

**Report of the Dialogue on Economics of adaptation:
Setting agenda for incremental and transformative change**

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Dialogue on Economics of adaptation: Setting agenda for incremental and transformative change



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1. Introduction

Adaptation research is using a range of economic approaches to assess resilience and vulnerability to climate change in different geographical contexts. A fundamental distinction, however, can be made between two types of adaptation – a series of small incremental responses or a drastic transformational change. Some of these economic approaches (project appraisal methods like cost-benefit analysis) are well suited to assess practical incremental measures in agriculture, water, or health. But they are less useful to identify when certain thresholds or tipping points are reached that necessitate transformational change. Other approaches, like social network analysis or well-being measures, can help understand the processes that drive transformational change like migration. Integrated assessment or general equilibrium models may be better in identifying thresholds when certain sets of choices or adaptation pathways are closed off and transformational change is the only way forward. But how well do they model incremental adaptation at the local scale? What is the precise nature of relationship between these two types of adaptation? These are the critical questions from the perspective of policy making as well as developing knowledge tools. It is important that the young researchers entering into the domain of adaptation research using economic lenses are adequately exposed to the range of tools available, their usefulness and limitations and their application in research on a range of adaptation related issues. At the time of the workshop, the CARIIA consortia were busy with completing their fieldwork and doing analysis. They together host a broad community of early career researchers who play a significant part in the actual research that is taking for CARIIA and beyond. Exposure to the thought process of setting long term research agendas along with appropriate means to perform quality and context relevant research is of great value. The “Cross-CARIIA Dialogue on Economics of adaptation: Setting agenda for incremental and transformative change” held from 9 to 13 January 2017 in New Delhi aimed at providing that exposure. This Dialogue was jointly supported by Climate Adaptation & Services Community (CASCO) project funded by EU and the CARIIA Opportunities and Synergies Fund (COSF) of the IDRC.

Objectives and expected outcomes

There exists a rich diversity of competency in using range of economic tools and methods within the consortia. There is an excellent opportunity for sharing of knowledge, comparison of on-going research and cross-CARIIA collaborations for future research towards building long term research agenda as well as competencies. This Dialogue cum training program aims to achieve the following:

1. **General Objective:** Enable skill building of young researchers and promote collaboration activities across research institutes in Europe, Asia and Africa.
2. **Specific Objectives:**
 - A. Train junior researchers on state-of-the art methods in the economics of adaptation and development, and via hands-on discussions of successful examples of private sector initiatives.

- B. Contribute to the development of the research agenda on adaptation for the coming years,
- C. Promote joint publications by participants

Design of the Dialogue

Understanding the usefulness and limitations of economic tools as well as on-going research is essential for identifying methodological as well as research gaps and a first step towards building long term research agenda. Dialogue to challenge and combine existing economic approaches and to identify needs for co-designing of new tools and methods to apply to adaptation research themes is an integral part of this exercise. With this in mind, this program is designed to facilitate such dialogue.

- **Overview and Long-term research agenda:** On day one, overview of on-going research by the participants followed by a panel discussion on the broader scope of research on economics of adaptation are expected to provide a common reference point for further deliberations during the program.
- **Lectures and sharing of experiences:** Half day sessions focusing on specific economic tools and/or specific themes will follow a presentation and Q&A mode. The aim is to provide a detailed overview of theme and concepts, research design and tools applied and status of research.
- **Group activity:** Group activities followed a break-away group discussion and reporting back in plenary pattern. The purpose was to reflect on the long-term research agenda, presented economic tools and shared experiences with a view to:
 - Refine and articulate long-term research agenda for adaption (including designing of new tools),
 - Identify the needs for combining multiple economic tools to refine on-going research, and
 - Develop ideas for collaborative research.

2. Tone of the dialogue

2.1. Inaugural Session

The dialogue began with an inaugural address by Dr. Leena Srivastava, Vice Chancellor, TERI University. Welcoming the participants at TERI University, she underscored the importance of this dialogue in the context of the challenges in finding win-win solutions to climate change and the prevailing uncertainties about the time and scale of climate risks and their complex relationship with development and decision making processes. She urged the participants to approach the dialogue from a perspective of responsibility of educators in defining the use and scope of the discipline of economics in order to address more complex issues. Dr. Vivek Dham, Advisor-Research and Innovation, EU Delegation to India encouraged the participants to come up with path breaking ideas and provided an overview of various funding opportunities for climate change researchers that EU offers. He hoped the dialogue to conclude with an idea for further research that EU may support.

2.2. Introduction to on-going research

This session focused on the research being under taken by some of the participants as part of the CARIIA consortia. Dr. Christian Siderius provided an overview of the research being carried out by different participating organizations under the Hi-AWARE consortium and elaborated upon the work focusing on “Himalayan Adaptation, Water and Resilience Research on Glacier and Snowpack Dependent River Basins for Improving Livelihoods”. This research analyses the critical moments of stress, the events that acted as an impetus to embrace adaptation, and, the pathways involved in the process of adaptation. The research divides the adaptation policies into three broad categories. Firstly, local approach, secondly, regional approach, and, finally, Asian scale approach. The local approach concentrates upon the adaptation techniques employed by the locals at the village level. The regional approach is used to calculate the regional adaptation capacity index. He noted that in the region water availability is changing so is economics. In this changing context, to assess the value of water availability, the idea of cost curves is useful, but needs improvement.

Introducing the PRISE consortium, Ms. Estelle Rouhaud elaborated on the research focusing on the pathways to equitable and resilient development in semi-arid economies. Semi-arid economies are predominantly agriculture centric economies that rely greatly on rainfall for irrigation. The growing risk of climate change, which is indiscriminately affecting all terrains seem to have a bigger negative impact on the livelihoods of people who are currently living in semi-arid terrains. This research tries to understand and strengthen the commitment of the key decision makers in local and national governments, businesses and trade bodies to rapid, inclusive and resilient development in these regions by deepening their understanding of the threats and opportunities that semi-arid economies face in relation to climate change.

