** Deepmala Baghel and Navtika **Rapporteur:** Rachan Daimary	**11:30-13:30**
Lunch	**13:30-14:15**
Session 12A: IPR, Standards and Regulation in Science, Technology and Innovation **Venue: Silver Oak, Indian Habitat Centre** **Chair: Reeta Sony (CSSP, JNU)** **Invited Speaker:** – **Sambit Mallick (Indian Institute of Technology Guwahati) |** The Intellectual Property Rights Regime: Changing Practices in Agricultural Biotechnology in India **Paper presenters:** i. Developing an Effective IPR Policy| Umang Gupta & Sujit Bhattacharya (CSIR-NISTADS &AcSIR) ii. Critical Analysis of Trade Secret Protection in India | Ajoy Jose (LLM, IIT Kharagpur) iii. Formal Standards, Tacit Adoption: Study in Aligarh Padlock Industry | Shekhar Jain (CSSP, Jawaharlal Nehru University, New Delhi) iv. National Intellectual Property Rights Policy 2016: Can It Provide New Opportunities for Research, Innovation and Development? | Umang Gupta & Sujit Bhattacharya (CSIR-NISTADS & AcSIR) **Discussant:** Reeta Sony **Rapporteur:** Stuti Haldar	**14:15-15:45**
Session 12B: IPR, Standards and Regulation in Science, Technology and Innovation **Venue: Magnolia, Indian Habitat Centre** **Chair: Aviram Sharma** (Nalanda University, Bihar) **Paper Presenters**:	**14:15–15:45**

i. What is the Reality Today for 20% Ethanol Blending Program? | Sujata (Teri University, New Delhi) ii. The Governance of one Technology for Civilian Applications in India: An Analysis Under the DGCA Regulatory Regime | Mohd Owais Farooqui (NALSAR University of Law, Hyderabad) iii. Reinforcement of Legal Infrastructure in Context to Modern Regime of Socio-Economic, Innovation and Invention Under Patent Laws | Tilottma Pandey (Manipal University Jaipur and Gujrat National Law University) iv. Innovation in Biotechnology: Role of Patents in Biosimilar Drug Development and Public Interest | Rujitha Shenoy (IUCIPRS, CUSAT, Kerala) v. The Governance of Drone Technology for Civilian Applications in India: An Analysis Under the DGCA Regulatory Regime | Mohd Owais Farooqui (NALSAR University of Law, Hyderabad) **Discussant: Ashish Gosain** **Rapporteur:** Anurag Kanaujia	
Interactive Tea	**15:45 – 16:00**
Session 13: Panel Discussion on Communicating Science Technology and Innovation for Sustainable Development: (Co-organized with Vigyan Prasar, DST) **Venue: Silver Oak, Indian Habitat Centre** **Chair: Prajit Basu (University of Hyderabad)** **Panelists:** – Gita Bamezai (Indian Institute of Mass Communication, New Delhi) – Smita Srinivas (TCLab) – Uma Shankar Pandey (SNCW, University of Calcutta, W.B.) – Manoj Kumar Patel (CSIR- CSIO, Chandigarh) – Sambit Mallick (Indian Institute of Technology Guwahati) – Aviram Sharma (Nalanda University, Bihar) – Mathieu Quet (CSSP, JNU and IRD France) **Comments and observations:** – Sohan Prasad Sha (Martin Chautari, and Presidential Business School, Kathmandu) – Girish Kumar (BIIC, Mahatma Gandhi University, Kottayam, Kerala) – Archita Bhatta (Vigyan Prasar) **Vote of Thanks :** Saradindu Bhaduri **Rapporteur :** Archana Poonia	**16:00 – 18:00**
Dinner **Venue : Faculty Center, JNU**	**19:30 –**

Inaugural Session

The Fourth IndiaLICS International Conference 2017 was convened at two different venues in the city of New Delhi. The inaugural session was convened at JNU Convention Centre in the morning of 2nd November 2017. The session began with chair's remarks, where the chair K.J. Joseph (President Globelics; Centre for Development Studies, Thiruvananthapuram) introduced the academic network 'IndiaLICS" in general, and the IndiaLICS Conference in particular. Then Lakhwinder Singh (Coordinator, IndiaLICS) familiarized IndiaLICS activities and academic outreach programmes to the audiences. P. Goswami (Director of CSIR-NISTADS) and Sachin Chaturvedi (Director General of RIS) elaborated perspectives of their institutions as co-organizers of the event. In his welcome address, M. Jagadesh Kumar (Vice-Chancellor, JNU) illustrated the importance of innovation for sustainable development in a developing country like India, where a considerable number of populations is underprivileged, below the poverty line, and illiterate. Saradindu Bhaduri (CSSP JNU) and Sujit Bhattacharya (CSIR-NISTADS) presented their remarks as conveners of IndiaLICS Conference 2017. In his inaugural address titled "Developing a shared understanding of 'innovation research' across continents: the mandates and the experiences of GlobeLICS", Mammo Muchie (Tshwane University of Technology in Pretoria, South Africa) introduced how the global network GlobeLICS is represented across the regions and countries through a strong network of regional and national chapters, such as AsiaLICS and IndiaLICS.

The session also included a Plenary Talk, chaired by D.K. Ghosh (former Vice President and Board Member, Siemens, India). The plenary talk titled "Channels of Knowledge Transfer from Universities: Does One Size Fit All?" was presented by Amit S Ray of JNU. In the end, Anup Kumar Das (CSSP JNU) proposed the vote of thanks.

Session 2: Innovation in the Informal Economy

Session 2 began with chair's remarks, where the chair D. Sengupta (CSIR) elaborated the aspects of inclusive innovation happening or affecting the informal economy. In this session, invited speaker Rajul G. Joshi (University of Technology Sydney, Australia) delivered her presentation titled "Phenomenological Approach for Innovation Research." In this lecture, she highlighted the concept of the phenomenological approach to innovation research and looked the different perspective of research like ontology, epistemology, and methodology. Phenomenology is the qualitative and naturalistic approaches to understand human experience inductively and holistically. She also mentioned that phenomenology approach focuses on the experience of individuals. Phenomenology tradition allows the understanding of social reality entrenched in the innovation phenomenon. According to this approach, an observer can easily understand the idea of grassroots, frugal and informal innovation studies because the innovator and innovation phenomenon are tightly entwined with their existence.

In the session, a paper "Possible Determinants of Grassroots Innovations" was presented by Sazzad Parwez (Indian Institute of Health Management Research Jaipur). In the presentation, his focus was on possible determinants of grassroots innovations. In such paper, he gave major stress on history of grassroots innovation. The introduction of the now ubiquitous term 'grassroots innovation' by Prof Anil Gupta of IIM-Ahmedabad and the Honey Bee Network (HBN) formed by him was discussed. Through HBN it was envisioned to denote indigenous innovators form the informal sector by local people without any formal education or training. Efforts undertaken by HBN has led to the successful documentation of 1,75,000 grassroots innovations in India. The talk concluded by emphasizing how economic and social constraint force some of them to give up on further development or implementation of their innovations and thus there is need to encourage

others to prevail over the same obstacles through innovations or use of traditional knowledge needs to be understood.

