FINAL REPORT for APN PROJECT
ARCP2009-11NSY-Roy

Role of Experiments in Sustainability Transitions in Asia

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OVERVIEW OF PROJECT WORK AND OUTCOMES

Non-technical summary

The project involved organizing scoping workshops to develop an international research programme on the role of innovative development project-level experiments in 'sustainability transitions' in Asia. Two such workshops organized were "Role of Sustainability Transition in Asia" held in January 2010 at Jadavpur University, Kolkata, India and "Innovation and Sustainability Transition in Asia" held in January 2011 at University of Malaya, Kuala Lumpur, Malaysia. The process included preparation of a background paper setting the stage for initial discussion suggesting a conceptual framework, a strategy to analyze the main challenges and mechanisms for the development, up-scaling and governance of such experiments and a strategy to investigate the opportunities and barriers for sustainability experiments. It was successfully aimed to understand how experiments can /have influenced Asian development pathways and transform some of the unsustainable systems of provision (mobility, energy, food, water, housing) as well as what lessons can be learned about opportunities and barriers for policy makers and practitioners who facilitate to set up such experiments. The workshops brought together an international group of academicians, practitioners and policy makers, especially from countries like China, Malaysia, Indonesia, Thailand, Vietnam, The Netherlands and India engaged in this unique field to develop a collaborative research strategy.

Objectives

The main objectives of the first workshop that took place in Kolkata, India in January 2010 were:

1. Giving grounds for the development of a conceptual framework for: inventorising, classifying and analyzing sustainability experiments
2. To advance a research strategy for identifying opportunities and barriers for successful sustainability experiments and
3. Identification of appropriate governance strategies to assist local level policy makers in up-scaling of experiments and increasing their impact

The main objectives of the second workshop that took place in Kuala Lumpur, Malaysia in January 2011 were

1. To synthesize and reflect on the current knowledge about innovation and sustainability transitions in Asia
2. To set up new research agendas on innovation and sustainability in Asia.

Amount received and number of years supported

The Grant awarded to this project was:
US$ 40,000 for 1 year (October 2009- September 2010) and then extended for six more months (Upto February 2011).
Grant Received: 80% of total grant = US$ 32,000 (INR 31,985/-)

Activity undertaken

1. Preparation of the Draft Background Paper
2. Generating reactions from the participants
3. Workshop 1: "Role of Sustainability Transitions in Asia" in January 2010 at Kolkata, India
4. Call for Papers/ Case Studies to be presented and discussed at Workshop 2
5. Workshop 2: "Innovation and Sustainability Transition in Asia" held in January 2011 at Kuala Lumpur, Malaysia
6. Determining the way forward

Results

1. Developing a consortium of partners interested in- and with capacity to- carry out tasks as explained above
2. Two scientific international workshops.
3. A workshop background paper and a set of short reactions to the background paper by partners as well as policy makers brought together in a workshop report.
4. A research programme proposal outlining research strategy for: (a) inventorising, classifying and analyzing sustainability experiments; (b) analyzing main challenges and mechanisms for experiments development; (c) investigating opportunities and barriers for sustainability experiments as well as their governance at a local level as compared to the OECD contexts and a funding strategy, division of tasks, timeline, budget etc.

Relevance to APN's Science Agenda and objectives

Given the transformative changes occurring in the developing Asia, the region deserves special focus in the context of Industrial Transformation research. Current research carried out by the Industrial Transformation project of IHDP has revealed that the developments in Asian countries do not necessarily have to follow conventional trajectories. There are a great number of various sustainability experiments but how they manage/do not to change the way in which current (unsustainable) systems of provision function has been analysed. Much current policy and research linked to technology, industry and sustainability in Asia relates to incremental innovations through the adoption of best available technologies. The achievement of sustainability targets has attracted less attention, partly because the Asian economies are still relatively less resource-intensive per capita than the industrialized economies. But the challenge is the decoupling of development from per capita resource intensity. Questions that will be addressed by the proposed project include: Which sustainability experiments can be identified in the Asian context? How can they be classified? What are the main challenges and mechanisms for their development? This study will prepare ground for the development of a research program on opportunities and barriers for sustainability experiments and on their governance at a local level.

In that view the project prepares a solid ground for transfer (creation) of existing (new) context specific knowledge on the human dimensions of change in the Earth system. By considering major systems (mobility, energy, food, water, and housing) and alternative more sustainable pathways of their development the project contributes to the core Scientific Agenda of APN. Furthermore, by involvement of local policy makers and practitioners already at the stage of formulating interesting

and relevant research questions as well as using their input in the strategy to develop a policy makers' tool kit, the project fully corresponds to the Policy Agenda of APN.

Self evaluation

Workshops have been very productive and successful to provide an interaction space among researchers in Asian region as well as from outside Asia to discuss challenges, existing knowledge and gaps in Asia Specific Transition studies. There is enough scope for enriching the theoretical literature through further empirical research by advanced researchers and capacity building among young researchers in Asian region.

Potential for further work

The first workshop ended with huge potential to carry forward the research on sustainability transition and it was decided that the second workshop would be designed to collate all the works in the field mostly in the form of case studies. The second workshop was designed to take stock of what has been learned in the International Human Dimensions Programme Core Project on Industrial Transformation (IHDP-IT) over the last ten years, as well as move forward by collating the research works in this field taking place in Asia mostly in the form of case studies. These two workshops together could help us in identifying core researchers in the region and prospective young researchers from the region with potential and enthusiasm. Secondly, through very productive discussions and participation of subject experts from Netherlands it has been possible to identify the knowledge gaps which can form future semi long term research agenda for years to come. The pool of human resources and ideas about way forward in the field of sustainability transition in Asian context needs to be sustained in Asian context through active interaction and regional institutional leadership. It generated a very useful integrated platform for an international network of researchers, practitioners, policy makers and other actors who are interested in innovation and in exploring how it influences alternative, more sustainable development pathways.

Publications: None

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Acknowledgments

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Preface

Two scoping workshops on Sustainability transition in Asia under the project led to the possibility of development of an international research program on the role of innovative development project-level experiments in 'sustainability transitions' in Asia. The ultimate aim of the workshops were to understand how experiments can come to influence Asian development pathways and transform some of the unsustainable systems of provision (mobility, energy, water, housing, food); what lessons can be learned about opportunities and barriers for policy makers and practitioners and about the experiments' governance at a local level. This is also the main research question that the planned research program will address.

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1.0 Introduction

The project was proposed in the form of organizing two scoping workshops which were expected to play pivotal role towards development of an international research program on the role of innovative development project-level experiments in 'sustainability transitions' in Asia. The rationale for this stems from the urgency of investigating sustainability transitions in the Asian context. Transitions to alternative development pathways have become a major theme in scientific and policy debates, emphasising the role of socio-technical innovation across production and consumption systems. This debate has focused on long-term changes across local and global scales, including innovations in technology, institutions and behaviour. Given the transformative changes occurring in developing Asia, this part of the world is particularly challenging for Industrial Transformation research.

1.1 Background Information:

Much current policy and research linked to technology, industry and sustainability in Asia relates to incremental innovations in processes and products, through the adoption of best available technologies. The achievement of higher-level environmental and sustainability targets -including low-carbon or less resource-intensive development pathways – has attracted less attention, partly because Asian economies are still relatively less resource-intensive per capita than industrialised economies. But the challenge is the decoupling of development from per capita resource intensity. Current research carried out by the Industrial Transformation project of IHDP has revealed two issues: (1) that the developments in Asian countries do not necessarily have to follow conventional trajectories and (2) that there is an abundance of various sustainability experiments. The experiments even despite of their great potential to transform these prevailing systems of provisions, they do not manage to influence them into more sustainable consistuencies.

1.2 Resaerch Gap:

Asian context raises several new questions that have not (or at least not sufficiently) been addressed in existing 'systems innovation' literature. There is a clear difference in maturity between the established systems of provision in Europe/USA and those in the emerging economies in Asia. While in Western societies systems such as transport or energy are deeply rooted and well embedded in society, in Asian countries they are often emergent, as shows the spectacular increase in private car mobility in China and India (with all the negative side-effects). Those developing systems in Asia might be distinctive in terms of being more 'fluid' and part of a wider ongoing transition towards economic growth and globalization. Another interesting dimension is the large variation in governance structures in Asian countries. In that light, one issue that needs to be better addressed is, what exactly are these distinctive features of Asian systems and how they limit or increase or invited newer dimensions for sustainability experiments. How can experiments be governed in this context?

1.3 Objective of the Proposed Research:

The objective of the scoping activity is thus to address how experiments are (or are not) linked to each other and how linking facilitates or complicates learning. Recent systems innovation literature has emphasized the importance of learning processes by making a distinction between local and global features of an experiment. Any experiment requires local innovation, adaptation and learning. Sustainability experiments with the goal to contribute to wider (disruptive) change towards

a sustainability transition, next to local level learning also require the emergence of local and global social networks. Mechanisms such as conferences, workshops, publications, dissemination of results, standardization, and best practices play a role in this development. To answer these scientific questions substantial amount of research needs to be carried out in close cooperation with practitioners and policy makers from the Asian countries. This creates a need for a more extensive research programme for which the proposed scoping activity will prepare the appropriate forum with right focus. This research strategy is thus built upon and make use of the existing knowledge in the field of system innovation studies. That particularly involves an analysis of the developments and transformations:

(i) Within the existing 'systems' providing specific need for society (e.g. energy, mobility, food, water, housing);

(ii) Outside of these systems, at a higher, international level and

(iii) How these posed barriers or created opportunities for sustainability experiments.

1.4 Resraech Questions:

The inherent research questions thus include the following:

- Which sustainability experiments can be identified in the Asian context?
- How can they be classified?
- What are the main challenges and mechanisms for their development?
- Which options do policy makers have to protect experiments or to create space for their development?
- How can more sustainable pathways be linked to or taken up by the current systems?
- How does this work for sustainability experiments in Asia?
- What role does local-level learning play in the experiments?
- What is the role of emerging local social networks in this process?
- What learning capacities and capabilities do sustainability experiments require in the context of increasing globalization?
- How is local-level learning governed in Asian experiments?
- How can practitioners strategically deal with opportunities or barriers emerging from national or international levels?
- How does that differ from governing experiments in the context of countries at different stage of development, in particular the well-established OECD contexts?

1.5 Expected outcome:

The extected outcomes of the proposed work are as follows:

1. A consortium of partmers interested in and with capacity to carry out tasks as explained above

2. This scoping activity was designed to prepare ground for the development of a research program on opportunities and barriers for sustainability experiments and on their governance at a local level as compared to the OECD context.

2.0 Methodology

Given two proposed scientific international workshops to prepare research and funding strategies for an international research programme – the way to accomplish the task included preparation of a background paper setting the stage for initial discussion during the meeting and in particular suggesting

(1) a conceptual framework to inventorise, classify and analyse sustainability experiments

(2) a strategy to analyse main challenges and mechanisms for experiments development and governance

(3) a strategy to investigate opportunities and barriers for sustainability experiments as well as their governance at a local level as compared to the OECD contexts.

Each partner reacted to this proposal from the country perspective and based on secondary information and existing body of knowledge about sustainability experiments and projects. The BG paper, the set of reactions were used in the group work and discussions that finally would lead to the definition of a full proposal outlining the research agenda, division of tasks, timeline as well as funding strategy. The proposed scoping activity aimed to bring together researchers, policy makers and practitioners from selected Asian countries: Thailand, India, China, as well as scholars from Europe and USA in two small workshops. Over time we also plan to expand the geographical spread of this activity to countries such as: Malaysia, Philippines and Singapore.