The major research themes are as follows

- Migration Futures in Asia and Africa: economic opportunities and distributional effects
- Migration, remittances, adaptation and resilience in arid and semi-arid regions of Senegal and Tajikistan

- Value Chain Analysis for Resilience in Drylands (VC-ARID): adaptation options in key sectors
- Enabling environment for private sector/multi-stakeholder action to strengthen resilience to climate change
- Property regimes, investments and economic development in the context of climate change in semi-arid lands
- Cross-boundary multi-scale governance of semi-arid lands: Implications for climate resilience and economic development
- Water governance in semi-arid lands: political and economic insights for the management of variability and extremes in a changing climate
- Subjectivity, resilience and well-being in Kyrgyzstan

Dr. Amir Bazaz introduced the participants to the research focus of ASSAR consortium and elaborated upon the barriers and enablers for effective adaptation along with the factors that enable more widespread, sustained adaptation. The study concentrates on the ways to enhance large scale adaptation techniques in semi-arid terrains. The project currently stands at the phase of data collection, which deals with mapping vulnerability, coping mechanism, response outcomes, and, intra household dynamics of the urban and rural economies located in semi-arid regions. The major research themes that the project tries to answer are as follows:

- *Dynamics of ecosystem services*: How can ecosystem services be managed and governed in an equitable manner to support wellbeing in the face of climate change?
- *Governance*: How do existing governance structures help those most vulnerable to adapt to existing climatic and non-climatic dimensions of risk?
- *Social differentiation*: How can transformative adaptation (that is effective and challenges existing inequalities) be achieved in highly differentiated and unequal social contexts?
- *Knowledge systems*: In what ways do current knowledge systems around climate change act as barriers or enablers to effective, widespread and sustained climate change adaptation in semi-arid regions? What responses are needed to shape these knowledge systems to enable more effective, widespread and sustained adaptation?

Dr. Inaki Arto (DECCMA) provided an overview of DECCMA consortia and elaborated upon the research design of the economic modelling framework in deltas. A delta is a very complex system where multiple players are involved. An adaptation strategy in deltas has to take into account rapid environmental and demographic changes that can take place in a drastic manner. The study aims to assess migration as an adaptation in (a) Volta Delta (Ghana), (b) Mahanadi Delta (India), and (c) GBM delta (India and Bangladesh). The aspects this research will give special attention to are sustainable gender-sensitive adaptation, migration process and the role of climate change adaptation choice with focus on migration, governance mechanism of deltas and vulnerability in deltas. The economics work, using CGE Modelling techniques, will focus on identifying scenarios linking the impact of climate change with jobs and livelihoods, migration fluxes, adaptation options and socio economic options. In setting up the model, biophysical and socio economic context of each delta and the economic links with the rest of the country will be taken into account.

2.3. Panel Discussion

The panel discussion with Prof. Samuel Fankhauser, Dr. Prodipto Ghosh and Prof. Eddy Moors was tasked to provide guidance to participants as to how to use and interpret the economic tools for adaptation research. Prof. Fankhauser and Dr. Ghosh cautioned the participants to be clear about the limitations of various economic models and tools. Prof Fankhauser noted that it is important to give careful attention to the dynamics of information, uncertainty and agent responses. Dr. Ghosh pointed out that in interpreting the results a policy maker is always confronted with competing ethical frameworks as decision making takes place in the context of multiple policy objectives. The issues of reason blindness in assessing revealed preferences through the concept of willingness to pay, diverse stakeholder interests, and abilities of different actors are all important to consider right from the beginning. These issues, and alike, must be given proper attention in setting up the model and assumptions. Most importantly, economic tools are data sensitive. Test of robustness of results through sensitivity analysis, therefore, is critical for quality research. Prof. Moor underscored the importance of engineering in the adaptation for climate change. He also insisted that scale and flexibility in decision making plays an important role in the adaptation to climate change. The involvement of stakeholders in decision making is more important and it is effective in the large scale. While the need for research is urgent, reliability and innovation can be ensured only if stakeholders' interests and capabilities are comprehensively incorporated.

The discussions with participants brought out following questions critical in conducting research on economics of adaptation:

- Selection of appropriate tool
- The extent to which adaptation is an economic question
- Meaning of evidence based research for policy
- Distinction between autonomous and induced adaptation
- Measurement of successful adaptation
- Uncertainty and sequential adaptation
- Importance of research and knowledge generation on implemented projects
- Agenda of adaptation driven funding

3. Thematic discussions

A brief summary of research presented by resource persons on different themes, and subsequent discussions is given below. The presentations can be accessed at the following link.

<https://drive.google.com/open?id=0B-NTjRqRncM3V2VBTGkwcVVUWkE>

3.1. Cost-benefit Analysis

A. Flexibility as adaptation option

Dr. Christian Siderius presented his research using hydro-economic model to assess whether flexibility in agricultural practices and resource utilization can be an adaptation strategy to address variability in rainfall. The adjustment in the cropping area in light of the anticipation by the farmers

of the weather variability and variation in water availability is considered as an adjustment or flexibility. For flexibility farmers require certain knowledge in water availability, overall cropping pattern, types of crops and land use practices etc., Usually, literature focusing on rainfall and food production focuses on the interaction between rainfall and crop yield per hectare of land. However, in semi-arid and sub-tropical regions the cropping area is not stable because of weather stock. Hence the model to estimate food production needed modifications to incorporate flexibility. The model thus included historical data on costs and prices as well in addition to rainfall, cropping area, yield, and total production and imposed a restriction on use of groundwater. He argued that by being flexible, farmers can increase their income upto 30%, even though total production is marginally reduced. Large scale investments to support flexibility in rainfed agriculture, with supplemental irrigation where needed, are required. In his modelling exercise he relied on observed data on rainfall, tanks outflow, groundwater use, cropping area and yield. This was complemented by interview with over 220 farmers growing rice, sugarcane, groundnuts and other crops gathering information regarding groundwater use and yields. The interviews provided insights into how the flexibility in the land use in relations to availability of water is exercised / understood by farmers. Another alternative to observe flexibility used in the study is to rely on satellite base NDVI for northern India, Nepal and part of Tibet. The satellite data helps to detect the production using greenness as an indicator called NDVI. Comparing this with the data set on rainfall for individual locations for each grid point may indicate if rainfall variability could explain variability in crop production.

The discussions suggested incorporating structural and aspirational aspects into modelling and alternatives for flexibility. For further research he suggested to examine following questions:

- Is flexibility for everyone?
- What level of flexibility is acceptable at national level?
- How do we organize global water & (food) trade governance? (and how do we best estimate trade-offs?)
- Overall, what enables such flexibility and how do we account for structural changes in our analysis? Should investments in technology be informed by the aim of supporting farmers to be flexible via enabling best use of forecasts, connectivity to markets, insurance schemes and storage facilities, to name a few?