Session 3: Responsible Research and Innovation

Session 3 began with chair's remarks, where Chair Sachin Chaturvedi (Director General, RIS) elaborated the concepts of responsible research and innovation (RRI) in the contemporary research landscape across the world. In this session, invited speaker Robert Braun (Institute for Advanced Studies, Austria) delivered his presentation titled "The Concept and Application of Responsible Research and Innovation in India and Europe". Responsible research and innovation is a key action of the science with and for society. Research issue is different from region to region; sometimes national priority, global and continental approaches are different; how RRI action promotes access and equity via science-technology index interlinkages with socioeconomic and basic need index. Responsible Research and Innovation is set to become an important cross-cutting theme for the EC Horizon 2020 programme. The definition of research and innovation state maps happy life and keeps adhere to basic values. Research and innovation always need to be open to the world. RRI based on six key dimension gender, equity, access, governance, societal engagement. Dr. Braun further emphasized that responsible research and innovation means all the stakeholders are the part of innovation that is for stakeholder, by stakeholder, and of stakeholder.

Hossein Sheykh Rezaee (NRISP, Iran), titled "Ethics of Innovation, Ethics of Technology", conceptualized his talk on Feyerabend works on Ethics in STI. He opines that ethical approach respects fundamental rights and the highest ethical standard to ensure societal relevance and to accept research and innovation. He then elaborated ethical approaches in research subjects.

In his presentation titled "Responsible Research and Innovation (RRI) in Indian Contexts", Amit Kumar (RIS, New Delhi) elaborated RRI approaches and practices in Indian S&T institutions. Stressed that RRI rests on responsibility toward whom or what. Public engagement is a key of RRI. Access, inclusion, and equity should be focused on any research issue. He also focused on science policy framework, which should be based on Access, Equity and Inclusion (AIE), S&T indicators, and socio-economic index. He opines that the indicators of STI are important for determining of socio-economic contexts of responsible research.

Anup Kumar Das, in his presentation titled "Role of Open Science in Addressing Responsible Research and Innovation (RRI)", the importance of open access is felt across the scientific communities. In the Indian context, open science would allow more scientific cooperation and collaborations across disciplines, including the interdisciplinary research. The open access movement facilitates the scientific communities in accelerating their quests for better research with effective collaboration, institutional cooperation, skills enrichment, and exchange of knowledge. The paper was jointly authored by Anup Kumar Das and Bidyarthi Dutta (Vidyasagar University, West Bengal).

In the end, K.J Joseph (Centre for Development Studies, Thiruvananthapuram) facilitated the questions and interactive comments from the audiences. Then he summarized the speakers' deliberations.

Session 4A: Indicators for Science, Technology and Innovation

Session 4A began with chair's remarks, where chair Praveen Arora (DST, Government of India) elaborated concepts and applications of STI indicators in sustainable development. All the presenters in this particular session deliberate key indicators with regards to the Science, Technology, and Innovation perspectives. The first presenter, Pradosh Nath in his presentation titled "Findings from the Indian Innovation Survey: Understanding Disconnect in Indian NSI" discussed the findings from Indian Innovation survey and how the disconnect with Indian NSI. He highlights the status of innovation in different industrial sectors in the country with its weaknesses and areas requiring institutional interventions. The second invited speaker, Prabir G. Dastidar in his presentation talked about citation networks as indicators for policy formation with regards to some relevant case studies on monsoon research and exploration in the area of ozone holes in Antarctica region. Both the speakers pointed out certain appearances of innovation dynamism from the perspectives of the developing countries like India.

In the case of paper presentations, Ritika Jain's (CDS, Thiruvananthapuram) paper "Who Spends More on Innovation in India? Public versus Private Sector Enterprises and the Effect of External Borrowing" talked about the financing innovation spending in India by comparing public sector enterprise and private sector enterprise. The paper identifies the differences between public sector enterprises (also refer to state-owned enterprises) and private sector enterprises with a good explanation. By focusing on the difference of innovation spending in these sectors with the help of data available on National Stock Exchange of India, the paper attempted to find out public ownership impact on research and development (R&D) expenditure in the country. Her findings are the public sectors spend more on R&D than the private one. At the same time, she has argued that external borrowing acts as a strong and strict tool to increase innovation spending for private firms' more than the public one.

Shilpa presented the joint paper with Sujit Bhattacharya on "Social Network Analysis of Indian Research Cooperation with France and Germany in Water Sciences". The paper underscored the structural and functional characteristics of two networks i.e. Indo-French and Indo-Germany that have developed in the field of water sciences. The research showed the distinct basic structures which differentiate these two networks: (a) Indo-French network influenced by development of two bilateral laboratories, for instance, Indo-French Center for Ground Water Research (IFCGR) and Indo-French Cell for Water Sciences (IFCWS), (b) Indo-German network through dedicated programmes and support of the German research bodies such as Indo-German Science and Technology Center. Elaborating further, the talk highlighted interactions through inter-personal networks playing a key role in development of the networks. The paper concluded by highlighting the role of institutions and usefulness of social network analysis to capture the interactions between the actors, a better understanding of how knowledge is developed and diffused; why and how specific changes occur in the social system.

Session 4B: Indicators for Science, Technology and Innovation

Session 4B began with chair's remarks, where chair Sujit Bhattacharya (CSIR-NISTADS) introduced different STI indicators for sustainable development. All the presenters in this particular session deliberate key indicators with regards to the Science, Technology, and Innovation perspectives. The first presenter, Sonu Verma (IIFT, New Delhi with Om Prakash Wali) in her presentation titled "Contemporary and Evolving R&D and Innovation Indicators Framework in S&T: A sector-specific approach in Indian Context" discussed the findings from DST-funded study with a key objective to develop R&D and innovation indicators framework in science and technology for Indian context in global environment (for private, sectoral R&D and innovation

activities).This paper had specific reference to Indian automotive sector and how they are evolving with sectoral innovation system. She concluded the presentation with following observations: Multiple roles indicators play from time to time like informed policymaking, for evaluation, for strategic positioning, for foresight and visibility of work; the process has been found to be evolving and iterative, with respect to the rubrics development for R&D evaluation in this context; Technology is fast evolving, and this mandates the monitoring of this dynamic indicators framework set which will have new emerging indicators along with the contemporary set.

The second presenter, Hemant Kumar (Central University of Gujarat) in his presentation titled "Trends in Informal Sector Innovations Research: A Scientometric Analysis of Publications across the globe," described his attempt to study informal sector innovations using scientometric methods. He observed, scholars across the world are using many keywords to describe research in innovations in informal sector, namely, grassroots innovation, jugaad innovation, frugal innovation, informal sector innovation, inclusive innovation, green innovation, and some local terms, such as Jua Kali (Kenya), Gambieara (Brazil), System D (France), Do It Yourself (D-I-Y) (USA), and folklore innovation or Zizhu Chuangxin (China).