The methodological steps could be summerized as follows:

1) **Firstly,** a telecall among the partners were organised to discuss proceedings and the outline of the BG paper. The BG paper was further elaborated by means of email communication over the following few months. The BG paper consisted of

   -detailout the initial conceptual framework to explain transition to sustainability through system innovation

   -a proposal for a strategy to

      (1) –inventorise, classify and analyse experiments in e.g. energy, mobility, food, housing systems

      (2) make suggestion as to how to analyse main challenges and mechanisms for sustainability experiments development. This will involve analysis of existing systems and their interaction with experiments;

   -proposal on how to investigate opportunities and barriers for sustainability experiments as well as their governance at a local level as compared to the OECD contexts so that they have the power to instigate alternative development trajectories

The BG paper was circulated to all workshop participants who will be asked to make comments about the proposals.

2) **Secondly**, following this a workshop was to be organised where partners discussed the feasibility of the entire conceptual framework. Input from all workshop participants were

internalised in the framework and after the first workshop a final research strategy was developed by the partners and it was decided that all the participants would persue their research in the form of case studies of sustainability transition in Asia and will present them in the second workshop. So, the research strategy will consist input to the second workshop.

3) **Thirdly**, the second workshop took place where both policy makers as well as potential funders of the following research program were involved to discuss the framework, feasibility and funding possibilities. During this meeting the project team together with participants and especially the policy makers discussed issues relevant for the development of a policy tool kit. The scientific outcomes of the process will be elaborated in a (set of) publication (s) after the second workshop.

4) **Finaly**, Partners prepared scientific workshop reports for both the workshops.

3.0 Results & Discussion

Both the workshops involved various stakeholders and policy makers working at different levels in the formulation of the agenda of the planned research programme, articulation of research questions and ways to address them. Especially programme managers who are in the position to influence new and ongoing experiments were invited for this dialogue and for pre-testing of the framework to analyse experiments. This is perhaps the best way to produce policy relevant science by bringing in various stakeholders on the same platform. The policy makers were involved in discussions on issues relevant for the development of the policy makers' tool kit. Such a tool was meant to help them design a successful sustainability experiment/s and design strategies to improve or govern existing initiatives. It is important therefore that those who are going to use it are involved in its creation.

3.1 Workshop 1: "Role of Sustainability Transition in Asia" held in January 2010 at Jadavpur University, Kolkata, India

3.1.1 Introduction:

The discussion during the first workshop focused on the fact that Sustainable Development is perhaps the most significant challenge faced by majority of the Asian countries. They have thus made a commitment to follow the principles of Sustainable Development. As a result majority of the sustainability experiments are flourishing under the waves of the environmental governance in Asia. There is a second wave of reforms going on in the developing countries – the first reforms took place in the 1970s 1980s when the economic reforms was the main agenda. Now the reforms are marked with policies, norms and issues guided by sustainable development. The economic reform agenda is getting transformed to sustainability led environmental reform agenda.

Although there are a lot of commitments, environmental reforms and large scale transformative actions, a key question is: "do we see substantial transformative changes in the developing countries?" In reality, in the developing nations, many developmental actions and policies are actually far from the pathway of sustainable development. There exist debate and conflict on this issue. It is important to understand the barriers of scaling up the good practices or scaling down of good policy intentions – bringing down the good policies from the global level and implementing the same at the local level.

For every economy there are multiple goals which are to be achieved and that too, simultaneously. An important question is how to move away from the current development paradigm to the sustainable development paradigm. While the older paradigm rested on the single transition pathway and phase models, the new paradigm talks of multi-level development. There is an interesting linkage between the micro, meso and macro level. The challenge is how to manage the shift from the current paradigm to the new sustainable development paradigm. The transition is not easy- it is a complex process and the long term on, therefore, management of this shift is equally important. It is important to assess whether the development programs that are being embarked upon will really lead us to a sustainable development pathway.

It is believed that whenever a new technology is introduced it creates a niche and the challenge is how this niche can be taken up to a larger level. An equal important dimension is the management of the new socio-technical regime and the networks of actors and stakeholders that emerge with this niche. Given the difference of socio-technical commitments it is extremely important to analyze the process by which the small experiments can be scaled up and taken to a larger audience. Some experiments die because they have not been fostered well at the meso level and not interlinked at the macro level. The management of transition of the experiments from the micro and meso level to the macro level is extremely important.

The current project (and, hence, this workshop) deals with the question how far the framework of nested hierarchy is applicable, in the context of Asia for explaining the transition of the sustainability experiments from a local to a global level; what is the global connectivity of and between these experiments given the trade linkage between the countries. Given the upcoming issues like the Global Common, there cannot be just a local or regional agenda but all such agendas must lead to a global agenda. How one orients a local agenda into a global one is an important research question. The literature says that there are a lot of sustainability experiments in different Asian countries and the important research question is how to collate all these experiments within a single framework and understands their connectivity (transition) to a global plain. This is not possible by an individual- it is a multi disciplinary study and a co production of knowledge. The research agenda requires participatory knowledge management and active interaction with the actors of the sustainability experiments in Asia.

3.1.2 The Role of Experiments in Sustainability Transitions

This part introduced the sustainability transition research and the role of experiments in sustainability transitions through an informative and detailed presentation. The main points could be summarized as follows:

- The contemporary societies face many problems and there are problems in many sectors. Some of these problems are persistent in nature and cannot be solved through “end-of-pipe-solutions”. The problems have been aggravated by the social cultural and environmental changes. On the longer term there are problems related to environment, particularly, depletion of natural resources and climate change.
- There is a need for transition- at the system level and socio-technical level. “Transitions” imply novel and radical changes.
- Transitions have happened in the past. For example, in the energy sector the fuel has changed from wood to coal and then to oil and gas, and finally to nuclear sources.
- It is interesting to note that certain social dimensions have built up around the technological changes.

- There are various social groups which have emerged because of technological changes and have played an important part in maintaining the socio- technical regimes. It is also interesting that these social groups and actors have different opinions and views which breed complexity in the process.

- Transitions are therefore long-term processes (50 years or more), multi-actor processes (science, policy, firms, NGOs, users, etc.), multi-level processes (micro, meso and macro) and co-evolutionary processes (mutual influences of technical and social changes)

The section also touched upon issues like the multi-level perspective of the desired conceptual framework, strategic niche management (SNM), socio-technical configurations, etc.

- **Socio-Technical Regimes (S-T Regimes**) are the current technological regimes that are deeply embedded in the society. The S-T regimes favour incremental changes.

- **Landscape:** These are the exogenous and autonomous trends and events that create pressure on the ST-Regimes.

- **Niches:** Spaces, which are partially protected, are the breeding grounds for the radical socio-technical innovations.

  An important question is how to understand the dynamics of transition and guide the transitions to a socially desirable level (for example, sustainability). Transitions happen when there is pressure from Socio-Technical (ST) landscapes, when ST regimes are de-stabilized and are open for change and there is innovation in the niches. The niche development tries to de-stabilise the regimes. An important research question at this context is under what condition a successful emergence of niche is possible.

- **Strategic Niche Management (SNM):** The analysis of creation and evolution of niches. The framework was developed in the 1990s and the evolutionary theories are applied to understand the evolution of niches. The main research question in this area is: "how and under what circumstances is a successful emergence of niche possible?"

  An important notion in this context is the notion of "protection". Innovations which are aimed at sustainability transitions are noble and if we want them to be successful they have to be against harsh prevailing regimes. The protections can be of various types: financial protections (subsidies); geographical protection (a specific location) where the goods have not reached the consumers; institutional protection (favourable regulatory measures); cultural protection (creating a mindset for sustainability experiments). The protection necessarily facilitates interactions of actors in the sustainability experiments and draws new actors in this space.

- **Sustainability Experiments:** Planned initiatives that embody a highly novel S-T configuration likely to lead to substantial (environmental) sustainability gains, holds a promise for radical system level changes and defy the conventional development pathways (Berkhout, et. al., 2009)

Experiments are the entry points for niche developments. The experiments question the conventional development pathway and foster new pathway. Experiments are planned initiatives that result in highly novel socio-technical configuration and ultimately lead to substantial sustainability gains. The word 'planned' requires intro sections as there may be a large number of unplanned experiments which are taking place and leading to considerable sustainability gains.

Experimentation gives rise to shared experience about the future development pathways that facilitates the emergence of new social networks and fosters a good learning process. To this effect, experiments are important. It is also important to note that one single experiment does not lead to the emergence of a niche. A large number of experiments consolidate and people start making

opinions about the experiments. It is through this process the niche develops and tries to de-stabilise the incumbent regimes.

Transitions are necessary. To facilitate transitions experiments leading to the development of niches is a critical element. Hence strategic niche management is important.

3.1.3 Strategic Management of Niches

Strategic management of niches involves understanding of two important issues- creation of niche and management of niche. Equally important is the issue of how social networks evolve and how the learning is transferred across the social networks. The other important issue in SNM is how the outcomes of a particular sustainability experiments influence further experiments and give rise to further niches. One important point in the evolutionary theory of sustainability experiments is that such experiments cannot compete in the open market. This justifies the requirement of protection for such experiments. There are different points for protection but the central idea is that the protection should be temporary.

Up scaling of projects is an important step towards successful sustainability transitions. However the up scaling does not concern just a few projects but many projects which lead to sustainability gains. Replication of projects implies translating a project in other regions. An important question in this regard is what the opportunities for replication of the sustainability experiments are and how to burst the barriers of replicating and up scaling the sustainability experiments. In this context, one has to be careful about "the burden of scale"- many projects may be feasible and successful when conducted in a small scale but it may be difficult to implement such projects in a large scale.

Resistance to implementation of projects can be at different levels. Resistance can come for local groups or could come from other agents. Therefore it is important to discuss how to find organizations and people who are willing to co operate in conducting experiments, up scaling and replicating experiments and facilitate sustainability transition. Equally important is to discuss the opportunities and threats facing the sustainability experiments.

3.1.4 The Research Agenda

This session introduced the audience to the three research questions that have been set out in the background paper. He also urged the participants to ponder over an important question: are these the right questions and are these exhaustive agendas:

- **Agenda 1**: Development of conceptual framework for inventorising, classifying and analyzing sustainability experiments in developing Asia.
- **Agenda 2:** Research Strategy to Identify Opportunities and Barriers for Successful Sustainability Experiments
- **Agenda 3:** Governance Strategies to Assist Entrepreneurs in Up-Scaling of Experiments

3.1.5 Discussions among Participants

The discussion among participants is summarized as follows:

- For the sustainability experiments it is important to make sure that when one is identifying the experiments there should be filter in place to indicate these are sustainable experiments. Many experiments and transitions take place in the context of development

perspective especially economic growth. By now we know that many of the economic growth oriented pathways are not sustainable.