B. Environmental cost-benefit analysis

Dr. Sukanya Das, explained the concepts of cost benefit analysis (CBA), social cost benefit analysis and environmental cost benefit analysis. CBA is used to estimate if community as a whole is better off or worst off as a result of the project. It mainly focuses on aggregation of social welfare of the community. She explained the steps to conduct the CBA: mainly identification of costs incurred and benefit gained by the communities and others. Mostly these are valued at market prices. If the costs and benefits accrue at different point in time, then present values are calculated using discounting rate. CBA then requires comparing present values of all benefits with present values all cost and calculation of net present value (NPV) of the project (Sum of PV of all Benefits minus the sum of PV of all Costs). A project is considered viable only if the discounted benefits exceed discounted costs. Contrary to the CBA, focusing on commercial profitability of a project, the social cost benefits analysis aims to maximise the social welfare and uses shadow prices which reflect the opportunity

costs of resources/outputs to society. She illustrated the application of CBA techniques through a case study of Dadri plant of the National Thermal Power Corporation (NTPC). The plant is 20 years into operation and wanted to assess its viability in the context of revised tariffs. A comprehensive analysis of social, economic and environmental costs incurred and benefits attained by the communities, nation, and state due to power generation was carried out. In the analysis 20 years data is used to estimate the Net present value with the discount rate 12% after that the discount rate is increased to 15% to compare the benefits. Stated preference method is adopted to understand the perception of households and works for improved infrastructure, good quality air, water, improved access to health services, and improved access to health education, improved road and drinking water facilities and recreational facilities and cost of illness. It was assessed that despite reduced economic viability, the plant was still serving the larger social interests. The discussions noted that CBA is a good ex-ante tool for decision making however its application needs to be careful in checking sensitivity of arbitrariness in discount rates or shadow pricing and boundary definition in terms of second and third order impacts.

C. Systems Approach

Mihir Mathur illustrated the use of systems modelling based analysis of adaptation options using a case study of system dynamics modelling for the grass land degradation of Banni Grassland in Rann of Kutch, Gujarat, India. The model captures interactions between grassland, *Prosopis Juliflora*, livestock and economy of Banni Grassland to assess the economic impact of various policy interventions by simulating future scenario from 1992 to 2030. Economic estimation is conducted with present value for future cash flows for *Prosopis* removal policy and cost of delay in implementing the policy. He illustrated how system modelling approach can be useful in developing adaptation strategy scenarios enabling informed policy decisions.

3.2. Econometrics

Prof. Saudamini Das, NABARD Chair Professor at Institute of Economic Growth, New Delhi illustrated how techniques of econometrics should be applied in climate change adaptation research. Elaborating on the meaning, pros and cons of econometrics she emphasized that application of econometric tools is data intensive and advised that these tools are complemented by multiple methods and approaches for robust results. In CCA, econometrics can be utilized when three conditions can be fulfilled namely - 1. Measurability – time to visualize effect on people’s behaviour, 2. Counterfactual – possibility of finding control and, 3. Model building – possibility of getting data for independent variables.

She illustrated her lecture through three case studies. The first case study looked at mangroves as an adaptation option against storms in Kendrapara district of Odisha, India. The hypothesis was that mangroves help to adapt to storms. The *measurability* factor was reflected by data on damages to village. The *counterfactual* areas were villages with mangroves and no mangroves and explanatory data also existed. Hence, this case was perfectly suited to carry out an econometrics modelling. Prof. Das illustrated how the damage function was defined as $D_i = f(P_i, V_i, W, S_i)$ wherein Damage (human death, house damage and livestock damage) = f (Population, Wind velocity, Velocity of storm surge and Socio- economic well-being). The analysis was carried out, where deaths averted by mangroves were even simulated based on two scenarios. The results showed that village with mangroves had

significantly lesser damage numbers especially if the villages were close to sea. The above vulnerability analysis has been published in 2012 by Das.

The second case study (unpublished, by Das, D'Souza and Bhatt) focused on the importance of education and women empowerment in resilience building against natural disasters in Andhra Pradesh. The result of this study based on econometric modelling showed that - Investment, women headed households, quality of house and higher educated families came out as factors for maintaining resilience in Andhra Pradesh to disasters like storms.

The third case study examined awareness campaigns as adaptation to heat waves using econometric modelling. In this study, the authors tried to establish which mode of dissemination of heat waves information helped reduce mortality rates to extreme heat wave events in Delhi. Data collection included data on newspaper circulation, radio announcements and heat stress advisory on televisions. Besides this large amount of socio-economic data was collected including health and mortality data. The results of the econometric modelling suggested that firstly, even if impact of heat stress is more in an area, awareness reduces probability of death, and secondly cumulative ad and television is the best and most robust dissemination medium for mortality reduction.

Saudamini Das, concluded that while usually in econometrics modelling, we find our research questions and then find our data, for Climate change adaptation and econometrics the order flips. It is important to first look for data, then justify it with economic theory, followed by the usual steps like looking for optimization issue, developing a reduced form and finally use econometrics.

3.3. Modelling techniques

Prof. Anil Markandya from Basque Centre for Climate Change, Spain provided an overview of modelling techniques and how economic models help in putting complex information into tractable structures so that it can be analysed. He explained the components of the models, and the strengths and weakness of using models. An important point made by him was that instead of putting effort in improving models, more effort should be invested in improving physical and economic data on climate change, which is usually incomplete and highly uncertain. He explained various advantages, disadvantages and applications of different types of models including partial equilibrium model, Input- Output model, computable general equilibrium (CGE) models, Integrated Assessment Models (IAMs) like DICER model structure, AD witch, AD dice, GCAM model. He also talked briefly about probability based models i.e. use of Bayesian model. He advised the participants to train advisors in the use of CBA under uncertainty and more importantly to recognize the limits of economic assessment as decision making is tricky in adaptation as well as in so many other area of public policy. Following the overview, colleagues of Prof. Markandya, Dr. Iñaki Arto and Dr. Ignacio Cazarro presented the ongoing research using CGE modelling techniques for assessing climate change risks in Delta regions.