The third presenter, Deepmala Baghel (National Law University Nagpur) in her presentation titled "Exploring Social and Technical Indicators of Innovation in Small Scale Industries", elaborated how innovations emerge from a certain background in society have impact on social entities, i.e. institutions, organisations, social groupings and individuals in their various roles in family, business, civil society and the public. Her study assumed that 'innovation is not just a technical and economic problem,' but a social process enmeshed in social practices. She further identified a set of indicators covering technical and social aspects of innovation.

Special Session: Screening of Documentary Films on Sustainable Development

In the evening of 2nd November, two documentary films namely "Small Millets: For Better Nutrition and Income" and "Agro Biodiversity: From Despair to Hope" were screened and discussed by the noted filmmaker Dinesh Lakhanpal. The documentary films, made in association with MS Swaminathan Research Foundation (MSSRF), thematically covered the food security and sustainable agriculture. Mr. Lakhanpal was also available throughout the conference for interacting with the researchers.

Plenary Session on 3rd November 2017

In the morning of 3rd November, a plenary talk by Peter Knorringa (ISS/Erasmus University, The Netherlands), chaired by Rakesh Basant (IIM Ahmedabad) was organized. The plenary talk titled "India and the Contested Relevance of Global Value Chains and Private Standards for Frugal Innovation". The talk challenged the established understanding of global value chains. Applying stylized figures and indicators, the talk underscored the need for developing the construct frugal innovation.

Session 5A: Global Value Chains and Innovation Systems

Session 5A began with chair's remarks, where chair Keshab Das (GIDR, Gujarat) elaborated concepts of global value chains and their linkages with the national innovation systems (NIS). This session included an invited talk by Mammo Muchie (Tshwane University of Technology, South Africa) on globalization and transition in the system of innovation in South Africa. Other two

papers presented in this session include "Exploring the Role of Enterprises in Nepal Innovation System: Drawing Selectively the Lessons from East Asia" by Sohan Prasad Sha (Martin Chautari, Nepal); and "A Review of R&D and Sectoral Incentives in Manufacturing in Industrialised and Emerging Economies: Lessons for Make in India" by Sabyasachi Saha (with Sachin Chaturvedi & Prativa Shaw of RIS).

In his presentation Sohan Prasad Sha discussed that every country has kinds of 'production system,' and the transition towards 'national system of knowledge creation and learning' (Lundvall & Maskell, 2000) has to happen to make a stronger NIS. He identified three implications in policy relevance, namely: (i) the studying of failures (market, strategic or government) usually characterized LDCs like Nepal but the drawing from experiences of other nations may free the policy imaginations to look forward; (ii) the strategies of late industrializers have been uniquely different which suggest that lagging behind is not a destiny for Nepal but it can be changed if provided with an enabling environment to establish science, technology and innovation (STI) system; and (iii) the lessons from South Korea, Singapore and Thailand emphasized that the manufacturing activities as a primary condition towards NIS. He then argued that Nepal is not landlocked but the policy locked.

Session 5B: Global Value Chains and Innovation Systems

Session 5B began with chair's remarks, where chair Devapriya Dutta (DST, Government of India) elaborated concepts of global value chains and their applications in innovation systems.

Invited speaker Saon Ray in her presentation titled "Global Value Chains and Innovation Systems: The Role of the Lead Firms" set the tone of the session. The session reflected on a various micro as well as macro aspects of GVCs and Innovation systems. It had an interesting discussion on the role of lead firms in catching-up, upgrading into the Global Value Chains. Also, the session revolved around various behavorial, psycho-social aspects of collaborations in a shared economy, pertaining to collaborations and networking, for innovation. There was a range of research work presented in the session. The first paper contended that Traditional diffusion theories have considered strategies and conditions under which innovation is communicated to the stakeholders. They generally analyze the spread of new technology or ideas to all (or almost all) members of a social system. However advances in the field of cognitive and motivated reasoning suggest that audiences react differently to innovative information based on their individual goals, which may include accuracy goals and defensive goals. Hence any approach to diffusion of innovation must account for individual preferences. It proposed a Capability Approach to account for these preferences. A fundamental innovation of the capability approach is its emphasis on the individual. It contends that a just and fair society should concern itself with expanding people's capabilities – their freedom to uphold or attain 'functionings' which they consider vital.

The second paper was presented by Sahil Patni (TERI University, New Delhi) on Mainstreaming Collaborative Consumption Systems: Role of Values Across Varying Group-Contexts | SahilPatni (TERI University, New Delhi). The paper explored value-shifts in the dimension of human agency by studying how engagement in collaborative consumption practices (CCP) contrasts between family and non-family exchanges. Using 'borrowing' as one of the CCP that most closely relates to LoT, the Study evaluated acceptance of the practice amongst in-groups and its renegotiation amongst out-groups. As this is exploratory, it examines the potential role of values in enriching collaborative experiences among people. The Study reveals three key findings useful for scaling up CCP: (1) borrowing is strongly preferred amongst in-groups but lacks systems of collaborative consumption for its enablement, (2) The alternative model of 'co-ownership' can be accepted

among out-group members who live within proximity, to enable sharing of frequently used items, and (3) 'trust' is based in several motivations that can be leveraged for wider uptake of the above two models of borrowing and co-ownership. This Study thereby posits that human values play a key role in understanding collaborative consumption amongst individuals, and proposes ways for its wider acceptance that are based on greater concern for others, rather than the self.

Uma Shankar Pandey (SNCW, University of Calcutta, West Bengal) presented a paper titled "Diffusion of Innovations: A Case for Audience Capability". The strength lies in the idea of 'heterogeneity', which departs from the conventional idea of homogenous audience. The literature review is considerably well. However, more attention towards a concrete theoretical framework will add value to this challenging and unique research endeavor. It would also be interesting if some data/case studies are brought into the paper, to showcase the significance of capability for diffusion of innovation, specifically in the domain of media.

Session 6A: Climate Change, Adoption, Mitigation and Resilience

The session had a broad theme "Climate Change, Adoption, Mitigation and Resilience" was chaired by Sandhya Wakdikar (CSIR-NISTADS). In this session, one speaker spoke on the challenges for innovation and sustainable development in research education in India, and the rest of the three had their talk revolving broadly around the renewable energy sector.

The first speaker Aviram Sharma (Nalanda University, Bihar) in his presentation titled "Diffusion of Climate Smart Technologies in Agrarian South Bihar, India: A Case of Solar Based Water Pumps" taking up a case study of Solar based water pumps talked on the Diffusion of Climate Smart Technologies in Agrarian South Bihar, India. After a brief analysis of the current status of the renewable energy status and the Solar energy scenario in a few countries and of India, Aviram spoke on the diffusion of smart climate technologies promoted by government and non-government actors at the local level. Solar-based groundwater pumping for irrigation as a smart climate technology with secondary data and primary fieldwork conducted in two villages in south Bihar, Dharnai, and Rajapur, as Hybrid models with community participation. He found from the beginning of the project in Dharnai, the use of the solar grid for residential purpose continued for some time but was not accepted for agricultural purpose as a technological solution and was termed as 'fake' technology (while the conventional energy source was perceived as 'real' technology). Here even the community approach did not work because of 'competing technologies'. For Rajapur too he found that less than 50 % of the land was irrigated by the solar pump and that too in certain seasons and the remaining land was being irrigated by diesel based pump, and further declined in use of solar water pumping. He concluded that both the models of hybrid governance failed to take over and community building measurements were not successful.