- In this respect in India and many other countries for instance in Bio fuel for the last 3-4 years which is pursued for local energy security to employment generation than by goals of sustainable development. There are various initiatives in India where we need to recognize the critical difference between development objectives and sustainability. For example, National Rural Employment Guarantee Act (NREGA) or solar missionetc. which are bringing other small niches together and putting them in a larger framework. Similarly, the National Rural Health Mission is fostering a lot of experiments on health sector. All such programmes are developing a new regime. Thus we need filters to distinguish between development pathways and sustainable pathways. And since there is a thin line between the two pathways, the filters have to be fine-tuned.
- One has to be careful about devising criteria for inventorisation and classification. It should be a combination of criteria.
- In designing the framework, we should also look at the experiments which have already de-stabilized the current regimes. This can give us some guidelines.
- There are two concepts - bottom-up initiatives and top-down initiatives and it is important to look into both the processes. Another important issue is to look at different sustainable experiments which have failed in the past. The reasons of failure can help design a robust framework.
- In order to find out those experiments that will develop into sustainable transition we not only have to learn from the failed experiments but also the medium local government initiatives which might be successful but may not have been identified as transition cases.
- The next big question is how the economies can move towards the sustainable development pathway or low carbon development pathway. The critical issue for the policy makers would be finding what kind of institutional, financial, capacity building would be required for sustainable energy or low cost development pathway. Most of the scientific reports of the policy makers have been based on their experiences in South East Asia, South Asia, and Africa which helps in promoting the technological transition in niche region to national and global. Putting together such regional experiences will help in understanding the concept of sustainable experiments prevalent in different parts of the world.
- Is it possible to quantify sustainability experiments? How can this be done?
- One needs to identify the different kinds of sustainability experiments and the cases. There are three important parameters - sustainability, motivation and intention. At time the proponent of the experiment labels the experiment as sustainability experiment. There are also cases where though it is not labeled as sustainable but it follows sustainable development. One should classify the experiments based on focus driven by testing propositions rather having an endless list of experiments.
- There may be experiments which are not sufficient for transition. It is needed to think about conditions as the common expectations of the users and the stakeholders. Though many innovations take place but they do not last long; some of the experiments cannot be up scaled. Most experiments are local where the actors use social networking and learning process to disseminate the information of the local experiments. It is important to study the reason behind the resistance of the local people. It has to be a multi level experiment. Moreover in reality people in different niches accept such multi level experiments.

- Do we focus on sector specific experiments or do we focus on system experiments? In India 30% of the country is urbanized at present whereas 70% aspire to be urbanized in 20years. Keeping that in mind we do not stress on sector specific but in making the whole urban system work. Thus system is more important that sector. Next, which criterion is to be taken? Which ones among lifestyle or the economic gain are the points that would lead us to make a choice of which experiments to adopt. Or is it more productive of taking all the three issues including social issues for sustainable development? If so then how does one balance them or prioritise them. What is the major barrier for sustainable development pathway in India? Past studies show that among the three pillars (of social, economic and environmental issues) environmental issue is the main barrier for sustainable development in most of the states in India. Thus how to choose the criteria is not a steady concept and is a major issue for all Asian countries. Many of the experiments in Asia are due to the Landscape change that is due to external funding and the policies which drive many of the projects and these projects live up to the funding cycle of the projects and not beyond it. Thus in the global level if there is any shift in the policy or landscape results in a shift in the National level as well. The governance in Asia is very much driven by what is happening at the external level. In Asia mostly there is a distinct similarities of experiments held in different countries one need to look into that.
- In sustainable development experiment it is important to identify the trigger. It's not important about which criteria but focus on the process of identification of the criteria.
- How to define sustainability transition? The levels of sustainability experiment be carried on whether Academic, corporate, Research and Development, Government level which will make a framework and then one can go sector wise or scale wise.

3.1.6 Discussion on Agenda 1

The participants were divided into two break-out groups to deliberate on the first research question. The following are the discussions that took place among the members of the 2 groups.

The discussion started with defining of sustainability experiments. Some of the members were critical about the word "planned" in the definition of sustainability experiments and the following are some of the views expressed by the members of the first group:

- The use of the word "planned" in the definition, as a corollary means that there exist a lot of experiments which are not planned. The planning is for novelty is called in socio-technical configuration and is not for achieving sustainable development. Therefore the word "planned" should be included in the definition as it points to the novelty. The word "planned" in the definition of sustainability experiments is not synonymous with government action but the word represents the "decision" element in the action.
- The word "planned" is apt because it says that the experiment is a decision (which has been taken after taking into account cost and
- The word "planned" points to a link to a vision of broader idea of an alternative regime which is crucial for sustainability experiments.
- However, the word "planned' should not be read as synonymous to government actions. It is in fact a goal-oriented decision which goes behind all the activities at all levels.
- Any experiments may be planned but the question is planning in relation to what. There are experiments which are carried out where the planned objective is neither novelty on socio-technical configuration nor sustainable development. Such experiments take place

out off pure private economic gains. Should such experiments be classified as sustainability experiments?

- The participants agree that even if the experiments are in response to motives for private economic gains as long as it leads to sustainability gains the experiments may be regarded as the sustainability experiments.
- After all these deliberations the group proposed a revised definition of sustainability experiments
- Planned initiatives to embody highly novel socio-technical configuration likely leading to substantial sustainability (socio-economic-environmental) gains

The next issue deliberated on was the selection criteria for experiments, i.e., which experiments should one choose?

- The filters applied for selecting experiments should be inclusive and not exclusive. By applying inclusive filters one would include as many experiments as possible and then apply the assessment criteria to measure the impacts of such experiments and exclude some of them.
- For each experiment one of the following levels can be applied.
- Experiments labeled as sustainable and leading to sustainability-it is important to note that the label sustainable is applied to the experiments by the proponent of the experiments and therefore re-examining whether the experiments lead to sustainability is important.
- Experiments not labeled as sustainable but having an inherent intention/motivation of delivering sustainability gains
- Experiments not labeled as sustainable but has potential for delivering sustainability gains
- Finally experiments which have a potential to bring about long term changes-transformation of regimes.
- The participants also discuss the need for incorporating the social acceptance of experiments as an important selection criterion. This is particularly important in the context of Asian countries where there has been instances where good projects even with financial viability and availability of finance to implement the same have failed because there was no social acceptance.

The next issue was the assessment criteria and the group defined it as the parameters for classifying experiments while inventorising experiments. Some of the proposed assessment criteria are:

It was followed by the issue of Scale- each experiment can have multiple dimensions with respect to scale and hence it is important to include all these dimensions while assessing the scale of the experiments. Some of the scales proposed by the group members are:

- Geographical scale- local, regional, national, international.
- Demographic scales- number of units in a locality, number of villages, number of towns/cities, number of countries, generation
- Cost scales
- Time scales- the time required to complete the experiments.
- Initiator of the experiment

- Geographical Level

The participants also deliberated on the issue of "potential for transition" in case of sustainability experiments. Many of the participants felt that it is not very easy to quantify the degree of change that an experiment will foster. They expressed over concern over the availability (and existence) of "enough data" to measure potential transition. However, it was discussed that the potential of transition needs to be ascertained by experts and not to be taken on the face value as claimed by the proponent of the experiments.

Up scaling and replicability of experiments are other issues raised. The group debated on this issue and many of the members felt that up scaling and replicability of sustainability experiments are not identical phenomenon. While replicability may not address the issue of increasing the scale of the experiments, up scaling necessarily implies changing the scale of the experiments.

Finally, there was discussion on the issue of uniqueness and diversity of Asia. The growth in Asia is not necessarily a hierarchical growth but a simultaneous growth in the economic, social and environmental issues. Therefore sustainability experiments will have this multi-dimensional objectives and managing this multi dimensional objectives of sustainability experiments is important. Given this complexities of experiments in the Asian context the participants raised doubts whether there can be a general framework for studying sustainability experiments or the framework must imbibe country specific factors. It was also discuss that the framework (s) applicable in the Asian context may not be applicable for the rest of the world. Given the issue of poverty in Asia, the economic lens for analyzing sustainability experiments is important while in the developed world this lens may not assume an important role.

3.1.7 Discussion on Agenda 2

The discussion started with drawing examples that would help in formalizing a research strategy to identify the opportunities and barriers for successful sustainability experiments. Some of the important points that were discussed in this interactive group discussion were:

- The technology innovation chain framework of the IPCC talks of four distinct faces- research and development, demonstration, pilot and commercialization. Therefore a possible framework for tackling research question 2 what are the opportunities and barriers to take projects from phase 1, i.e., research and development to phase 4 (commercialization)
- Not all the time technology development moves in this fashion. There could be reverse flow as well. An example in this regard is Short Message Service (SMS). All though the technology was developed long back in the laboratories of Toshiba and Sony it was commercialized only after the potential users (young people) showed how this could be used to communicate with each other. Therefore interaction between the producers and users of technology is important.
- The example of solid waste management in India the technology has been developed, the pilot has been successful, and commercialization has also been done. Once producer launches the product he finds the numbers of users are inadequate to generate sufficient revenues and guarantees a meaningful rate of interest. The reason is that the sustainability parameters are not valued in the market. Thus it is required the extra protection should be given to such projects. Social acceptance of projects is an important criterion for the success of the project and the addition of sustainability gains as a value addition to projects requires revisiting the technology innovation chain.

Experiments are the practices taking place in the society. There are experiments which are taking place at the research and R & D centre and laboratories but they are different kind of experiments.

Most interesting experiments take place between the laboratories and the societies. The present workshop probably talks of these interesting experiments. Another important area of research could be how protection evolves over time. Regarding up scaling of experiments there are two important issues that need to be addressed- what do the actors do to upscale the experiments, i.e., what do they do to organize the learning process and what do they do to organize protection? A corollary would be what are the favourable social and institutional factors that help this organization process? It is important to analyze cases which are successful and cases which are failures. In this context the role of leaders also requires close scrutiny.

In the context of barriers of experiment, two different situations could arise. 1) Funding agencies could extend funding for a stipulated period, if the experiment cannot go on once the funding is stopped then sustainability experiments face major challenge. 2) In case of bottom up voluntary initiatives, local activist may join, protectionist support might be there, but after a certain point of time the experiment might be worn out. For scaling up, 'support structure' is a much suited word than 'trigger'.

The group also discussed that an experiment can have different meanings for different niches and this gives rise to a complex problem which can act as a barrier to sustainability transition.

The group deliberated on the uniqueness/specificity of Asia in the research agenda and the following issues were identified which are very specific to Asia.

- Poverty- for many Asian countries this is an important issue and one of the goals of many sustainability experiments can be poverty alleviation.
- Presence of a huge informal sector
- And an increasingly important role of the civil societies.
- In many Asian countries multiple regimes exist and very often the regimes are interlinked. A real challenge in sustainability transition is how to manage the interlinked regimes.
- In many Asian countries the actions are in (at) the community levels and which makes the set of actors unique when compared with the developed countries.

At the end of deliberation the working group came up with the following assumptions and research questions

- Assume an interactive model of innovation
- Experiments are 'spaces for interaction' involving producers of knowledge and users of new configurations.
- Protection is concerned with maintaining these spaces
- Removal of protection relates to 'normalisation' of interaction to market interactions alone
- What interactions are happening?
- Interactions between multiple regimes (traditional to modern) and between niches and regimes
- These highly-diverse interactions generate greater potential for learning, but are also highly complex
- Asian contexts may imply multiple transition pathways
- Two Research questions:

- What do actors do to upscale experiments?
- What are the problems/tensions faced by conventional regimes that niches respond to?

3.1.8 Discussion on Agenda 3

The major focus was on two issues:

1. how certain projects are categorized as sustainable development projects and
2. How these projects could be accumulated and connected to potential niche. Terminologies such as 'niche', 'protection' and 'up-scaling' were discussed with much concern.