3.4. Experimental and survey methods

Studies focusing on people's responses collected from survey methods suffer from the risk of reliability of data and pose challenges of both survey design for data collection and interpretation of

data. Dr. Ulka Kelkar (ATREE, Bangalore) and Dr. Upasana Sharma (IIT, New Delhi) addressed these issues. Dr. Kelkar provided an overview of Behavioral Economics, its history, some behavioural biases, its impact on policy and research and a case study from Karnataka, where such behavioural biases were at play. Behavioural economic was developed by Israeli Psychologists Kahneman and Tversky. An interesting trivia on how this branch evolved was also shared as an example to make the participants understand the concept of Behavioural economics. The example was about how a group of economists found it difficult to decide whether to continue to eat a bowl of cashew nut or stop given that there was dinner later. It was observed even after knowing that dinner was to succeed the event, they didn't stop eating the cashew nuts until someone actually took away the bowl. Similar examples were discussed with the help of images and small stories. For example, an optical illusion example of line painted closer and closer on a sharp bend of the road to nudge people to decelerate was shown, on how optical illusions can be used to make behavioural changes. Such optical illusions are called nudges (libertarian paternalism) or heuristics were explored and how they can inform policy and research were discussed. Another behavioural bias example called anchoring was discussed wherein people tend to anchor on to a particular number because it seems the best. For this, donation example was explained where, given three values of 18, 50 and 100 dollars, people tend to pay 50 which seems the best value as 18 is not a round figure and 100 is too high. Other behavioural biases explained included

- Status quo – stick to default option than switching to alternative
- Conforming to social norm
- Sunk cost bias
- Endowment bias
- Satisficing
- Loss aversion
- Risk aversion
- Temporal discounting

All these biases can have policy implication, as there is usually a discrepancy between what people say and people do. Biases can affect the interventions in climate change research. Hence, it has implications for CARIIA researchers as well and it important that efforts are made to understanding peoples choices even maladaptive one that increases vulnerability, designing and interpreting survey responses better and designing adaptation interpretation more effectively. Some advice meted out included

- Framing of choices makes a difference (loss oriented message is received more strongly than gain oriented messages)
- Interpretation of numerical scale is always better when words explain the scale.
- Designing an interview questionnaire should always have specific questions first rather than general questions. Effects such as Order, Primacy, Recency and Priming should be looked at.
- Simplification of information is important
- Boomerang effect wherein information message combined with emotional nudge helps to create a stronger impact. This was even tested in California and India, wherein electricity bills were accompanied with graphs of neighbours consumption plus smiley to emotionally nudge people into taking up electricity saving actions.

Dr. Upasana Sharma explained the method of Randomised Control Trials (RCTs) and its use in climate change adaptation research. There are two types of statistical studies, observational studies where associations are made between different variable but causality cannot be established, and experiments which can help apply causation with the help of RCT. The reason observational studies cannot conclude causality are because of the presence of Confounding variable whose presence effects the response and explanatory variable and can lead to invalid conclusion, as their impact cannot be separated from explanatory variables impact on response variable. RCT helps control such confounding experiments. The steps of RCT follow closely the steps of a Classical experiment i.e. identification of independent and dependent variable; identification of Control and treatment group; application of Stimulus/intervention/treatment and Pre-test and post-test.

Upasana's own team is currently carrying out an RCT in Haryana, for studying the impact of Agro-Met advisory on farmer's decision to irrigate his fields. They are studying whether farmers use rainfall forecast as an indicator for irrigating their fields. Since her own RCT was in the initial stages of village selection, she even discussed a published paper - Shame or subsidy revisited: social mobilization for sanitation in Orissa, India. This paper conducted RCTs to understand whether awareness campaigns nudge people to take up sanitation activities.

Upasana also cautioned that RCTs cannot be used at all instances and their use should not lead to any adverse ethical and social implication. For example carrying out an RCT to find out whether cigarette cause cancer. There are lot of Quasi-experimental methods that can be used to give insights and make inferences. Moreover, RCTs are expensive so the designing should be robust to prevent its failure. Measures like DID i.e. double difference can be taken to remove differences that have cropped up over the time of study and not because of the intervention. DID is technically – first, difference between two groups pre and post and second, difference between control and treatment. Context is extremely important and must be always kept in mind when designing RCT. Moreover, RCT are not be all or end all, esp. for policy decision. RCT only gives strong causality hence, methods like direct observation; ethnography can be used to supplement the study.

3.5. Framing 'Migration'

Migration has been seen by many as an adaptation strategy. However, drivers as well as types/pattern of migration are diverse. Therefore, migration needs to be understood in that context only. The framing of any migration study is critical. The Session focusing on migration engaged with the diversity of drivers and patterns of migration as well as of framing.

Dr. Tuhin Ghosh explained the various dimensions of migration in Satjelia Island in the Indian Sundarbans, India. Sundarbans is one of the world heritage sites accounting for 4.3 percent of mangrove cover in India. 4.6 million people depend directly or indirectly on the Sundarbans out of which 34% of people are under poverty. In recent years, Sundarbans has experienced population explosion putting pressure on livelihood options. People are returning back to traditional farms practices like agriculture, honey collection, fish catching etc. Resource is less but the competition is increase exponentially. He focused on the Satjelia Island, an area of 56.66 km square. Main livelihoods options of the island are mono cropping based agriculture, inland and off shore fishing. The area faces issues such as increasing salinity in river water and sand, increasing temperature and rainfall, cyclones and river bank erosion. There is no adaptation policy to safeguard. There is

increase in investment but decrease in production and productivity. The Satjelia Island has 24 villages with 3037 households out of which 2894 households adopt migration, including out migration, as a coping mechanism. In this Island migrants are mostly seasonal. Average age group of out migrants is 40-45 years whereas it is 36-45 years for in-migrants. Male or female are mostly going as construction laborers with the average age group of 25-25 for male and 36-45 age group for female. Remittances per month for male are 6031 INR and for female it is 4086 INR. Explaining his methodology and approach for the study, he explained that people don't know our criteria of hotspots or other concepts. So asking direct questions would not give correct results. Hence, he chose to train villagers for study through persistent personal engagement. For example, instead of asking direct questions about climate change, some of the awareness questions were asked about the climate change such as fish catch quantity today and 10 years before etc. This is much better way to access people: ethnography but without following a set step by step approach. He also underlined the distinction between **climate induced migration and opportunity induced migration**. For the study 56 persons were trained in the island and 3 from each village with 7 subsidiary training and they identified the households for pilot study. Persons were selected from within the villages. Modified questionnaire parallel with surveyed with 7 villages with 3 month time duration. It was also supplemented by focused group discussions.