The second speaker Stuti Halder (Central University of Gujarat) in her presentation "Green Entrepreneurship in the Renewable Energy Sector - A Case Study of Gujarat" discussed a case study of Gujarat for the Green Entrepreneurship in the Renewable Energy Sector. Entrepreneurs who have the concern for the environment can have an urge serving as a pull or push factor for green production activities. The role of green entrepreneurs in bringing in cleaner and effective technology in the energy sector of India could be very important for achieving the Sustainable Development Goals. To study this, she has taken a primary survey in Gujarat having a sample size of three entrepreneurs to explore the motivations and barriers as well as specific attributes for the renewable energy sector. She concluded that these 'entrepreneurs serve as hotbeds for sustaining a green economy as they take up the role of innovators hence creating comparative advantage in terms of environmentally superior goods and services'. They are instrumental in creating green jobs

and boost the demand for eco-friendly products. She has pointed out that for a systematic approach towards green entrepreneurship, government interventions and environmental awareness is required. She feels that there is a huge opportunity for green entrepreneurs which can boost the environmental and economic gains.

The third speaker of this session Rajeev (University of Kerala) in his presentation titled "Research Education in India: Challenges for Innovation and Sustainable Development" underscored the role of knowledge and innovation being the drivers of growth and economic development in a "Knowledge-Based Economy". The study based was based on inputs of research scholars in the universities of Kerala, enrolment in various disciplines, research performance of various fields, etc. to find out the challenges in the research education and the contribution to sustainable development. The study finds that innovation related activity is not key motivation of scholars. Issues of sustainable development are not areas addressed in research studies. Motivation is more towards getting required qualification for getting permanent position in a government institution.

The fourth speaker Amit Kumar Singh Akoijam (CSSP, Jawaharlal Nehru University, New Delhi) in his presentation titled "Innovations, Linkages and Knowledge Production in Indian Renewable Energy Sector: A Comparative Study of Solar and Wind Energy" gave an overall view of the renewable energy sector in India and details of activity in solar and wind energy innovations, linkages and knowledge production. The sectoral system of innovation was used as a conceptual framework of this study. Drawing from this framework, the paper highlighted the need for enhancing linkage between the academia, industries and government institutions to strengthen actor's capability. The paper concluded by calling for improving the policy and regulatory support

In the session, Mammo Muchie (Tshwane University of Technology, South Africa) gave an open invitation to all the speakers to look into the website www.ansole.org (which promotes research, education and vocational training in renewable energy among Africans and non-Africans) for participation in solar energy network where funding is also provided.

Session 6B: Gender Technology and Innovation

The session on Gender, Technology, and Innovation, chaired by Tabassum Jamal (CSIR-NISTADS), had some very vivid and interesting research presentations, ranging from the participation of women, in education, vocational/professional training institutions to their engagement in formal as well as informal sectors of the economy. There was a very elaborative and enlightening presentation titled "Innovation: The New Realm of Women's Activities in Iran", presented by Akram Ghadimi (NRISP, Iran) on the role and participation of women and the evolving socio-economic structure in Iran. It was overwhelming to see that Iranian women have challenged the existing patriarchal structure and have come forward for higher education, especially in the field of science and technology. The other research papers presented during the session reflected on diverse issues and challenges which revolves around technology, innovation, and gender-related aspects.

The session had the first paper titled "Challenges Faced by Women in Entering into the Area of Innovation with an Emphasis on Traditional Societies" presented by Maryam Ghadimi (NRISP, Iran), where she described crux of women participation in the national systems of innovation in Iran. The second paper titled "Changing Gender Patterns of the Informal Economy of 'Muga' Weaving Industry of Assam", presented by Antara Chakrabarty (Jawaharlal Nehru University) undertook a women's perspective on how technology has influenced employability and their participation in the Muga Silk cottage industry, in the light of the social, cultural and patriarchal

setting of Assam. This paper reflected on a very interesting case of Muga silk industry, and the nature of participation of women, in the given informal setup. It will be appreciated to reflect on the role of non-state actors like civil society, NGOs, etc. on the issues pertaining to women's underemployment, low wages, and bad work conditions. Also, Literature strands dealing with motivation, resistance and exclusion can be incorporated to make the framework more aligned with the research objective. 'Technology and Gender' theories have made room for examining Gender-technology interdependence, influences, and outcomes. One may try to incorporate such narrative in this research. Lastly, the very fact that 'Muga Silk' has a Geographical indication (GI), changes the entire debate, which cannot be devoid of IPR issues, Access and Benefit Sharing aspects and so on. The third paper titled "Scientific Temper, Skill Development and Innovation in Select Industrial Training Institutes (ITI) in India: A Gender-based Perspective", presented by Subhash Kumar (CSSP, JNU) pondered upon Gender and development, from a capability approach, reflecting on the scientific temper of males and females in ITIs in Uttar Pradesh. The paper's crtical reflection opened room for discussions on how significant it is to understand gender-related issues in the arena of Science, technology and Innovation studies. The paper talked about vocation education and training and scientific temper among males and females in ITIs in Uttar Pradesh.

Session 7A: Innovation in Healthcare and Pharmaceuticals

The session having a broad theme "Innovation in Healthcare and Pharmaceuticals" was chaired by Mathieu Quet (CSSP JNU). In this session, invited speaker Girish Kumar (Mahatma Gandhi University, Kerala) spoke on "Innovation Divide in Access to Health Technology: A Case Study of Cancer Medication in India". In this presentation, he identified different factors responsible for insufficient access to cancer medication and inaccessibility to cancer treatment across India. Another presenter in this session, Nidhi Singh (CSSP JNU) spoke on "Molecular Diagnostics (MDs) Innovation System Development in India: Role of Indian Science Base". At the end of her presentation, she concluded that system building activities are very weak for building MDs innovation to cater the requirement of the health care system in India; to foster scientific base for MDs innovation, the role of government R&D support and promotion is critical, which is currently lack of suitable direction in the conducts of science base actors; evidence from government policy and initiatives for molecular diagnostic development shows that there is a need for more focused vision for dealing with country-specific diagnostic challenges.