Some of the important points that were discussed in this interactive group discussion where:

- Niche management is one of the most important issues of concern. What should niche protect is important to identify. There might be many types of experiments with similar issues and problems. Again similar experiments might face different problems and challenges. How to integrate these projects? It is also important to identify who all are involved in sustainable experiments. Whether new groups are working with small technologies or not. It is important to identify the 'actor'. Not only actors but also it is important to identify the stake holders and target groups, not only just looking at the experiment but also by identifying the direction of the experiment. Regarding protection, what is the value of initial protection and when can it be dropped off? Regarding scale –up, some kind of clarity needs to be established: what kind of scaling we are talking about? Regional? Local? National? Or international? What are the triggers of scaling? What is the support structure that facilitates the scaling? What are the favorable conditions? What are the inputs of scaling? However, the notion of 'up scaling' is not always comfortable.
- Coming to the discussion regarding 'niche', as the title of the project contains the expression 'sustainable experiment', it is alright to use the word 'niche'.
- 'Niche' has a negative connotation. A 'niche' can also mean something related to old arrangement. What it intends to mean here is an experiment which can create a separate space? 'Exemplar' might be the word more suited in the context. It would be helpful from a policy perspective as well. The word 'pioneering' is also suitable. Scaling up might remain a concept much debated. Because it need not always be an experiments which affects thousands of population. Given a particular scenario if the experiment impacts even 500 people in a sustainable manner, it would be worth studying.
- It is important to understand why sustainability experiments are different from other experiments. There is a problem of scaling up. They are essentially not similar to any other technological innovation experiments. The word "upscale" is better replaced by "scale".

3.2 Workshop 2: "Innovation and Sustainability Transition in Asia" held in January 2011 at University of Malaya, Kuala Lumpur, Malaysia

3.2.1 Introduction

Transitions to alternative development pathways have become an important theme in research and policy debates in industrialized and newly industrializing economies. These debates have focused on long-term changes across local and global scales, including innovations in technology, institutions and behaviour. Transitions imply major changes in the way societal functions (e.g. transport, energy) are fulfilled. They are systemic in nature and involve both technological and social dimensions, hence socio-technical transitions (or system innovations). Transitions can occur for various reasons such as persistent problems (e.g. climate change, loss of biodiversity), opportunities offered by new innovations (e.g. the introduction of the motor car, the jet engine, the mobile phone), unexpected events (September 11, Chernobyl), because of socio-cultural factors such as changes in lifestyle or limitations and problems in existing systems (e.g. reaching technical limits for further improvements). Examples of transitions include a change from horse and carriage based transport systems to automobiles or from a telegraph to a telephone mode of communication. Transitions in societal functions are on the one hand much wider than changes in the organizations (such as from punched cards to computer (Elzen et al., 2004)) or changes at the level of human being (from child to adult or student to worker (Geels, 2005b). On the other, however, they form a part of a bigger societal transformation such as the one from the agricultural to industrial mode of subsistence.

For analyzing innovation taking place in such systems over the longer-term, the literature on 'socio-technical transitions' argues for a multi-level framework. The framework highlights the role of 'socio-technical experiments' in protected spaces ('niches') to enable learning in actor configurations that may transform prevailing 'socio-technical regimes' (such as electricity systems or urban transport systems) in favourable 'socio-technical landscape' conditions. In particular, this approach seeks to analyse technological and industrial changes significant to environmental sustainability, placing them in a broader institutional and governance context.

Up until now much of the current policy and research linked to technology, industry and sustainability in rapidly urbanizing and industrializing Asia related to incremental innovations in processes and products, through the adoption of best available technologies. The achievement of higher-level environmental and sustainability targets - including low-carbon or less resource-intensive development pathways – has attracted less attention, partly because Asian economies are still relatively less resource-intensive per capita than industrialized economies. Asian societies are also confronted with the necessity to decouple the development from the per capita resource intensity while attending to a multitude of social and economic problems occurring simultaneously and with greater intensity as compared to the OECD contexts.

From the research perspective it is therefore interesting and challenging to apply the new transition concepts and ideas to rapidly developing cities, regions and countries of Asia and explore whether niche-based innovations generating sustainable alternatives can direct development pathways towards a more sustainable end. Part of the research challenge is to understand better how niches, regimes and development pathways are embedded within global knowledge, production and governance networks. These connect and shape innovation in niches and regimes, and provide the channels by which they grow and come to have a wider influence on development locally and globally.

The two day IT-APN conference on Innovation and Sustainability Transition in Asia was designed to develop a critical understanding of the current state of knowledge and practices on innovation and sustainability transitions. The aim was to create a platform to facilitate interactive dialogues

between different stakeholders on the themes of sustainability, role of innovation, challenges, drivers and barriers, actors and networks, policies and governance and the case studies of success and failure mostly in Asia. The conference had two integrated parts: an initial and final plenary and a number of parallel breakout sessions. The Conference ended with a visit to environmental sustainability projects in Putrajaya, Kuala Lumpur, Malaysia- new governmental district of Kuala Lumpur. Following the interactions and discussions a proposal of setting up new research agendas through a focused group meeting was accepted by the participants.

The conference that took place in Kuala Lumpur on 9-11 January 2011 built on this rationale and focused on the nature and role of sustainable system innovation in transforming Asian development pathways in field such as energy, mobility, sanitation, nutrition and housing in urban and rural areas. The conference was the biggest meeting organized so far in that area by the Industrial Transformation project of the International Human Dimensions Programme (IHDP-IT). It brought a number of participants who already applied the transition concepts to the analysis of Asian contexts as well as many participants, including many young researchers, postgraduate students and PhD candidates, who were new to the field and only starting to get acquainted with the transition frameworks and terms.

The first goal was to take stock of what has been learned over the last ten years about sustainability transitions and in particular innovation of Asian socio-technical systems. Second goal was to identify new elements in the research agenda such as the role of sustainability experiments in stimulating Asian transitions and discuss ways to move this work ahead. A number of plenary speeches set the stage for discussions and were followed by 18 breakout sessions where specific aspects of sustainability transformations in Asia were discussed in more detail. The conference was generously supported by the APN (Asia-Pacific Network for Global Change Research), the Research Council of Norway and the International Human Dimensions Program on Global Environmental Change.

As the conference officially marked the end of the IHDP Industrial Transformation project, there was a discussion on what the project has achieved and how it contributed towards the learning and understanding of sustainability transition over the past ten years. The learning from the project puts emphasis on the fact that change involves more than technology alone. An understanding has been developed on transformation and system innovation, multi level models of social niche which is a patchwork of regime and has potential to become landscape. What is in that case needed is a converging relationship between economic and technological analysis. One such example is that of the case of energy consumption and related emission pattern. In recent time emission of greenhouse gases is posing a serious threat in the process of development. The question is whether the positive relationship between GDP and energy consumption always holds or not. Is decoupling possible? What is also important is the maintenance and distribution of networks. The study looked into the industrial transformation processes in early moving countries. These countries progressed in a particular transition path. In that case what is important is to understand that when the case of late comers is considered it is not necessary that they would follow a similar path. The problem these countries would face would be the problem of skilled man power i.e. human capital and energy resource and shortage of environmental space. So the process of sustainability transition in late comer countries is likely to take a completely different trajectory. Asia as the land of study can provide with processes and examples of multiple transformations of the system and the socio technical regime in this context where multiple models of social niche and regime could be analyzed.

It was followed by a southern perspective of sustainability transition and a brief description of policies designed in India to board the path of sustainable development, especially in the context of low carbon economy and green growth. As growing GDP and per capita income is likely to contribute towards increased energy demand, market based solutions alone could not lead to sustainable

development. The strategy would not be, however, following what has been done in the developed countries. In fact there need to be Nationally Appropriate Mitigation action, if we talk about the emission and climate change and not a top down approach. The contrast in approaches in different parts of Asia is expected and is justified in the context of different sectoral composition and national ambitions. Finally, the conclusion of the introductory session was that sustainability transition needs to go beyond consumption maximizing growth process and there need to be a complete paradigm shift.

3.2.2 New Analytical Perspective

The discussion was on transformative innovation through multilevel perspective and socio-technical network. Transformation can lead to change in practice and shift in policy discourse. Sustainability transition would require multiple radical changes; incremental change will not work. But where does the idea of transition and low carbon economy come from? Climate change has posed challenges towards sustainable development and at the same time it opened an arena to think about a new dimension in the line of policy formulation to achieve sustainable development incorporating the impacts of climate change. It gives rise to the idea of low carbon sustainable innovation solutions. Evolutionary theories of epochal transformation talk about the techno-economic paradigm. What is needed is a synthesis between innovation studies and socio-technical transition studies in order to define changes in relation to the domain of social use rather than fields of technology. It would also be important to understand the relationship between macro and micro level transition paths. The approach of multiple perspective dynamics is explained by interaction between levels and could be well analyzed within a similar framework as evolutionary economics with an emphasis on variety and selection. The innovation studies thus challenge the linear science push model. Sustainable transition innovation policies need to be challenge-led and not technology-driven.

It was followed by demonstration of the issue of strategic niche management. Setting the background by saying that the present system suffers from major sustainability challenges and as a result incremental improvements would fail to bring about any change and multiple perspectives need to be introduced. In that case it would be important to understand the conflict between experiments and classical innovation projects. Experiments affect the niche, which contribute to development of regime which would finally lead to a sustainable landscape under the condition of successful experiments. It would be also important to understand how protection creates opportunities and barriers towards niche management. The nature of protection also determines the niche adaptation and selection process. The niche management is thus important to convert experiments into modes of sustainability transition rather than simply being local project.

Then the presentation and discussion was on the partners and pathways of sustainability experiments. Since the nature of regime is heterogeneous it is important to do an ex ante analysis of sustainability experiments. The trajectory of such experiments is shaped by the internal and external factors. There are certain limitations of case study analysis. The methodological challenge remains in development of efficient conceptual framework. What trigger practices, which are the main actors, how these actors are connected to the whole system, what the important triggers are, and how to compare different groups of experiments become central questions in the context of case study analysis.

The conclusion was that small structural changes, introduced today, often have potential to transfer through cumulative changes over a period of time. But those changes need to be structural and not only incremental. The summary of the session put forward few very important questions: what are

the criteria for successful experiments? Why usually donor driven projects tend to fail? And how actors build up protected spaces?

Plenary contributions

Leena Srivastava, Executive Director of TERI and Senior Vice President of TERI-NA (The Energy and Resources Institute, North America), Washington, DC, USA in her almost 30 years of experience she has worked on a range of issues covering energy and environment policy, planning, energy economics and climate change. In her key note address she spoke about a great number of sustainability experiments that have been run by TERI in the area of energy. In particular she emphasized the biofuels experiments that have been initiated in various places of India and argued that these had been difficult to realize due to numerous unexpected problems. She made a strong point that the problems were predominantly of socio-economic nature which proves that innovation involves much more than technology alone.

Frans Berkhout, Professor of Innovation and Sustainability, chair of the IT IHDP program and director of the Institute for Environmental Studies at VU University in Amsterdam gave a short history of how societal perceptions of environmental problems changed over time and how this influenced the broadening of analytical perspectives: away from local problems and end of pipe solutions via improvements of industrial ecosystems and towards socio-technical systems change and sustainability transformations. He emphasized the scale of global development and the specific characteristic of changes that take place in Asia, which together create ample opportunities for alternative, more sustainable systems of provision and pathways of development. Given that the priority of the Asian region is increasingly on growth and poverty reduction, the major question for the scientific community is about the necessary conditions which would allow Asian countries escape the catch up model of development.