Dr. Chandini singh focused her presentation with the **framework of effective adaptation as enhanced well-being**. The goal for the framework is to attain the well-being of the communities which derived from dynamic systems namely climate, environment, society and economy. She underlined the distinctions between the subjective and objective well-being of semi-arid region in the context of the definition of adaptation given by IPCC as 'the process of adjustment to actual or expected climate and its effects' ..."seeks to moderate or avoid harm or exploit beneficial opportunities".

She started with case study conducted in Gulbarga and Kolar districts of Karnataka. 17 villages across both the district were selected. A survey of 840 households was conducted along with 24 focus group discussions and 16 life histories as methodological tools. As findings she highlighted the presence of both push factors as well as pull factors:

- Push factor: Environmental degradation increases climatic variability leading to migration.
- Pull factor: Changing aspiration, employment opportunity, and disinterest in farming lead to migration.

Adding to the discussion on framing of migration, Prof. S.Chandrasekhar, IGIDR, Mumbai posed a question **whether migration is a coping strategy or adaptive strategy?** Looking at the National Sample Survey Organization's (NSSO) data as well as other survey data on migration he deliberated on the need for a National Migration Policy as a part of broader development policy framework. He noted that the NSSO data for 2013 showed a large number of farmers disliking or wanting to take up other occupations. He noted the three stages of rural non-farm employment transition: change in nature of job, technology making jobs irrelevant, large migrations from urban to rural and rural to urban areas. In the context of **link between migration and agricultural incomes** he linked the discourse on migration with the discourse on small farms and land fragmentation. He argued that small is beautiful but it doesn't give livelihood. Aggregating land is one of the options and strengthens local system to cluster the agriculture land. Efforts like building farm pond to cope up

with the water scarcity, availability of credit etc. play a major role in it. Noting that these aspects are deeply rooted in socio-cultural relations, he stressed upon the need to understand the cultural dimension of migration as well.

Shriya Anand, IIHS, Bangalore further elaborated upon the sociological aspects of migration. Sharing her study with the Ola and Uber drivers in Bangalore coming from 10 different districts adjacent to Bangalore, she pointed out the **transferability of skills and lack of opportunity play important role** in the pattern of drivers' migration choices. Intra-city variation and heterogeneity of the migrant drivers prevail among Ola as well as Uber drivers.

3.6. Well-being framework: Cross-Cutting Survey Analysis and Economic Experiments

Professor Martine Visser (University of Cape Town) along with Mr. Arjun Srinivas (IIHS), Chalmers Mulwa (UCT), and Zachary Gitonga (UCT) shared their work on using Cross-country surveys to study adaptation to climate change in Semi-Arid regions in India, Tanzania, Kenya, Namibia and Botswana. They focused on the need to understand the drivers of vulnerability in these regions and explore viable adaptation options to inform on policies that can promote resilience to the increasing threats. Taking a wellbeing perspective their work builds on more than 1500 household surveys examining the role of social differentiation, perceptions of climate change access to information on both coping strategies and longer term adaptive strategies within households, across multiple countries in semi-arid regions, across 2 continents.

Against the traditional economic approach focusing on considers impacts on income and expenditure, GDP growth etc., the Wellbeing approach attempts to bring in a holistic perspective that incorporate a more complex set of outcomes. It considers materials outcomes, relational outcomes and also subjective outcomes. It takes into account not just about what people have, but what their goals and aspirations are; what they are trying to do with what they have, and about what choices they make in trying to achieve these goals. A study of vulnerability from the Wellbeing perspective ensures that social, environmental, economic, and institutional aspects of climate change vulnerability are covered. In that it captures vulnerability in its multi-disciplinary, multi-scalar, multi-dimensional, dynamic, socially differentiated, holistic and embedded form.

The survey approach for the study in its pilot phase collected different experiences within households through more than one informant, including under 18s. It included questions on likely areas of difference, subjective wellbeing and complemented with other methods to capture subjective and social dimensions. The use of Wellbeing approach and its findings were illustrated by three ongoing cases studies:

1. Differential vulnerability and adaptive responses in some of the semi-arid parts of India and Southern Africa. (India, Namibia, Botswana)
2. Livelihoods diversification and effect on household wellbeing in India, S. Africa, E. Africa
3. Impact of Migration on Climate Change Adaption and Social Protection in India and South Africa

3.7. Risk and adaptation finance

This session focused on tools, governance and accountability in Climate finance. Dr. Swenja Surminski, LSE elaborated on the risk dimension of adaptation and how financial instruments can help with adaptation, particularly insurance. She defined risk as a function of exposure, vulnerability and hazard and as a dimension of adaptation. In adaptation studies risk can be managed by identifying right mix of options between Economic CCA tools like Cost curves; risk reduction pilot studies which provide testing and learning lessons and risk layering instrument that match risk and instruments. One such instrument is Insurance and it has a long track record in supporting adaptation. Dr. Surminski highlighted the existing types of risk insurances offered across the globe like agricultural risk insurance based on crop loss; indexed insurance linked to parametric triggers like absence of rain for particular number of days; G7 climate risk insurance; mutual crop insurance policy; remote sensing based information and insurance for crops (RIICE); African risk capacity; Afat Vimo (Disaster Insurance) Policy (AIDMI). She indicated that all the insurances had their own set of pros and cons and it was necessary to understand the insurance before it is utilized. For example, the commonly utilized crop insurance based on crop loss is calculated at an aggregated level leading to lack of compensation in many cases, or in indexed insurance where the parametric trigger condition is not met by a small margin. Moreover, insurance should not lull the insurance takers into a false sense of security which could create maladaptation due to increased dependence on the insurance payout and reducing their focus on other innovative solutions to fight climate risk. The other disadvantages of insurance also included were that they were expensive schemes and usually have high transaction cost.

Dipak Dasgupta, Former Board Member, GCF and Former Advisor, Ministry of Finance, Government of India shared his experience on how climate finance is handled at ministerial level. The scale of problem of adaptation in India is 'dramatic' and 'big'. If numbers were calculated it would account for 2.8% of India's GDP. It is extremely important thus to first work out the numbers regarding the scale of the problem. Once the numbers are punched a clearer direction can be created for allocation of financial resources based on need and urgency. He focused on the importance of research for climate finance. According to him, the needs of the hour are – building a more robust meteorological systems; increasing usage of new technology like remote sensing; building database on risk; having high frequency locally adapted data, network building and having specialized financial cells for Climate change adaptation in financial institutions are of the utmost importance. Another aspect he adjudged important was increasing community understanding for building sustainable policies which included financial inclusion of the communities. He also stressed that technically there are no specific criteria for financing climate change adaptation; just broad goals which included aspects of social acceptability, participation and good safety net. He also dwelled on changing nature of crop insurance in India. He said that a new policy which focused on indexed crop insurance, increased subsidies and reduced burden on farmers was being formulated.