Session 7B: Innovation in Healthcare and Pharmaceuticals

The parallel session having a broad theme "Innovation in Healthcare and Pharmaceuticals" was chaired by Ritu Priya (Centre of Social Medicine and Community Health, JNU). In this session, invited speaker Dinesh Abrol (ISID, New Delhi) spoke on "Indian Pharmaceutical Industry's Trajectory Post 2000: Developing or Hollowing out?". In his presentation, he presented an industry-wide metrics of innovation based on the characterization of the learning potential of foreign direct investment (FDI), technology acquisition and in-house R&D, analysis of patenting activity, assessment of R&D directions and evaluation of innovation outcomes. The purpose of his study was to reflect on strategies adopted for learning, competence building and innovation and for creating complementarities and linkages within India's pharmaceutical industry during the post-Trade Related Intellectual Property Rights (TRIPs) period. With India facing the challenge of constituting pathways and strategies for accelerated learning, he also explored through whose actions, types of strategies and routes of growth have the limits of Indian pharmaceutical industry innovation been reached within one decade. Finally, he identified how and with what kind of policy

design the Indian state and society can intervene to push the frontier of innovation further within this industry. He further assessed systemic connections of these implications, suggesting that for a significant change in domestic and foreign pharmaceutical firms' orientation to disease, as reflected in outcomes of their R&D investment activity, there also has to be a major focus on pathways toward innovation for domestic markets.

Other presentations in this session included "Breast Cancer Management in India: Examining Deficiencies in R&D, Policy and Diagnosis Measures", presented by Priyanka Kumari (Central University of Gujarat); and "Impact of Rural Sanitation on Water Quality and Water Borne Diseases", presented by Sunil Goyal (Government College, Anjad, Madhya Pradesh).

Session 8A: Sanitation and Waste Management

The parallel session having a broad theme "Sanitation and Waste Management" was chaired by Madhav Govind (CSSP, JNU). In this session, invited speaker Keshab Das (GIDR, Gujarat) spoke on "Scaling up Sanitation in Indian Villages: Innovation Challenges". In his presentation, he briefly discussed the crises of sanitation in rural India and implications of poor sanitation. At the end he identified certain innovation challenges for the community of innovators and researchers, which are summarily: (i) Lack of access to basic services such as water and sanitation are long recognised as denial of human rights; (ii) Informed by field observations one needs to think of much beyond product (toilet unit, typically) innovation; (iii) Institutional innovation in the rural sanitation remains one of the little-researched areas and calls for deeper enquiry; and (iv) Celebrations on ODF (open defecation free) figures could, in fact, wait.

Other presentations in this session included "Emergence of Bioremediation based Waste Water Treatment in Yamuna River: An Intervention through Eco-Innovation" presented by Jyoti (CSSP JNU); "Sustainable Disposal of the Dead: The Case of New Cremation Technologies in India" presented by Vishwambhar Nath Prajapati (CSSP JNU); and "Recycling of Urban Solid Waste in India: Empirical Findings from Some Select Colonies in Delhi" by Mirinchonme Mahongnao (with Madhav Govind, CSSP, JNU).

Session 8B: Sanitation and Waste Management

The parallel session, having a broad theme "Sanitation and Waste Management", was Chaired by KJ Joseph (CDS, Thiruvananthapuram) and Mammo Muchie (South Africa). Four presentations deliberated in this session included "Waste an Opportunity: Innovative Methods For Tapping The Potential in Municipal Solid Waste Across Indian Metro Cities" by C Babu Gurucharan S H (with Priyanka Kaushal, Teri University); "Environmental Impacts of Waste Management and Sanitation Deficiencies and Health Issues: A Imperial Study in The City of Delhi" by Atul Ratna & Sumit Kumar Mishra (Central University of South Bihar); "A Priority Based Growth of South Asia for Sustainability in Relation with Hygiene & Sanitation" by Partha Sarathi Sarkar (Ramakrishna Mission Vivekananda University, West Bengal); and "Electronic Waste Management Practices in Urban India: A Study from STS Perspective" by Anwesha Borthakur (with Madhav Govind, CSSP JNU). The session mostly featured the importance of solid waste management; it's effective segmentation and recycling techniques. The presenters also discussed the challenges of hardware innovations, and local specific rules to handle increased volumes of municipal solid wastes in the Indian cities.

Session 9: Session in Honour of Ashok Parthasarathi

In the morning of 4th November, a Plenary Session in Honour of Professor Ashok Parthasarathi was organized, which was chaired by Sachin Chaturvedi (RIS). Professor Ashok Parthasarathi delivered a special lecture titled “Down the Memory Lane: Recalling India’s Nation Building Exercise” on occasion. Then he was felicitated by Dinesh Abrol, KJ Joseph, Saradindu Bhaduri, and members of the audience. Later, Dinesh Abrol, KJ Joseph, and Saradindu Bhaduri spoke about contributions of Professor Parthasarathi in establishing formal research in the areas of science policy studies in India.

Session 10A: Innovation in the Informal Economy

Session 10A began with chair’s remarks, where chair Peter Knorringa (ISS/Erasmus University, The Netherlands) elaborated concepts of innovations in the informal economy. He then introduced invited speaker Thomas Thurner (University of Cape Town, South Africa). The speaker in his presentation titled “Communities of Practice in Emerging Markets: Finding Ways to Identify Innovative Capacities and Means to Unleash Their Innovative Power”, elaborated global energy praxis and later he identified a few examples of regional innovations in African countries. Three presentations deliberated in this session included “Informal Sector Innovations and Formal-Informal Economy Linkages: Exploring Interaction at Knowledge, Resource and Institution Level" presented by Birendra Singh (CSSP, JNU); “Role of Design in the Social Shaping of Grassroots Innovations” by Gautam Sharma (Central University of Gujarat); and “Impact of Mass Media in Adoption of Agricultural Innovations: Developing Exploratory case study approach towards understanding role of Print Media in Western Maharashtra” by Rahul Mane (Bhavtal magazine, Pune).

Session 10B: Innovation in the Informal Economy

Session 10B began with chair’s remarks, where chair Hemant Kumar (Central University of Gujarat) elaborated innovations in the informal sector. Three presentations deliberated in this session included “Informal Sector Innovations and Formal-Informal Economy Linkages: Exploring Interaction at Knowledge, Resource and Institution Level" presented by Birendra Singh (CSSP, JNU); “Role of Design in the Social Shaping of Grassroots Innovations” by Gautam Sharma (Central University of Gujarat); and “Impact of Mass Media in Adoption of Agricultural Innovations: Developing Exploratory case study approach towards understanding role of Print Media in Western Maharashtra” by Rahul Mane (Bhavtal magazine, Pune).

11A: Innovation for Sustainable Agriculture

Session 11A began with chair's remarks, where chair Pranav N. Desai (CSSP JNU) gave brief insights of innovations in the agricultural sector. He then introduced invited speaker Prof KJ Joseph (Centre for Development Studies, Thiruvananthapuram). The speaker in his presentation titled "Interrogating Innovation System from a Small Farmers' Perspective: India and China", written with Liyan Zhang (Tianjin University of Finance and Economics, China), elaborated the cases of agricultural innovation system (AIS) and small farmer innovations in India and China. He also made some observations related to implications for innovation system research in the Global South.