Fred Steward, Professor of Innovation & Sustainability, Policy Studies Institute, University of Westminster, London, UK in his presentation on 'Understanding transformative innovation through multilevel perspectives and socio-technical networks' emphasized a significant shift in policy discourse over the last 10 years towards a shared acknowledgement that addressing sustainability implies radical change. The shift took place not only at the rhetorical level but was substantially supported in practice by for example incorporation of ambitious targets into national and transnational agendas. Fred Steward also discussed conceptual roots and gave a short history of transition thinking. He closed by delineating four principles of 'sustainable transition' innovation policy.

Rob Raven, Assistant Professor in Transition Studies, Eindhoven University of Technology gave a talk about the role of niches and experiments in sustainability transitions. Given that experimentation is an important seed of change, he highlighted the importance of creating conditions in which experiments link and reinforces each other in a way that together they can create a strong alternative for incumbent systems. One of the very important elements is protection of novelties. Protection can be of various sorts: institutional, financial or geographical and in relation to experiments it has a number if functions: shielding, nurturing and empowering. Based on a number of examples Rob Raven has clarified the difference between sustainability experiments, classical innovation projects and development initiatives. He closed his talk by listing a number of challenges for researching on sustainability experiments in Asian context.

Xuemei Bai from CSIRO Australia in her presentation focused on urban sustainability experiments and ways to identify commonalities and emerging patterns across cases. She presented and discussed results of analysis of over 30 Asian urban good practices and considered what contributes to the success of a "good" practice, what the determining factors and mechanisms shaping these patterns are and what sound analytical approaches for identifying them are. Results of this research indicate that technology or cultural aspects are seldom identified as major barrier. Political aspects

seem prominent for both success and failure of the experiment and involvement of the state government helps. Interestingly Xuemei Bai showed that many international donor funded projects tend to stay as individual experiment, only sometimes multiplied but rarely up-scaled to change system of practice.

3.2.3 Forum on Sustainable Bio Fuel

To engage in a dialogue with policy, an interactive Policy Roundtable took place on the theme of Befuels, with participation of policy makers and practitioners involved in the field: Dr Lim Weng Soon from the Malaysian Palm Oil Board who talked about Sustainability of biofuels from Asian perspective; Dr. Faizal Parish from the Global Environment Center talking about Options and constraints for sustainable biofuels; Prof. Rasiah Rajah from the Malaya University outlining the biofuels question : beyond neoclassical argument and Dr. Geert Verbong from the Technical University Eindhoven providing a scientific perspective on biofuels. The aim of this Roundtable was to explore the potential of biofuels in replacing fossil fuels in Asian energy systems. It is because numerous Asian experiments with biofuels (production and use) are being developed with many different rationales (greenhouse gas emissions reductions, fuel security, and sustainable development) but the sustainability of biofuels is hotly contested. No conclusive response was given to the question of whether biofuels production and use is sustainable because much depends on the production systems, location, application and the general context. There was however a common understanding that they are an interesting resource that can constitute a part of the energy mix or of other applications on condition they are produced following strict sustainability criteria.

The summery of the session that emerged is as follows: Given the environmental crisis and the alarming properties of the same and how neo classical economics alone would fail to solve the puzzle of allocation of distribution mechanism of environmental resource. The international movement of resources would depend on the wage rate and interest rate as well. Countries with high wage rates and low rate of interest would tend to exploit more and more natural resource and there would be a simultaneous movement of investment from one country to the other. In that case Environmental Kuznets curve also loses its importance in the ongoing economic discourse. In that context the role of renewable energy becomes more and more important. The time is thus ideal to set the platform to understand the sustainability perspective of bio fuel as an alternative renewable resource.

Conflict between the uses of resources for bio fuel production and food material is one of the burning issues of the day. China actually banned the production of bio fuels on this ground. The sustainability of the production of bio fuel thus depends on the type of raw material, the interface between bio fuel and food production and other socio-economic and political perspectives. With respect to the production of bio fuels, therefore, some of the cases do have high potential while the rest do not. The conflict is not only between bio fuel and food production but questions do arise regarding the relationship between bio fuel production and the mechanism of REDD.

However, production of bio fuel is still in an experimental level and the scale is a limitation. The future of bio fuel would depend on how the successful experiments are up-scaled.

The forum also raised some relevant issues like where to get the raw material for bio fuels from. One suggestion was not taking a site for cultivation where carbon stock is high in the ecosystem. The use of palm oil could also lead to an enhancement of bio diversity. It would be interesting to explore processes of decoupling the use of palm oil from the use of palm biomass to avoid certain conflict.

In the context of sustainability transition two important questions regarding the future of bio fuel are related to its economic deployment and policy toward bio fuel.

3.2.4 Parallel Sessions on Case Study Presentation

The plenary debates were followed by a number breakout sessions organized on themes related with sustainability transitions:

1. Innovation, growth and sustainability
2. Transition challenges facing bio-innovation for the poor (2 sessions)
3. Measuring sustainability
4. Emerging socio-technical regimes
5. Transition analyses
6. Urbanisation and urban management
7. Governance, innovation and sustainability
8. Innovation and environmental policies in waste management
9. Sustainability experiments – drivers and barriers
10. Case studies of sustainability experiments – successes and failures (2 sessions)
11. Bio-energy related sustainability transitions
12. Politics, governance and power relations
13. Institutions and instruments
14. Actors and networks
15. Building capabilities for sustainability transition
16. Climate change, challenges, impacts and policies

A large part of the workshop was devoted to presentation of case studies from Asia on sustainability experiments as it was planned during the first workshop. (List attached in the Appendix)

Total of 65 scientific papers were presented and each one was commented upon by a commentator. Since the theme of sustainability transitions was new to many participants, all commentators were instructed to direct authors' attention to aspects of their papers that related to the conference theme. What was particularly interesting and great to observe during the breakout sessions was the increasing recognition and appreciation of the sustainability transitions style of work and frameworks within the Asian research community. The break -out sessions provided evidence that a learning process is going on and that the earlier efforts of IT supported by APN, IHDP and KSI (Dutch Knowledge Network on System Innovations) begin to bring results. Scholars who have been attending some of the prior workshops have now been practically internalizing the concepts in their own work.

The abstracts of all presented papers have been included in this report. Selected papers were invited to contribute to a special issue of Sustainability Science journal on socio-technical transitions co-guest edited by Frans Berkhout:
(http://www.springer.com/environment/environmental+management/journal/11625

3.2.5 Final Plenary

The last plenary on looking forward and new agenda had a format of an open debate of the audience with Joyashree Roy, Head of the Department of Economics and Coordinator of the Global Change Programme at Jadavpur University; Fatimah Kari vice-dean of economics faculty Malaya University; Louis Lebel, director of USER Chiang Mai University and Anantha Duraiappah, executive director of IHDP. The discussion was chaired by Pier Vellinga, Wageningen University, former chair of IHDP IT. Reflecting on the conference suggested several key areas for future research and activities:

First, improving understanding of transitions in socio-technical regimes remains an important focus for empirical research. Further progress will come from novel hypotheses and innovative methods.

Second, the opportunities for more engaged research that spans the boundaries between science and policy or practice are growing. Interest and commitments to a green economy, for example, provide an important context and target for future policy-relevant research on socio-technical regimes.

Third, research in Asia has and is likely to continue to make a large contribution to theory and understanding. An important next step in the region is to revisit and prioritize key research questions, for example, through a small working group meeting.

4.0 Conclusions

The aim the scoping workshops were i) giving grounds for the development of a conceptual framework for: inventorising, classifying and analyzing sustainability experiments, developing a research strategy for identifying opportunities and barriers for successful sustainability experiments, iii) identifying appropriate governance strategies to assist local level policy makers in up-scaling of experiments and increasing their impact, iv) synthesizing and reflecting on the current knowledge about innovation and sustainability transitions in Asia and finally, setting up a new research agenda on innovation and sustainability in Asia.

The project prepares a research programme on ways in which alternative, more sustainable development pathways can be initiated in the local contexts of Asian countries and how to empower local communities and policy makers to design initiatives that will help achieve the goal. The knowledge generated will directly help stakeholders in any future experiments.

Against the earlier elaborated background the project prepares a solid ground for transfer of existing-and creation of new context specific-knowledge on the human dimensions of change in the Earth system. By considering major systems of provision (mobility, energy, water, food, housing) and alternative, more sustainable, pathways of their development, the project contributes to the core Scientific Agenda of APN. Furthermore, by involvement of local policy makers and practitioners already at the stage of formulating interesting and relevant research questions as well as by focus on a strategy to develop a policy tool kit, the project fully corresponds to the Policy Agenda of APN The proposed project contributes as well to the institutional agenda of APN by involving the member countries in the discussion about policy agenda that needs to be put in place in order to initiate or direct ongoing changes into a more sustainable end. With regards to the institutional agenda of APN the proposed activity will involve a number of participants from the APN member countries (Thailand, India, China and possibly later Singapore, Malaysia, Philippines) in a very active manner, which will strengthen the member countries research capacity in the field. This activity will also allow non-member countries benefit from the local knowledge in the region. This will build on the earlier activities of IHDP IT in the region (2 workshops and 2 special issues of international peer reviewed journals). Being a part of the Industrial Transformation of the IHDP programme, this initiative aligns perfectly with the other global change programs. Financially the non-member as well as member countries contribute additional in-kind resources to make this initiative possible. The

planned following on research programme is a way to keep the viability of the initiative beyond its APN funding period.

5.0 Future Directions

The aims of the conference were to derive idea regarding how people bring in changes, what is the nature of societal transition process, what are the indirect drivers of transformation and what are the barriers and opportunities towards sustainability transition studies. The approach to answer these questions needs to be multidisciplinary. In the field of sustainability transition study and research four key areas have been identified: development of better hypothesis, actor centric analysis, problem driven approach and training towards development of a new area of research.

Although the important questions are raised in Asian context where experiments and rapid industrial transformation have started some time ago, but it is also relevant for other areas, in particular several countries on the African continent. It is important not only from the perspective of Asian transitions towards sustainability, but also from a general (theoretical) 'systems innovation' perspective. System innovations only can come about through interactions between processes at different levels. The nature and timing of linking and coordination processes can result in different transition pathways. The failure of the experiments in the Asian context can be understood as a lack of creating linkages or a lack of coordination between processes on these different levels. Understanding these processes also offers insight in the options to guide sustainability transitions.

The workshops opened the possibility of developing a proposal for conducting a follow-up small meeting to develop a research proposal for APN next round of proposal submission.