Prof. Purnamita Dasgupta from IEG, talked about the importance of understanding the producers and user of information. She focused on how important it is to know that if the knowledge produced doesn't have a community feedback and comes in a top down manner, it will often fail to generate results. This is because while the thinking of policy makers may be robust the lack of transparency or understanding of context would fail to bring about community participation. There are examples of how people perceive risk across the world and how it impacts their decision making. One such

example was of Hurricane Katrina where after the hurricane, a large number of people bought insurance but a few years after most of them bought out of the insurance by not paying its premium. The reason behind this was that people realized that an event such as hurricane Katrina was a one off event with low probability of a second occurrence within their life span and hence made no logical sense to take insurance. On the other hand, in Japan insurance to risk is high because it has a long history of disasters. However, she emphasised that it is important for the people to take an informed decision. With increased climate change, the events like Katrina may have an increased probability, making it wise to take out an insurance but this information again need to be generated and distributed to the users so that they can make such decisions.

3.8. Entrepreneurship

Participants in the workshop interacted with different types of leadership in building resilience among different communities. Mr. Elango Rangaswamy, a local leader from Tamil Nadu, who was awarded the Ashoka award for local governance, shared his experience of mobilizing villagers towards self-reliance and importance of local participatory governance. He reiterated that villages are our natural resource base and we need to empower the villagers. The first step at the national level for this was the Panchayat Act in the Constitution, which gave back some power to the villages. The Panchayat is at 3 levels, village, block and district. The Panchayat is a local self-government according to the 73rd amendment and has two facets: a Constitutional mandate of gram-sabha (people's parliament), and people vote and govern themselves and have access and right to talk to their panchayat members. He then highlighted the example of his own village to show how self-governance can lead to self-reliance and resource independence. Mr Ramaswamy was the president (Kuthambakkam) from 1996-2001 of his village panchayat. Under his leadership, villagers made five-year plans which included repair of roads, school, water facility and irrigation system. All these initiative were possible within the village. However, power dependency was still on the grid. According to Ramaswamy, removing this dependence was important to move to complete SWARAJ (Self-governance). Energy audits were done to understand energy pattern and identify options to save electricity. Subsequently, following initiative were taken:

- Converted streetlight from tube lights to 18 CFL lamps, created indigenously with the help of SHG. Every year 3 lakh 50 thousand was saved by the panchayat. This was advocated to the families, with support from panchayat for conversion to CFL.
- Energy saving burner (kerosene) – Saving 2 litres of kerosene from earlier 10 l. Saved money of around 2 lakh per month in the village. Plus making these innovative burners became a model cottage industry
- Green bricks and building materials – Rs. 60 lakhs saving
- Energy saving fans – 23Watts also been promoted.
- Solar DC home systems

According to Ramaswamy, developing a role model panchayat can be considered equivalent to demonstrating working of a small country and the knowledge can then be distributed. It is important, hence, to help the community to build and support themselves, to the extent they can. This includes effort to generate their own energy to create self-reliant village. Then burden on the government will decrease as communities will become stronger. The goal of the world is and should

be sustainable development and reducing the difference between income groups. Creating many such model villages can do this. Ramaswamy even has a Panchayat academy which is a platform for people to discuss innovative ideas to help create such model villages, 700 panchayats are currently enrolled under this academy.

Mr. Jaideep Srivastava from NABARD, the National Implementing Entity (NIE) for the Green Climate Fund, shared his experiences on Climate Change project financing and implementation as the GM of NABARD. NABARD is an apex institution created in 1982, by constitution for integrating rural development, creating resilience in local communities and having rural prosperity. NABARD was created to help the farmers by providing them support. It focused on building resilience to become self-sustaining, through livelihood generation, institutional development like farmers clubs, promoting informal groups for share croppers so that they can access formal credit institutional development securing natural landscapes like watershed development, technology transfer like drip irrigation, women empowerment through SHG, creation of go-downs and market yards.

With increasing climactic risk NABARD soon forayed into financing climate change adaptation projects as well to help rural communities According to Srivastava, the areas that are the focus of NABARDs attention with regards to climate finance include, sustainable organic agriculture, creating local markets, creating farmer collectives, promoting Farm Sector Promotion Fund, creating weather stations and weather advisories, promoting WADI model, creating bank credit for natural resource management. A large number of activities overlapped with their existing work but with an additional aspect of understanding climate dimension. He discussed the multiple sources for climate finance both at International and National level that India can access for it adaptation needs. There are three major funds namely - Adaptation fund under UNFCCC, Green climate fund under UNFCCC and national adaptation fund for CC (GOI). The sources of the funds, their utilization, implementation, pros and cons and progress were also discussed in the session. For example, according to Srivastava, the international fund, the GCF, is very limited from India's perspective in terms of resources it has to offer. Hence, projects need to be tailored according to the budget of the fund and its requirement which is a difficult task leading to slow progress. According to Srivastava the key learning from all their climate adaptation projects boiled down to following tenets:

- Conceptual clarity of project and fund
- Stakeholder consultation and vulnerability assessment
- Selecting Robust interventions
- Emphasis on mainstreaming/ sustainability
- Implementing CBOs
- Knowledge management

Mr. G C Shrotriya of IFFCO Kisan Snachar Ltd. shared the experience with using ICT for dissemination of climate smart agriculture advisories through mobile phones. Lack of information is major problem for smallholder farmers. It has always been a bottleneck for farmers and was addressed with the help of conventional extension services initially. Beyond conventional channels, information kiosks were designed to spread information but there were connectivity and upkeep issues leading to the final revolution in the present time of 'mobile based information services'. The importance of ICT based agro advisory services is embed in their characteristics of being cost-effective, timely, large beneficiaries and contextualized. Statistics show that 80% Chief wage earners have one mobile

phone, and there is at least one phone per household, which makes mobile-based services a top choice for knowledge dissemination. Moreover, with the coming of smart phones the efficacy of such advisories has become even more relevant. Shrotriya then spoke about IFFCO Kisan, a mobile based agro information service promoted IFFCO. It is a company promoted by IFFCO, and Airtel, their communication partner. They provide 3-4 messages free of cost for area of interest besides other facilities like phone in program, mobile app. It is Public – Private partnership between IFFCO Kisan and Indian Meteorological Department (IMD). The main route for transmission of information is as given below:

Raw met data (IMD)—> Weather based agro advisory (State agricultural university)—> Message creation(IFFCO kisan) — >Message dissemination (Airtel) —> Message receiving and Feedback (Farmer)

The key to the success of this initiative is that information is provided in a crisp message for 60 seconds. Its success is measured by the number of customers and average listening duration of the message. The speaker also used some fascinating examples of how farmers and marginalized women have used IFFCO Kisan successfully to increase their productivity and create success stories. Examples included the use of information by individual marginal marigold farmer to solve flowering problem caused by pest by using the advisory function for technical solutions to more community based examples like women SHG using it for helping them rear goats and create a sustainable business model to support their families.

4. Group Activities

On the first day of the workshop the participants deliberated on their expectations from the workshop. These included, - Networking, learning about economic modelling tools generally and modelling methods used within consortia, understand links between qualitative and quantitative research, explore the possibility of linking migration research datasets across consortia, explore scope of skills-exchange between consortia members, deliberate on ways to conceptualization of adaptation and its application, explore strategies for better dissemination and impact of research, etc. Accordingly, the group activities were designed in the form of participants reflecting on the session proceedings and their ongoing research, research interests. Through this process, on final day the participants were divided into three different groups focusing on the issues of (A) Dissemination of research, (B) Modelling tools- CBA, input-output models, and CGE Model, and (c) Migration research. At the end of the workshop, following action points emerged from these deliberations:

1) migration, 2) CBA, 3) input/output and CGE model, and 4) synthesis paper on economic approaches (Amir's idea) and we could say that these themes formed the action points for the working group to take forward for after the workshop. The discussion on dissemination/research-into-use was in plenary, not in groups, and its aims was to share what each consortium is doing, what the benefits of research-into-use are, any good tips on what works and what doesn't, and future plans for the remaining period of CARIAA.

1. A synthesis paper on economic approaches to research on adaptation hot-spots based on the on-going research at participating institutions,

2. A ready reckoner on bibliography covering economic tools for adaptation research discussed in the Dialogue as well as others should be available for the benefit of young researchers, this could be part of the synthesis paper,
3. For a meaningful impact of the research, continuous engagement with policy makers, stakeholders along with media outreach should be integral to research design,
4. Participants should explore opportunities of more joint publications and sharing their research with each-other

5. Reflections by participants post-Dialogue

(A) Devjit Roy Chowdhury (ICIMOD)

- Participating in the workshop was an enriching experience. I would like to take part in future workshops, trainings or conferences on economics.
- The workshop introduced me to the literature of cost benefit analysis which I feel will be useful in my research especially for policy evaluation.
- Given the uncertainty involved in forecasting extreme events, economics of adaptation should incorporate non probabilistic methodology of climate change or use Bayesian modelling methodology to forecast impacts of such events.
- Work on migration discussed in the panel could be carried forward by building a framework to determine costs of migration.
- My interest is to work on the agriculture aspect of economics of adaptation. There is an immense potential to do cross-initiative work in this regard. A working group needs to be formed on this issue.
- Qualitative research tools such as life history methodology can complement quantitative work done by economists. The workshop highlighted various instances where qualitative work combined with qualitative data provides stronger evidence on impacts of climate change on migration decisions.
- The workshop provided a platform to discuss various issues such as migration, risk and adaptation finance, modelling techniques and Cost Benefit analysis through the lens of Economics of Adaptation.
- Knowledge generation of various fields in economics via lectures on topics like Econometrics, Randomized Control Trials, Behavioral Economics and Survey implementation.
- Interaction with young researchers on their work in various initiatives.
- Group discussions on economics of migration and possible cost benefit analysis.

(B) Rinan Shah (Ashoka Trust for Research in Ecology and the Environment, ATREE)

Migration seemed to be the undercurrent of many of the research questions where climate change was not a primary driver. Migration however did not come under adaptation in the present research scenario. The issue of adaptation which was discussed from the perspective of small land holdings was an interesting one. Small land holdings appear as the one of the causes that economic adaptation might be a difficult subject.

The idea of development was questioned with respect to the complexity of aspiration of people moving from villages/small towns to cities. The right to the city and buying the right to the city as a process of migration and adaptation was also discussed.

The generation and direction of flow of information was also explored. Who creates information for whom? Is it a one directional from the scientists/researchers to the potential users of information or vice versa? Or is it a bidirectional flow between the scientists/researchers and the users of information?

It has been understood that disasters in addition to having a one-time effect also have cumulative effects. These cumulative effects do not support the conventional insurance theories; hence new methodologies should be taken up. Non-probabilistic methodologies and Bayesian statistics also need to be considered.

An interesting explanation behind the air pollution in Delhi which was said to be driven by crop burning in Punjab was presented. The usage of combined harvester and the policy prescription of the Government of Punjab to sow paddy by June 15th and harvest by October 15th were the combined causes of this incident. The policy prescription leaves around 2 months to prepare the fields for Rabi crops which present burning as the safest solutions. The harvesters do not clear fields entirely hence burning helps in clearing the fields which is a prerequisite for some sowing technologies. This explanation showed how various biotic and abiotic factors including policy decisions and economic investments affect one another.

The introduction of behavioural economics was very useful. The session presented various methods and concepts like heuristics, biases and nudges. This would be a very impactful way of understanding people's choice, interpreting surveys better and designing adaptation interventions more effectively.

The sessions brought together the people who had been interactive via the internet. It also help the members of the consortia understand the work being done by each other. There were very interesting suggestions like sharing of the data generated, writing a paper on the methodologies of economics of adaptation and many others. Overall the workshop provided a good exposure to what the economics of adaptation entailed and what old and new methods could be used, as is or by a little tailoring.

(C) Musharat Mehejabeen (Bangladesh Centre for Advance Studies, BCAS)

- Social Cost Benefit Analysis (SCBA) as an important issue which was discussed in the workshop. As it has three pillar, economic, social and environment so the sustainability analysis of a project definitely need to blend these three issues while conducting project. SCBA should be given more focus before implementing any project. The CARIIA consortiums prioritize Cost benefit Analysis (CBA) to understand whether the project is economically and environmentally viable or not.
- Amount of damage avert can be measured by categorizing types of damages by preparing different damage functions in terms of River erosion, flood or drought.