Three presentations deliberated in this session included "Sustainable Agriculture through Hapa Irrigation System in Rainfed Area of West Bengal, India", by Amartya Pani (IIT Kharagpur); "Scientific Knowledge and Science Policy: Technological Shift in Agriculture Sector" presented by Diwakar Kumar (Central University of Gujarat); and "Sustainability in Crop Research and Agricultural Models: Promoting Reliance on Neglected and Underutilized Species", by Abhinav Jha (with Kunal Sinha, Manish Dubey, and Ravi Chauhan, Central University of Gujarat).

Session 11B: Innovation for Sustainable Agriculture

Session 11B began with chair's remarks, where chair Piyush Verma (LM Thapar School of Management) elaborated the roles of innovation in sustainable agriculture. It is an interesting session where we got some new knowledge through amazing presentations. Overall, the session contributed to discussions on quality and quantity of food, space technology mapping wetland, accessibility, and commercialization, adapting technology to local people. In this session, invited speaker Tawheed Reza Noor (Dhaka School of Economics, University of Dhaka, Bangladesh) delivered his presentation titled "Seed Systems and Seed Security of Rice Plantation under the Light of Seed Security Framework: A Case Study from Stress-Prone Eastern Nepal". He talked about the characteristics of agriculture in four villages in Nepal where the formal and informal kind of projects were going on to bust the seeds production. Secondly, Sonia Sultana Ashrafee (Unnayan Bhabna, Bangladesh), in her presentation "Right to Food in Bangladesh: Experience from Urban Poor", mentioned about right to food in Bangladesh from the dimension of urban poor. She also mentioned the quality and quantity of food system in Bangladesh and different actors like children, women, government and non-governmental organizations. She also talked about new food policies about Dhaka city. Ramnath Raghunathan (Mahatma Gandhi University, Kerala) presentation titled "Role of Space Technologies in Wetland Mapping" highlighted the role of new information regarding space technologies in wetland mapping I India. He argued that new technologies could help the policymaker and government to prepare monitoring report of a particular area. Sheeraz Ahmad Alaie (Central University of Gujarat) presented his paper titled "Agricultural Innovation System and Sustainability: A Case of Horticulture Sector of Kashmir Valley, India", where he elaborated challenges and opportunities in the horticulture sector at Kashmir valleys. Anurag Kanujia (with Sujit Bhattacharya, CSIR-NISTADS &AcSIR) in his presentation "The GM Crop Debate in India: Identification of Stakeholders and Regional Variations in their Interests" reflected upon the debates of GM crops in India, the stakeholders, regional variation and their interest of adapting the growing process.

12A: IPR, Standards and Regulation in Science, Technology and Innovation

Session 12A began with chair's remarks, where chair Reeta Sony (CSSP, JNU) elaborated roles of IPR, standards and regulations in the science, technology and innovation (STI). She then introduced invited speaker Sambit Mallick (Indian Institute of Technology Guwahati). The speaker in his presentation titled "The Intellectual Property Rights Regime: Changing Practices in Agricultural Biotechnology in India", elaborated the implications of IPR protection in the agricultural biotechnology in India. He then concluded with his observations, e.g., scientific research seems to be more commercial and contract-dependent, industry-sponsored and user-related; Scientists in India face the question of demonstrating the applied and/or "user" benefits of research in funding applications; and Funding vis-à-vis accountability of scientists need to be understood in the shifting paradigms.

Three more presentations deliberated in this session included "National IPR Policy 2016: Can it provide New Opportunities for Research, Innovation and Development", presented by Umang Gupta (AcSIR with Sujit Bhattacharya, CSIR-NISTADS); "Critical Analysis of Trade Secret Protection in India", presented by Ajoy Jose (LLM, IIT Kharagpur); and "Formal Standards, Tacit Adoption: Study in Aligarh Padlock Industry", presented by Shekhar Jain (CSSP, Jawaharlal Nehru University, New Delhi).

Session 12B: IPR, Standards and Regulation in Science, Technology and Innovation

The session, chaired by Aviram Sharma (Nalanda University, Bihar), included papers outlining how standard setting operates on the ground and their implications for regulations in general and intellectual property in particular.

The first speaker Sujata (TERI University), in her paper "What is the Reality Today for 20% Ethanol Blending Program?", dealt with the standard development process for 20% Ethanol Blending program, outlining gaps in raw material availability, costs of raw materials and the localised nature of production. The paper implemented a life cycle assessment method for assessing the carbon foot print of the Individual plants. The paper introspected at the highly anticipated auto-bio-ethanol blending programme of the government of India and tried to come up with policy suggestions for efficient and realistic implementation. Through a Sectoral analysis of the bio-ethanol production value chain, the speaker highlighted gaps in the availability of raw materials and adequate infrastructure to support the programme. Further, the speaker emphasized on the diversion of bioethanol into other more lucrative economic activities like potable usage. Although speaker was skeptical about the programme ever reaching its stated objectives, the paper advised that government should follow a dynamic ethanol pricing scheme to prevent diversion of bioethanol. To push the production higher based a systemic view of ethanol industry paper called for incentivizing the producers and farmers through support and subsidies.

The second speaker Tilottma Pandey (Gujrat National Law University), in her paper "Reinforcement of Legal Infrastructure in Context to Modern Regime of Socio-Economic, Innovation, and Invention under Patent Laws", dealt with the reinforcement of legal infrastructure of the patenting system and evaluated the optimal standard of protection component thereof. This was to be done in light of socio-economic factors. The paper is an attempt to look at the patent laws and their role in promoting innovation activities in India. In the continuously evolving international landscape of technology and thus the related laws and regulations, the author argues that the rate of adjustment in the domestic Intellectual Property Rights (IPR) is slow. Highlighting the key issues of IP theft and copyrights infringement the author emphasized the need for a strong national

IP regime as an important precondition for progress in science technology and innovation. Post TRIPS the IPR standards all over the world have been affected, and strengthening of patent protection is required in all sectors. Looking at some sectors, Pandey highlighted that pharmaceutical companies in India are dependent on western countries for medicinal compound knowledge and need protection against exploitation. However, she cautioned against the misuse of laws as they produce tangible benefits for the owners and other stakeholders as well.

In the third Paper titled "The Governance of Drone Technology for Civilian Applications in India: An Analysis under the DGCA Regulatory Regime", Mohd Owais Farooqui (NALSAR University of Law, Hyderabad) presented an analysis of legal dimension for the use of drones in public spaces. Also known as unmanned aerial vehicles (UAV) and remote controlled aircrafts they originated in the 1890s when first attempts to make UAVs were documented. Military advantages of UAVs were clear after the use of 'kettering bug' in First World War. In India, this technology has promising applications in agriculture, surveillance, disaster management, etc. but there are various avenues for its misuse as well. The International community has recognized these issues through the Chicago convention and underlined the need for regulation for the use of unmanned aircrafts. Although, the issue of privacy has not been focused in the draft legislations. Using the example of Kottaswamy vs. The union of India the author underlined a requirement of regulation while simultaneously promoting the technology use. According to the author, a role of agencies like telecom regulatory authority of India (TRAI) needs to be brought under focus. International jurisdiction is another dimension where Indian draft regulations need to deliberate. The author recommends that the regulations at domestic level shall be made so that the use of data from these UAVs is clear and ethical. Transparency and safety shall be the primary objective of the regulatory legislation.