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Abbreviation

APN	Asia Pacific Network
OECD	Organization for Economic Co-operation and Development
IHDP	International Human Dimensions Programme
IHDP-IT	International Human Dimensions Programme -Industrial Transformation
IVM	Institute for Environmental Studies
NPUMA	International Institute of Public Policy and Management
BG	Back Ground Paper
USA	United States of America
NGOs	Non Governmental Organizations
SNM	Strategic Niche Management
S-T Regimes	Socio Technical Regime
ST	Sustainability Transition
SNM	Strategic Niche Management
NREGA	National Rural Employment Guarantee Action
IPCC	Intergovernmental Panel on Climate Change
SMS	Short Message Service
IT-APN	Industrial Transformation- Asia Pacific Network
GDP	Gross Domestic Product
TERI	The Energy Research Institute
REDD	Reduction in Emission due to Deforestation
KSI	Dutch Knowledge Network on System Innovations

Appendix 1: Agenda– Workshop 1

INTERNATIONAL WORKSHOP ON

Role of Experiments in Sustainability Transitions in Asia towards a Conceptual Framework for Alternative Development Trajectory

Jadavpur University
Global Change Programme
Kolkata, India
14-16 January, 2010

The workshop is a 'working session' to generate good ideas around next generation research – rather than to present the results of work done to date. The implication for its set up is that there are no paper presentations scheduled.

Thursday, 14 January, 2010
Venue: Jadavpur University

10:30 -11:00	**REGISTRATION**
11:00-11:45	**OPENING SESSION** Welcome and introduction of the Workshop *Joyashree Roy*, APN Project (2008ARCP-SP29-Roy Proponent) Address by Prof. P.N. Ghosh, Vice chancellor of Jadavpur University
11:45- 11:55	**Break**
11:55-12:10	**SUSTAINABILITY TRANSITIONS RESEARCH** *Geert Verbong*
12:10-12:40	**ROLE OF EXPERIMENTS IN TRANSITIONS** *Rob Raven*
	Break
12:50-13:30	**RESEARCH AGENDA** **RQ1:** Conceptual framework for: inventorising, classifying and analysing sustainability experiments in Asia. **RQ2:** Research strategy to identify opportunities and barriers for successful sustainability experiments. **RQ3:** Governance strategies to assist local level policy makers in up-scaling of experiments and increasing their impact. *Anna Wieczorek* **REACTIONS and DISCUSSION** *Frans Berkhout* The above presentations are meant to set a stage for discussion about applicability of socio-technical approach to analysis of Asian experiments and their role in inducing transition to sustainability. They are also meant to clarify some of the questions that have been signalled in the participants' reactions to the background paper. We propose that the working groups are built around the three RQs.
13:30-14:30	**Lunch**

14:30-16:30	**WORKING GROUPS on RQ1** **Conceptual framework to inventorize, classify and analyse sustainability experiments:** • Which sustainability experiments can be identified in the Asian context? • Along which criteria can they be inventorised and classified? • What adaptations and extensions to the current transitions framework are necessary to analyse sustainability experiments in developing Asia? Sectoral focus to choose at the workshop depending on the expertise & interests of participants. It is fine if all w. groups will take the same focus.
16:30-16:50	**Break**
16:50-18:15	**REPORTING BACK AND PLENARY DISCUSSION on RQ1** Presentation of the WG analyses (10 min each WG), followed by discussion about the framework. Outcome of this plenary should be an adjusted conceptual framework and a list of criteria for experiments inventorisation and classification. Can be per sector. *Fred Steward (moderation and summary)*
evening	**DINNER**

Friday, 15 January 2010

Venue: Jadavpur University

10:00–10:30	**GET TOGETHER and INTRODUCTION DAY 2**
10:30–13:00	**WORKING GROUPS on RQ2 incl. BREAK** **Research strategy to identify opportunities and barriers for successful sustainability experiments:** • What are the main challenges to and mechanisms for establishing and pursuing experiments? • What forms of protection are needed to create space for their development? • How can these more sustainable initiatives be up-scaled, linked to or taken up by the current systems?
13:00–14:00	**Lunch**
14:00–15:15	**REPORTING BACK AND PLENARY DISCUSSION on RQ2 incl. BREAK** Presentation of the WG analyses (10 min each WG), followed by discussion about the research strategy. Outcome of this plenary should be an adjusted research strategy for identifying barriers and opportunities. *Louis Lebel (moderation and summary)*
15:15–15:30	**Break**
15:30–17:00	**WAY FORWARD AND FUTURE PLANS** *Joyashree Roy and Frans Berkhout (moderation and summary)*
evening	**DINNER**

Saturday, 16 January 2010

Venue: Jadavpur University

10:00-12:00	**WORKING GROUPS on RQ3** **Governance strategies to assist local level policy makers in up-scaling of experiments and increasing their impact:** • What exactly are the distinctive features of Asian systems with respect to governance and how do they limit or increase the possibilities for governing sustainability experiments? • How to govern sustainability experiments in these specific governance contexts? • How does that differ from governing experiments in the context of countries at different stage of development, in particular the well-established OECD contexts?
12:00-12:30	**Break**
12:30-13:45	**REPORTING BACK AND PLENARY DISCUSSION on RQ3 incl. BREAK** Presentation of the WG analyses (10 min each WG), followed by discussion about the research strategy. Outcome of this plenary should be a set of governance strategies to assist policy makers in up-scaling of experiments. *Anand Patwardhan (moderation and summary)*
13:45- 14:15	**WRAP UP & ADJOURN**
14:15- 15:15	**Lunch**

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Appendix 3: Call for Paper- Workshop 2

Conference:

Innovation and sustainability Transitions in Asia

9-11 January 2011, Kuala Lumpur, Malaysia

University of Malaya, Kuala Lumpur

*** Call for Papers***

Extended deadline for Abstracts: 15 October, 2010

Sustainable development is an objective for societies world-wide. But transitions to sustainable production and consumption have been studied primarily in rich, developed countries. However, the transformative changes now occurring in the rapidly urbanising and industrialising Asian economies and societies suggest a new focus. Transitions towards more sustainable development pathways are also fundamental challenges in Asia.

Achieving a profound decoupling of economic growth and development requires innovation based on industrial and technological capabilities, as well as deep-seated social, institutional and behavioural changes. Such large-scale, structural change we term 'system innovation'.

Previous research has shown that system innovation occurs through a quasi-evolutionary interaction between innovations emerging in niches and opportunities for change opening up in socio-technical regimes. System innovation involves the destabilisation of incumbent regimes and the emergence of new regimes involving novel configurations of technologies, actors, behaviours and rules. System innovation takes time, typically periods of decades.

An important new research challenge is to apply these concepts and ideas to rapidly developing cities, regions and countries. In these contexts, socio-technical regimes are already undergoing modernisation, but often following models from technologically-leading countries. The question is whether niche-based innovations generating sustainable alternatives in these contexts can change development pathways by linking to and transforming emergent socio-technical regimes in key sectors like energy, water, transportation, the built environment and food and agriculture. Part of the research challenge is to understand better how niches, regimes and development pathways are embedded within global knowledge, production and governance networks. These connect and shape innovation in niches and regimes, and provide the channels by which they grow and come to have a wider influence on development locally and globally.

This conference will focus on the nature and role of sustainable system innovation in transforming Asian development pathways in field such as energy, mobility, sanitation, nutrition and housing in urban and rural areas. The conference will take stock of what has been learned in the International Human Dimensions Programme Core Project on Industrial Transformation (IHDP-IT) over the last ten years, as well as move forward a new research agenda supported by the APN (Asia-Pacific Network for Global Change Research) and the Research Council of Norway. We welcome an international network of researchers, practitioners, policy makers and other actors who are interested in innovation and in exploring how it influences alternative, more sustainable development pathways.

Goals

The conference has two goals:

1. To synthesise and reflect on the current knowledge about innovation and sustainability transitions in Asia.
2. To set up new research agendas on innovation and sustainability in Asia.

To engage in a dialogue with policy, an interactive Policy Roundtable is planned on the theme of Biofuels, with participation of policy makers and practitioners involved in the field. The aim of this Roundtable is to explore the potential of biofuels in replacing fossil fuels in Asian energy systems. We observe numerous Asian experiments with biofuels (production and use) being developed with many different rationales (greenhouse gas emissions reductions, fuel security, and sustainable development) but the sustainability of biofuels is hotly contested. Under which conditions could biofuels become a major energy source in Asia while at the same time being socially, environmentally and economically sustainable?

Themes

Expanding on the two goals, papers on the following themes are invited:

- Theories of economic development and sustainability
- Innovation, growth and sustainability
- Learning, capability-building and system innovation
- Sectoral innovation studies and sustainability
- Transnational knowledge, technology and governance networks and sustainable innovation
- Governance, innovation and sustainability
- Consumption, behaviour and innovation
- Alternative technologies, livelihoods and lifestyles
- Case studies of sustainability experiments: successes and failures
- Development of sustainable technologies and niches
- Socio-technical regimes and their sustainability
- Expectation dynamics and participatory methods

- Diffusion and replication of experiments
- Innovation and environmental policy
- Politics, governance and power relationships
- Urbanization and urban management in Asian experience
- Climate change challenges, impacts, and policy

Papers are invited that address relevant aspects of the above two themes preferably addressing one or more of the topics identified above. We invite historical and empirical studies, as well as theoretical contributions and policy and practice-oriented cases. Papers that address the themes of the conference but cover experiences from geographical regions outside of Asia will also be considered.

Papers and sessions

Abstracts for papers and proposals for sessions (no more than 500 words) will be considered by the conference Scientific Committee. For sessions an overview and 3-4 abstracts should be proposed, and a session chair identified. Both, paper abstracts and session proposals should be submitted to it-apn2010@ivm.vu.nl by 15th October 2010.

The conference Scientific Committee will provide decisions on selected papers and sessions by the 30 October 2010.

Those invited to present will be asked to provide short papers by 15 December 2010. These will be made available on the conference website: http://umconference.um.edu.my/it-apn2011 prior to the meeting. Authors of accepted papers will be invited to make 15 minute presentations at the conference.

Participation costs

Conference registration fee is U$150. This covers:

- Conference materials (program book and list of participants, CD, and stationery)
- Lunches and coffee breaks on 9, 10 and 11th January 2011
- Reception buffet on 9th January 2010
- Dinner on 10th January 2010

Participants will be asked to pay their own travel expenses and hotel costs at the conference venue (a block booking of rooms will be made by the organisers at preferential rates). However, financial assistance for travel and subsistence is available for participants from the Asian region whose papers are accepted for presentation. Guidelines on how to apply will be posted on the conference website after evaluation and selection of abstracts.

Practicalities

All enquiries about the conference should be directed to the conference email: it-apn2010@ivm.vu.nl. Information about registration, accommodation, venue etc will be posted at the conference website.

Organisation

The conference is organised under the auspices of the IHDP's Industrial Transformation project; APN – Asia-Pacific Network for Global Change Research; University of Malaya, Kuala Lumpur; The Research Council of Norway; Eindhoven University of Technology, The Netherlands and the Jadavpur University, India.