- A vulnerability analysis can be done at the end of the synthesized report from all the river basin areas which are based in Bangladesh under HI-AWARE project
- Climate change adaptation measures need to be planned under “uncertainty” which was also a great learning from the workshop
- Partial equilibrium model can be used to understand the effect of climate change in specific agricultural sector as crops productions are highly affected by flood and river erosion in lower Teesta basin areas in Rangpur, Bangladesh.
- To understand the sudden climate change shock on the regular flows of goods and services can possible to look up if we use input output model. This model will also include the ripple effect of the climatic shock which will describe how the effect of one particular disaster event causes a series of other evens to happen. From HI-AWARE context these other events might be migration, turning into wage earners, moving towards other earning sources, breaking the gendered norm etc. Moreover to compute CGE modelling there is the need of intense crop level and non-crop level data, village level data for a specific period of time. The current scenario of not only HI-AWARE but also other consortia can certainly proceed with these specific tools in their respective projects.
- A small presentation on behavioral economics was also presented which explains how the researchers of climate change may modify their questions while conducting any surveys to the victim group. All the consortium may apply behavioral economics as a tool of preparing numerical scale of survey question, asking specific questions, inferring answer through heuristics manner (particularly in such case where it is difficult to find a specific answer).
- Considering these above mentioned economic tools, there could be many opportunities to do cross country analysis in this regard. For this need to create organized groups with certain goals and tools which will continue economics based researches. The young resources like us will be highly motivated and helpful to be a part of such group which will enhance adaptation and environmental researches in economics sector.

6. Agenda of the dialogue

	9 January	10 January	11 January	12 January	13 January
Morning	INTRODUCTION Moderator: Manish	MIGRATION Moderator: Amir Bazaz	Dialogue with ENTREPRENEURS Moderator: Manish	SURVEYS / EXPERIMENTAL ECONOMICS Moderator: Amir Bazaz	EXCURSION
09:00	Opening Address: <ul style="list-style-type: none"> • Leena Srivastava (TU) • Vivek Dham (EU) 	Panel Discussion - Framing 'Migration' within CARIIAA: <ul style="list-style-type: none"> • Tuhin Ghosh, DECCMA • Chandni Singh, ASSAR South Asia <p>Interactive learning session, titled, 'The Changing Nature of Rurality: Reframing the Discourse on Migration and Commuting'</p> <ul style="list-style-type: none"> • S. Chandrasekhar (IGIDR) • Shriya Anand (IIHS) • Amir Bazaz (IIHS) <p>With inputs from Aditi Surie (IIHS) and Jyoti K (IIHS)</p>	<ul style="list-style-type: none"> • Jaideep Srivastava (NABARD) • G.C. Shrotriya (IFFCO-Kisan) • Elango Rangaswamy (Participatory Governance) 	<ul style="list-style-type: none"> • Ulka Kelkar (ATREE): Behavioral Economics (30 min) • Upasana Sharma (IITD): RCTs (30 min) • Martine Visser (UCT): Economic experiments and tying up the earlier discussions, with sharing of some examples (45 min) 	
09:30	EWG Presentations: Brief introduction on economics work in the 4 consortia <ul style="list-style-type: none"> • Christian Siderius: HI-AWARE, • Estelle Rouhaud: PRISE • Amir Bazaz: ASSAR • Iñaki Arto: DECCMA 				
11:00	Break				

	9 January	10 January	11 January	12 January	13 January
11:30	<p>Panel Discussion: Scope of Economics of Adaptation Research</p> <p>Moderator: Manish Shrivastava</p> <p>Panellists:</p> <ul style="list-style-type: none"> • Samuel Fankhauser (LSE) (video) • Prodipto Ghosh(TERI), • Eddy Moors (WUR), • Purnamita Dasgupta (IEG) 	Session Continues	Session continues	<p>Cross-Cutting Survey Analysis and Economic Experiments:</p> <ul style="list-style-type: none"> • Brief overview of the framing of ASSAR research questions in a well-being framework and reasoning for doing so (Prof Martine Visser) • Presentation of the analytical frame that allows to do cross-country analysis on select themes, using a well-being perspective (Zachary, Chalmers, Arjun) <p>This session will be supported by Zachary Gitonga, Chalmers Mulwa (UCT) and Arjun Srinivas (IIHS).</p> <p>Facilitator: Amir Bazaz (IIHS)</p>	
13:00	Lunch				

	9 January	10 January	11 January	12 January	13 January
Afternoon	Techniques – CBA / project appraisal / Systems Dynamics	Risk and adaptation finance	MODELLING TECHNIQUES	TECHNIQUES: ECONOMETRICS	
14:00	Sharing experiences: <ul style="list-style-type: none"> Christian Siderius (LSE/WUR): Cost curves Sukanya Das (TU): CBA Mihir Mathur (TERI): Systems Dynamics 	Keynote: Swenja Surminski (VC)	Keynote: Anil Markandya (BC3)(VC)	Keynote: Saudamini Das (IEG)	
14:45		Sharing experiences: Dipak Dasgupta (TERI): Institutional and policy perspective on adaptation finance	Sharing experiences: <ul style="list-style-type: none"> Iñaki Arto (BC3) Ignacio Cazcarro (BC3) 		
16:00	Break				
16:30	Group activity & plenary: lessons from the session and knowledge gap vs policy demand, towards the production of a synthesis product Moderators: Christian Siderius, Estelle Rouhaud and Manish Shrivastava	Group activity & plenary: lessons from the session and knowledge gap vs policy demand, towards the production of a synthesis product Moderators: Christian Siderius, Estelle Rouhaud and Manish Shrivastava	Group activity Q&A: lessons from the session and knowledge gap vs policy demand, towards the production of a synthesis product Moderators: Christian Siderius, Estelle Rouhaud and Manish Shrivastava	Synthesis and wrap up - Setting research agenda - Future collaboration Moderators: Christian Siderius, Estelle Rouhaud and Manish Shrivastava	
Evening 17.30	Welcome drinks & snacks. Getting to know each other exercise	Close	Close	Workshop dinner	

7. List of participants

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Cross-CARIAA Dialogue on Economics of adaptation: Setting agenda for incremental and transformative change

9 -13 January 2017
TERI University, New Delhi