The three papers in the session covered domains of policy, law, and regulations in the context of new technologies and their application. The speakers looked at Indian Bioethanol project, Patent laws in India and Use of drones in civilian applications in India. Expressing his anticipation for the potential of knowledge generation from these studies, chair Aviram Sharma suggested an in-depth engagement with literature as an important facet for the further development of the papers presented in the session.

The discussant Ashish Gosain (CSSP, JNU) suggested that the presentations should try to look at their studies through an interdisciplinary perspective. Enriching the connections between STS and respective fields of studies would identify the papers with the theme of the conference. According to him the studies have done the first step of flagging the interests in technology use but could gain from a multidisciplinary perspective in understanding the bigger innovation perspective associated with them. Specifically commenting on each study, Gosain brought out some gaps in each study. For the analysis of ethanol value chain, he underlined the dysfunctional nature of standard setting and absence of well-defined standards in the domestic manufacturing sector. With respect to the patent protection paper, he suggested that IP has multiple dimensions thus reducing the legal infrastructure into the IP protection regime seems to be an oversimplification. And for the application of drones, on the basis that a technology exists in a society, an approach which includes societal factors in the development of technology was suggested.

There were multiple questions from the audience which put the studies in a larger context and evaluated the applicability of policy suggestions from each study. Sujata was asked to comment on the compatibility of bioethanol blending programme and COP21 goals of reduction of carbon emission. The programme forms a part of various measures to meet these goals. Farooqui was asked to draw upon the sustainability and economic viability of drone usage in agriculture with specific references to government schemes like PMFBY (2015), and licensing policy for

manufacturing of drones in India. The case for the use of drones in agriculture is well established now; it is much cheaper and sustainable than remote sensing. Drones are easier to operate and provide easy access to collected data thus it gives farmers greater autonomy in surveillance and maintenance.

Session 13: Panel Discussion on Communicating Science Technology and Innovation for Sustainable Development: (Co-organized with Vigyan Prasar, DST)

Sustainable development is a key focus area for the majority of the research interventions in both Global North and the Global South. The seventeen sustainable development goals (SDGs) today define the central research and policy approaches worldwide. South Asia including India is no exception. How does proper communication of science, technology, and innovation contribute towards sustainable development? This was the foremost query being addressed during the panel discussion on "Communicating Science Technology and Innovation for Sustainable Development" in the recently concluded the Fourth IndiaLICS International Conference jointly organized by the Centre for Studies in Science Policy, Jawaharlal Nehru University (JNU); Research and Information System for Developing Countries (RIS); and CSIR-NISTADS. The panel discussion was co-organized by Vigyan Prasar, DST.

The panel was chaired by Prajit K Basu from the University of Hyderabad with panelists including Gita Bamezai (Indian Institute of Mass Communication, New Delhi), Smita Srinivas (TCLab), Uma Shankar Pandey (SNCW, University of Calcutta, West Bengal.), Manoj Kumar Patel (CSIR-CSIO, Chandigarh), Sambit Mallick (Indian Institute of Technology Guwahati), Aviram Sharma (Nalanda University, Bihar), and Mathieu Quet (CEPED IRD, France; CSSP JNU, New Delhi). The discussants for the session were Sohan Prasad Sha (Martin Chautari, Nepal), Girish Kumar (BIIC, Mahatma Gandhi University, Kottayam, Kerala), and Archita Bhatta (Vigyan Prasar).

During the session, several significant issues and queries were raised on communicating science, technology and innovation for sustainable development, which revolve around the following four concerns.

1. Is science communication at all necessary for sustainable development?
2. If yes, isn't it imperative to listen to peoples' voices and ensure their active participation?
3. How framing of a problem is important to shape communication among diverse groups?
4. To what extent the success of communication depends on the ability of participants to develop an acceptable language of discussion?

The gist of the discussion that was taken up during this important session is presented in the following sections.

'What are we communicating and to whom' – this is a significant concern that should be addressed adequately. The panelists of the session largely agreed to this viewpoint. Providing a relevant example, Prajit Basu emphasized on the appropriate framing of a problem. The problem of allergies of women who sprays pesticide in agricultural fields can either be seen as a medical problem requiring medication to cure allergies, or a health problem demanding innovation of alternative, greenerform of crop management. The second way of viewing the problem has indeed led to

invention of newer management practices in agriculture. In attending to such problems, knowledge of agricultural sciences, local farmer's issues, and medical sciences would intersect with an aim towards developing a sustainable solution. Thus, an issue, pertinent to the present day context, is the need for interdisciplinary research and policy approaches towards devising sustainable solutions to the existing and forthcoming problems.

Nevertheless, Smita Srinivas argued that interdisciplinary research approaches are still inadequate because people are either afraid of their professional identity or skeptical about if they are contributing towards their parent discipline, indicating that there appears to be a tradeoff between catering to one's own profession and reaching out to larger public. Therefore most of the researchers are reluctant to take up studies beyond their comfort zone or parent subject. This kind of situation is both unfortunate and upsetting. Most of the speakers in this panel discussion agreed to the fact that interdisciplinary perspectives to present-day problems are of utmost importance and it is essential to promote such knowledge for the larger benefit of the society.

During the very beginning of the commentary session, Prof. Gita Bamezai emphasized on 'why communication is significant to scientific exploration and to search for scientific solutions to the problems'. She argued that the whole idea of communication should be redefined or reframed in the context of science. Most of the presenters argued that it is essential to move from a deficit to a dialogue model. Archita Bhatta, however, pointed out that although theoretically, communication models have evolved from 'deficit' to 'contextual' to 'participatory'; application of participative communication approaches is still missing. She argued that the very problem lies with the way our education is conducted in India. The culture of asking questions is still very much missing among the Indian students which restrict many science communication approaches. Substantiating her point, Sambit Mallick argued that critical thinking and culture of interrogation must be cultivated from the very beginning of childhood days in such pursuit. He further emphasized that when we dwell upon communicating science, technology and innovation for sustainable development, we must examine the nature of the state itself, its location within the matrix of a class-divided society and its relationship with various other contending social forces.

Substantiating points related to communicating science to school children and youths, Manoj Kumar Patel pointed out importance of the public outreach events such as open days in the national laboratories, the Children Science Congress, the India International Science Festival, and the Indian Science Congress, where school children and youths get chance to learn from the hands-on experiments, or demonstrate problem solving models dealing with the societal challenges. He appraised the inclusive innovation approaches of the agencies such as National Innovation Foundation and CSIR, where the grassroots innovators can get involved with the scientific institutions for formalization of their frugal innovations.