Appendix 4: Scientific & Organizing Committee: Workshop 2

Scientific Committee

Frans Berkhout (IVM, Vrije University, The Netherlands)

Rajah Rasiah (University of Malaya, Malaysia)

Louis Lebel (USER, Chiang Mai University, Thailand)

Yonglong Lu (Chinese Academy of Sciences, China)

Anand Patwardhan (Indian Institute for Technology, India)

Mike Rock (Bryn Mawr College, USA)

Joyashree Roy (Jadavpur University, India)

Rob Raven (Eindhoven University of Technology, The Netherlands)

Geert Verbong (Eindhoven University of Technology, The Netherlands)

Anna Wieczorek (IVM, Vrije University Amsterdam, The Netherlands)

Organizing committee at Malaya University, Kuala Lumpur

Rajah Rasiah and Fatimah Kari - Chairs

Zeeda Fatimah Mohamad

NurulHuda Mohd Satar

Santha a/p Chenayah@ Ramu

Nik Meriam Nik Sulaiman

Amran Muhammad

Yew Siew Yong

Mario Arturo Luiz Estrada

Abul Quasem al-Amin

Rafiq Idris

Representatives from MPOB Malaysia and Green Technology Corporation

Appendix 5: Agenda– Workshop 2

IT International Conference "Innovation and sustainability transitions in Asia

Faculty of Economics and Administration, Universiti Malaya, Kuala Lumpur, Malaysia

9-11 January 2011

Sunday 9 January 2011						Monday 10 January 2011						Tuesday 11 January 2011
8:30-:9:00	Registration											
9:00-9:10	**Welcomes**: *Rajah Rasiah(Universiti Malaya), Subramaniam MOTEN (APN)*					9:00-10:30	**Forum**: Sustainability of Biofuels - Asian Perspective With participation of science, governmental, industry and NGO representatives					9:00-14:00 *
9:10-9:30	**Official opening & Keynote Address**: *Prof. Dato Dr Zakri Abdul Hamid* *Science Advisor to the Government of Malaysia*											Visit to environmental sustainability projects in Putrajaya *Lunch provided*
9:30-10:00	**Plenary**: What have we learned about sustainability transitions over the last 10 years? *Frans Berkhout, VU University*						Chair and summary: *Frans Berkhout, VU University*					* *For those who need to catch flight or leave early to the hotel on that day, transport can be arranged at Putrajaya at 12:00 and will bring you to the airport/hotel.* ***Pls report while registering whether you will use this option.***
10:00-10:30	**Plenary**: Southern perspective on sustainability transitions *Leena Srivastava, TERI*											
VENUE: DK3	Chair and summary: *Joyashree Roy, Jadavpur University*					VENUE: DK3						
10:30-11:00	COFFEE BREAK					10:30-11:00	COFFEE BREAK					
11:00-13:00 VENUE: Postgraduate Building	**Breakout session 1**	**Breakout session 2**	**Breakout session 3**	**Breakout session 4**	**Breakout session 5**	11:00-13:00 VENUE: Postgraduate Building	**Breakout session 11**	**Breakout session 12**	**Breakout session 13**	**Breakout session 14**	**Breakout session 15**	
13:00-14:30	**LUNCH**					**13:00-14:30**	**LUNCH**					
14:30-16:30 VENUE: Postgraduate Building	**Breakout session 6**	**Breakout session 7**	**Breakout session 8**	**Breakout session 9**	**Breakout session 10**	14:30-16:30 VENUE: Postgraduate Building	**Breakout session 16**	**Breakout session 17**	**Breakout session 18**	**Breakout session 19**		
16:30-17:00	COFFEE BREAK					16:30-17:00	COFFEE BREAK					
17:00-18:30	**Plenary**: New analytical perspectives *Fred Steward, Policy Studies Institute* - Understanding transformative innovation through multilevel perspectives and socio-technical networks *Rob Raven,* University Eindhoven – Strategic niche management *Xuemei Bai,* CSIRO – Experiments - patterns and pathways Chair and summary: *Anand Patwardhan, Indian Institute of Technology*					17:00-18:30	**Plenary**: Looking forward/New agenda/ Asian network – debate format: - Joyashree Roy, Jadavpur University - Fatimah Kari, Universiti Malaya - *Louis Lebel,USER, Chiang Mai University* - Anantha Duraiappah, IHDP Chair and summary: *Pier Vellinga, Wageningen University*					
19:30	IT RECEPTION					19:30	BUFFET DINNER					

PARALLEL SESSIONS

Venue: Postgraduate building, Faculty of Economics and Administration

9 January 2011 (Sunday)
Morning Sessions - 11:00-13:00

ROOM 1: Innovation, growth and sustainability

Chair: Frans Berkhout

132	Jean-Christophe SIMON	Low Carbon Economy vs Green Growth Packages in developing Asian economies: A new context for public policies and sustainability transition?
134	Md. Azizul Bari	Current Status of Energy and its Impacts on CO2 Emissions in Malaysia
115	Akeem Olawale OLANIYI	Demographic Variables and Land Use Dynamics: Any Meeting Point? – A Case Study of Malaysia

Discussants:
Geert Verbong (paper 132); Frans Berkhout (papers 134 & 115)

ROOM 2: Transition challenges facing bio-innovation for the poor

Chair: Louis Lebel

015	Rowena dT. Baconguis	Enhancing Sustained Adoption of Innovations: The Case of Bio-nitrogen Fertilizer in the Philippines
016	Sunita Sungar	Enabling poverty relevant bio-fertilizer bio-innovation systems – lessons from India
017	Eun Jeong Ma	Ethical Market: Ethnographic Encounter with Global Market, CML patients, and Glivec in South Korea

Discussants:
Zainal Abidin Sanusi (papers 015 & 016); K Thiruchelvam (paper 017)

ROOM 3: Measuring sustainability

Chair: Joyashree Roy

048	Sumit Sharma	An Approach to Measure Sustainability: Comparative Evaluation of States in India
027	Pravin Agrawal	Segregating the Survival Emission from luxury emission: An innovative approach for policy prescription
082	Manta Devi Nowbuth	Re-engineering to achieve sustainable development: Case Study – Mauritius

Discussants:
Joyashree Roy (papers 048 & 027); VG Chandran (paper 082)

ROOM 4: Emerging socio-technical regimes

Chair: Anand Patwardhan

110	Bilal Hamid	The Face of Renewable Energy in Pakistan
085	Vishal Narain	Water scarcity and adaptation in periurban Gurgaon, India: emerging socio-technical regimes for sustainable water use
084	Reuben Andrew A. Muni	Emerging Agricultural Technologies in the Philippines: The Link between Food Security, Individual Well-being, and

Human Connectedness

Discussants:
Ibrahim Hafeezur Rehman (paper 110); Anand Patwardhan (papers 085 & 084)

9 January 2011 (Sunday)
Afternoon Sessions - 14:30 – 16:30

ROOM 1: Transition analyses

Chair: Fred Steward

106	Gopal K Sarangi	Multi-perspective Framework for System Innovations in India; An Analysis of the Renewable Energy Development
043	Mattijs Smits	A tale of two transitions: a multi-level perspective on energy transitions in the Lao PDR and its challenges
044	Somporn Sangawonge	Agricultural Land Use Change and Urbanization in Thailand
133	Rafiq Idris	Malaysia's Innovation and Comparative Advantage in Producing/Exporting Palm Oil and the Development of Best Sustainability Practices Applied by Palm Oil Producer

Discussants:
Fred Steward (paper 106 & 044); Rob Raven (paper 043); Ibrahim Hafeezur Rehman (paper 133);

ROOM 2: Transition challenges facing bio-innovation for the poor

Chair: Geert Verbong

018	Geeta Bhatrai Bastakoti	Surge of high-input vegetable production in northern Thailand: Is the innovation pro-poor and gender sensitive?
019	Louis Lebel	Lazy Gardens: A sustainability experiment in the uplands of northern Thailand-
131	Madhumitha J	Impact of livelihoods and lifestyle changes on home gardens, an urban scenario

Discussants:
Zainal Abidin Sanusi (papers 018 & 019); Abul Quaseim al-Amin (paper 131)

ROOM 3: Urbanization and urban management

Chair: Xuemei Bai

088	Geoffrey I Nwaka	Planning Sustainable Cities in Africa
039	Dasgupta Shyamasree	Growing Mobility in India: How sustainable are the new efforts?
066	Maitreyee Choudhury	How to Sustain Towns in the Mountains? Challenges of Urban Management in the Indian Himalayas -
040	Bonela Sandhya Sri	New Dynamics in Urban Environmental Management - An Educational Approach

Discussants:
Xuemei Bai (papers 088 & 066); Nurul Mohd Satar (papers 039 & 040)

ROOM 4: Governance, innovation and sustainability

Chair: Pier Vellinga

122	Mari Shioya	Socio-Ecological Resilience and Adaptive Governance towards Sustainable Resource Management (Case studies from Malaysia and Japan)
051	Herminia C. Tanguilig	Institutional Aspects of Local Participatory Strategies in Natural Resource Management
104	Abdul Hamid Oba Yusuf ESQ	Corporate Governance and Environment in Asia and Africa:

		Malaysia and Nigeria Examples
112	Leah Abayao	Cultural resilience and sustainable innovation systems of the Ifugaos in Northern Philippines

Discussants:
Pier Vellinga (papers 122 & 104); Amran Muhammad (papers 051 & 112)

ROOM 5: Innovation and environmental policies in waste management

Chair: Sumiani Yusoff

135	P. Agamuthu	3R Related Policies For Sustainable Waste Management in Malaysia
125	Helmut Yabar	Evaluation of the Linkages between Environmental Policy and Innovation: Case Study in Waste Management Technologies in Japan
111	Rakesh Johri	Stakeholder engagement for sustainable e-waste management: a case study on mobile phones in India

Discussants:
Sumiani Yusoff (papers 135 & 111); Zeeda Fatimah Mohamad (paper 125)

ROOM 1: Sustainability experiments – drivers and barriers

Chair: Anna J. Wieczorek

046	Sudhir Rama Murthy	Rejection of Technology
052	John Thøgersen	Transition Towards Sustainable Consumption in China - Wha Motivates Early Adopters of Organic Food Products in Guangzhou?
055	Xiao Guang-ling	Combining the Government Behavior with the Market Mechanism for the Virtuous Cycle of Innovation and Sustainability: Based on the Practice of China's Sustainable Communities
068	Duke Ghosh	Drivers and Barriers for Experiments Related to Sustainable Energy Management Practices: Case of MSME Firms in India

Discussants:
Geert Verbong (paper 046); Che' Wan Jasimah (paper 052); Abul Quaseim al-Amin (paper 068); Anna J. Wieczorek (paper 055)

ROOM 2: Case studies of sustainability experiments – successes and failures (I)

Chair: Rob Raven

041	Sebak Kumar Jana	Sustainable Small Scale Irrigation Experiment in the Dry Zones: A Case Study on Happa (Small Tank) Model in the State of West Bengal, India
091	Ramani Sankaranarayanan	Sustaining Transitions and Generating Livelihoods: Lessons from a Local Production for Local Use Biodiesel Agro-Booste in Odisha, India
137	Vishnu Sharma	Relative Potential of Organic Livestock Farming for Sustainat Production in Arid Regions: Way Forward
143	Suyash Jolly	Upscaling of business model experiments in off grid PV solar energy in India

Discussants:
Rob Raven (papers 041 & 137); Joyashree Roy (paper 091); Dipanjana Maulik (paper 143)

ROOM 3: Bio-energy related sustainability transitions

Chair: Ibrahim H. Rehman

031	P.P. Bhojvaid	Policy issues in sustainable development of Biofuels in Asia
032	Ibrahim H. Rehman	A transition experiment on improved biomass cookstoves for rural households
033	Sunil Dhingra	Energy transitions related to biomass gasification and its applications in for rural households and enterprises
034	Abhishek Kar	Role of processed fuels in cooking energy transitions

Discussants:
Rafiq Idris (papers 031 & 032); VG Chandran (papers 033 & 034)