Two sets of changes are indispensable today: one is inside the scientific organizations, and another is outside them involving general public including policymakers, media, civil society, etc. For instance, there are inherent problems the way science is done. Scientists, most of the time, are reluctant to share their knowledge with others. The only platform where they would prefer to share their knowledge is the scientific research journals or in the conferences/seminars within the peer group. It is essential to share their knowledge in platforms other than the above two. There are

needs of rethinking professional education and its role in science communication. Smita Srinivas argued that a huge gap exists in applying theories to evidence and evidence to the theory. She mentioned that major challenges are faced by the researchers when they attempt to apply evidence to the theory. With her ventures in curriculum development in new university programmes in Asia, America, and Africa, she argued that the role of professional education in science communication is an issue still addressed ineffectually. She further described her experiences while beginning the Technological Change Lab (TCLab) in Columbia University about a decade ago and the challenges associated with carrying forward the initiative successfully to date.

Is it essential at all to communicate science to public? This was the question first raised by Dr. Mathieu Quet pointing out that large popularity of plastic and nuclear technology, at least in France, was due to the scientists' efforts to popularize such technologies a few decades ago. Unfortunately, now scientists are being seen as trying hard to retract from their position. These innovations confront SD and SDGs! One should also think in this line as SD approaches are futuristic and require 'ahead of the time' research and thinking capabilities.

Commenting on the session, K.J. Joseph was skeptical/confused about 'who are we to communicate science.' For instance, he ascertained that farmers have much better knowledge about their practices than scientists do. Therefore scientists must be particularly cautious in communicating scientific approaches to them so that their traditional or indigenous knowledge base is appreciated and preserved. He emphasized on the need for a capability-based approach in science communication.

Commenting further on science communications and sustainable development, Mammo Muchie said that we need to 'critique' science and not only confine ourselves to communicating it. There is a larger need to teach non-western science in terms of Indian science, Islamic Science or African science. He pointed out that universities evolved in what we call today as global south long before the west or global north. In his words, we must learn to unlearn and then relearn to communicate science better. Taking reference from Prof. Steve Fuller, an American philosopher-sociologist in the field of STS, Sambit Mallick argued that universities both as political and academic sites reflect the dialectic between science as a social movement and as a disciplinary formation. For science cannot be reduced to the recording and analysis of the 'pre-notions' that social agents engage in the construction of social reality; it must also encompass the social conditions of the production of these pre-constructions and of the social agents who produce them. Towards the end of the session, Dinesh Abrol proposes if innovation scholars can engage in science communication experiments firsthand which would eventually aid in realizing a better picture of the current situation and identify the gaps in the existing communication models.

Media also plays an important role in science communication approaches. Gita Bamezai argued that media tends to unnecessarily sensationalize issues, making scientists apprehensive about approaching and communicating a certain idea/invention to them. Further, sometimes areas within the scientific framework are so difficult even for the scientists of a different domainto comprehend that they are reluctant to convey it to the general public. For instance, for a physicist to understand a biotechnological invention or vice versa is already challenging. In such a condition, scientists are hesitant to communicate science to the common public due the uncertainties associated with its

effectiveness. Therefore a common language should evolve for successful communication of science.

Mathieu Quet pointed out that mostly science communication approaches are 'top-down'. However, scientific communication or benefits of science should reach people who have been left behind. Therefore, instead of a 'top-down' approach, a 'bottom-up' structure has much higher possibility of success as it will ensure active public participation. Such an approach will aid in achieving the seventeen goals of sustainable development (SDGs) by the targeted year of 2030. He emphasized on three factors, which could be instrumental in directing science, technology and innovation towards sustainable development – communication, public engagement and participation. He argued that it is not exclusively about communicating science, but about creating platforms for dialogue and discussions. For him, it is essential to broaden the public participation in order to attain the proposed aim of SD.

Nonetheless, there are a number of challenges India always encounter in bringing all the stakeholders to the same platform. As pointed out by Prof. Uma Shankar Pandey, populace of the country is diverse, and it is quite understandable that their perspectives are dissimilar as well. Therefore, it is essential to design communication approaches considering these varied viewpoints. For instance, Prajit Basu emphasized on developing a 'pidgin language' through which scientists from across the disciplines could effectively communicate among themselves, as well as to the larger public. It is also essential to defy the flawed attitude that people are ignorant and scientists know everything. As argued by Aviram Sharma, and Bamezai, it is crucial to shift from the currently dominant 'deficit model' to 'dialogue model' or 'participatory model' which involve engaging and working with communities. This is especially relevant in the context of genetically modified (GM) crops and climate science.

For Prajit Basu, further challenges arise during attempts to effectively communicate 'techno-sciences' such as nanotechnology, nanobiotechnology, or information technology. For instance, 70% of researches in these sectors are carried out in the private domain. Interests of private and public sector differ significantly and so thus their science communication approaches. Private sector acknowledges that innovations associated with these new techno-sciences do have certain uncertainties. However, more often than not, this sector argues that 'benefits' of these techno-sciences are certain; it is only the 'impairments' that is uncertain. Contrary to that, researches in the public sector often believe that if 'harms' are uncertain, so do the benefits.

Although India is a party to the SDG promises, SDGs still look ambitious for India. On a positive note, there are certain initiatives taken up in the country which have the potential to contribute towards attaining sustainable development. For instance, as pointed out by Prof. Smita Srinivas, Neighborhood Improvement Partnership (NIP) organized in the year 2015 in the city of Bangalore could be considered a significant first step in this regard. For her, the support for NIP obtained from different quarters of the society was something overwhelming. There were key interests of all groups, be it citizens, corporate, local authorities or ministries. For instance, significant financial supports were provided by corporate houses through their Corporate Social Responsibility (CSR)

initiatives. With a total number of 140 groups registered for the event, it is considered one of the largest programmes of this kind in India till date.

During the discussion, Sohan Prasad Sha raised the concern that before communicating science, it is imperative to evaluate how much science is actually done, especially in the context of countries like Nepal. In Nepal, 86% of students in their tertiary education do not study science which restricts the students with a science background to only 14%. He argued that there is still a long way to go, both in 'doing' and 'communicating' science. Dr. Girish Kumar, during his presentation, emphasized on a 'lab to land' approach and discussed how inventions for sustainable development should be brought from the laboratories to the markets.

Finally, it is imperative to acknowledge that participation in science communication is not about unconstructive arguments or fallouts. Views of the diverse public should be listened to and respected. As suggested by Basu, this calls for the development of an agreeable 'pidgin language'. Without devising such a language, no science communication approaches will be successful or effective enough for contributing towards sustainable development.

Picture 1: Panelists in the Vigyan Prasar Session on *Communicating Science Technology and Innovation for Sustainable Development*

The Q&A Round

Discussions from the floor during the Q&A Round

This Proceeding is prepared by Dr Anup Kumar Das, Dr Saradindu Bhadhuri and Dr Sujit Bhattacharya* based on reporting done by rapporteurs from students of CSSP-JNU and AcSIR Students at NISTADS Campus.

(In alphabetical order)