ROOM 4: Politics, governance and power relations

Chair: Louis Lebel

095	Li-Nan CHUNG	Local Governing Regime, Science City and Sustainability- A Case Study of the Tainan Science Park Special District in Taiwan
012	Joni Jupesta	The development of biofuel in Indonesia from diffusion and stakeholder interactions
101	Bhagwati Uniyal	Traditional Knowledge System of Medicinal Herbs and Sustainable Livelihoods in Garhwal Himalaya, Uttarakhand, India

Discussants: Hezri Adnan (paper 095); Louis Lebel (paper 012); Wong Chan Yuan (paper 101)

ROOM 5: Institutions and instruments

Chair: Pier Vellinga

092	Rajah Rasiah	Institutions and Environmental Practices: Evidence from Electronics Supplier Firms in Malaysia
107	Gunapala Angoda	Introduced Innovative Approaches and Legislative Arrangement for Sustainable Rural Water Supply Systems in Sri Lanka
132a	Gerard Fernando	Challenges of Sustainable Water Supply for Cities Lessons Learnt in Reduction of Non Revenue Water in Colombo, Sri Lanka

Discussants: Pier Vellinga (paper 107); Nurul Mohd Satar (paper 132a) tbc; Fred Steward (paper 092)

10 January 2011 (Monday)
Afternoon Sessions - 14:30 – 16:30

ROOM 1: Case studies of sustainability experiments – successes and failures (II)

Chair: Rob Raven

128	Dipanjana Maulik	Successful and sustainable technology transition in Kolkata, India – A case study for system innovation
060	Architesh Panda	Towards a Low Carbon Society in Asia: Role of Carbon capture and Storage
014	Tae-Hyeong Kwon	Niche management policy to increase the market share of Alternative Vehicles : A system dynamics model of the policy effect

Discussants:
Rob Raven (paper 128); Hezri Adnan (paper 060) - tbc; Xuemei Bai (paper 014)

ROOM 2: Actors and networks

Chair: Geert Verbong

129	Yuti A. Fatimah	Actors in Transition: Jatropha Initiatives in Indonesian Villages
029	Ramalis Sobandi	The governance of innovation towards urban sustainability: A compara analysis of Bandung and Surakarta challenges
094	Sarala Aikanathan	Case-study on Sustainable Agricultural: The Roundtable on Sustainab Palm Oil (RSPO)

Discussants:
Geert Verbong (paper 129); Louis Lebel (paper 029); Ibrahim H. Rehman (paper 094)

ROOM 3: Building capabilities for sustainability transition

Chair: Rajah Rasiah

069	Govindran Jegatesen	Sustainability in Higher Educational Institutions: Systemic Transformation for a Sustainable Future
117	Prachi Kaul	Innovation and Sustainability Transitions in Asia: A Critical Appraisal of Informal Institutions of Delhi, India
071	Tony K. Hariadi	Modelling A Sustainable Energy Transition in Indonesia
120	Mundinamani S.M	Sustainable Approach of Farmers Field School (FFS) in the Tank Commands of North Eastern Karnataka (INDIA)

Discussants:
Zeeda Fatimah Mohamad (paper 069); Amran Muhammad (paper 120); Rajah Rasiah (papers 117 & 071)

ROOM 4: Climate change, challenges, impacts and policies

Chair: Frans Berkhout

076	Joyashree Roy	Role of Policy Innovation in Sustainability Transition - Case Study of India's National Action Plan on Climate Change
126	Rowena dT. Baconguis	Innovative and Effective Climate Change Adaptation Measures Needed by Households and Institutions in the Philippines
108	Rosita Hamdan	Socio-Economic Vulnerability to Climate Change: Impact Assessment on Aquaculture Framers in Sarawak, Malaysia
081	Manish Kumar Singh	Technology Diffusion in a Carbon Constraint World: A Case of Wind Power Generation in India

Discussants:
Fatimah Kari (papers 076 & 081); Frans Berkhout (paper 126); Rafiq Idris (paper 108)

Appendix 6: List of Participants: Workshop 2

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Appendix 7: Funding Sources (cash/kind) outside the APN

Industrial Transformation: IHDP – Industrial Transformation Project, The Netherlands (IHDP-IT) and Vrije Universiteit, The Netherlands (IVM) - in-kind contribution in the amount of US$ 10,000 in the form of in-kind personal costs and out of pocket travel costs

IHDP (IT www.ihdp-it.org) is a core project of the International Human Dimensions Programme on Global Environmental Change (IHDP). It was launched in 1999 together with publication of the IT Science Plan (Vellinga and Herb, 1999) with the challenging goal of improving the understanding of the ways in which society could combine economic and social development with the reduction of pressure on the environment. The scientific agenda of the IHDP IT has been built around a number of research questions in the fields of: energy and material flows; food; cities with focus of water and transportation; information and communication; governance and transformation processes. Industrial Transformation research starts with the notion that changes in technologies put differently, changes in the ways in which humans use environmental resources and services are embedded in the socio-economic realm and modify the natural environment. This embraces processes and products, production and consumption chains and distribution and disposal activities. IT research is also interested in the institutions and incentives that shape these systems (i.e. property, liability, regulations), and how these situate and influence social actors (government, producers, and consumers). In thinking about how these systems might change, IT is concerned with the interaction of innovation by economic and social actors with processes of change at a higher level in socio-technical systems of provision (energy systems, mobility systems, food and nutrition systems and so on). IT is interested not only in identifying alternatives, but also in seeking to understand how broad-scale change in systems that are relevant for global environment may occur and be influenced over the longer-term future (Olsthoorn and Wieczorek, 2006). IT seeks to integrate and stimulate co-operation among international and interdisciplinary scientists by establishing both a research framework and a network which can be useful for exchanging information and identifying priority research questions. The IT project has been hosted by the Institute for Environmental Studies (IVM) of the VU University Amsterdam, The Netherlands: http://www.ivm.vu.nl/en/index.asp.

Human actions lie at the heart of current global environmental change. Societies define the boundaries and character of their environments, while affecting and reacting to their environment with only a limited and biased understanding of it. To understand and respond effectively to these current changes requires major inputs from the social sciences - the perspective of human behaviour and actions. IHDP provides a platform for fostering original research. In conducting innovative science, we select and develop substantive research themes, further stimulating scientists to coordinate their efforts toward them. This means building international, multi-disciplinary teams of scientists to conduct integrated, long-term

collaborative research. IHDP adds value by strengthening the voice and impact of a huge network of individual scientists and research initiatives.

www.ihdp.org

Technische Universiteit Eindhoven University of Technology
Where innovation starts

Eindhoven University of Technology, The Netherlands- in-kind contribution in the amount of US$ 5,000 in the form of in-kind personal costs and out of pocket travel costs.

Global Change Programme, Jadavpur University, Kolkata, India – in kind US$ 3000 in the form of personal costs and workshop facilitation charges. See more in Appendix 9 where the details of organizing institutes are given.

Faculty Of Economics And Administration

Faculty of Economics and Administration: University of Malaya, Kuala Lumpur, Malaysia- in kind US$ 3000 in the form of personal costs and workshop facilitation charges. See more in Appendix 9 where the details of organizing institutes are given.

The Research Council of Norway

The Research Council of Norway: Underlying all the Research Council's activities is the viewpoint that research expands the boundaries of what we know, understand and can achieve. Research adds cultural resonance to society and creates a viable framework for welfare, value creation and sustainable development.

Through its efforts as an advisory body on research strategy issues, a research funding agency and initiator of meeting places and networks, the Research Council seeks to meet and constantly refine the objectives for Norwegian research policy.

Vision

In the Vanguard of Norwegian Research

Research generates greater insight, enhanced opportunity and innovative solutions. Research is a driving force behind the advancement of Norwegian society and is vital to promoting scientific and knowledge-related development. Research is in and of itself enriching and comprises an important part of Norwegian culture. At the same time it provides direct practical benefits and is a tool for satisfying society's need for concrete results.

By carrying out broad-based, high-quality research activities, Norway can contribute actively to the global pool of knowledge and gain access to the international knowledge community.

In keeping with its vision, the Research Council incorporates the widest possible range of motivations for research activity into its efforts, and its objectives, instruments and working methods are adapted accordingly.

Mandate and tasks

The Research Council is Norway's official body for the development and implementation of national research strategy. The Council is responsible for enhancing Norway's knowledge base and for promoting basic and applied research and innovation in order to help meet research needs within society. The Research Council also works actively to encourage international research cooperation.

Three central areas of focus

- The Research Council serves as an advisory body on research policy issues, identifies research needs and recommends national priorities.
- Through the establishment and implementation of targeted funding schemes the Research Council facilitates the translation of national research policy objectives into action.
- The Research Council serves as a meeting place for researchers, funders and users of research findings, as well as for the different sectors and subject fields that are affiliated with the world of research.

Five main goals

- **Enhanced quality and capacity:** The Research Council will work to enhance the capacity and quality of, and promote the diversity in, Norwegian research.
- **Thematic priorities:** The Research Council will work to strengthen research in areas of particular importance for research, trade and industry.
- **Structure:** The Research Council will promote constructive cooperation, distribution of responsibility and structures in the research system.
- **Learning:** The Research Council will help to translate research results into action.
- **Organisation:** The Research Council will work towards becoming an even more competent and strategic organisation.

http://www.forskningsradet.no/en/Home_page/1177315753906

NPUMA
INTERNATIONAL INSTITUTE OF PUBLIC POLICY AND MANAGEMENT
(Institut Antarabangsa Polisi Awam dan Pengurusan)

International Institute of Public Policy and Management (NPUMA)

Appendix 8: List of Young Scientists

List of Young Scientists

Include brief detail (full name, involvement in the project activity) and contact detail (name of institution/country and email address) of your scientists involved in the project. Also include short message from the young scientists about his/her involvement in the project and how it helps develop/build his capacity and the knowledge he gained.

List of Young Scientists from Jadavpur University (Research Scholars associated to the University)

CHAKRABORTY Debrupa
Senior Lecturer, Netaji Nagar College, Calcutta University, 170/436 N. S. C Bose Road, Kolkata – 700 092, West Bengal, India
Tel: 9433379291
Email: debrupa_04@yahoo.com

DASGUPTA Shyamasree
Research Associate, Global Change Programme, SYLFF Fellow (M.Phil), Dept. of Economics, Jadavpur University, 188, Raja S. C. Mallick Road, Kolkata – 700032, India
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Email: shyamasree.dasgupta@gmail.com

GHOSH Duke
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Email: duke@bitscrape.com

JANA Sebak
Senior Lecturer, Vidyasagar University,
Midnapore, West-Bengal – 721102,
India

MAITRA Sulagna
Research Associate, Global Change Programme,
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Tel: +91 9830434143
Email: sulagnamaitra.ju@gmail.com

MUKHERJEE Shubhra
Reasearch scholar, Electrical Engineering,
Jadavpur University, 188, Raja S. C. Mallick Road
Kolkata – 700032, India

List of Young Scientists from Jadavpur University (Faculty)

BARDHAN Suchandra
Senior Lecturer, Dept. of Architecture, Jadavpur University, 188, Raja S. C. Mallick Road, Kolkata – 700032, India
Tel: 9830024841
Email: suchandrab@gmail.com,
suchandrab@yahoo.com

DEY Sudipto
Professor, Dept. of Mechanical Engineering, Jadavpur University, 188, Raja S. C. Mallick Road
Kolkata – 700032, India
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Appendix 9: Local Organizers

Global Change Programme- Jadavpur University: Local Organizer of the first Workshop I

Global Change, a term increasingly preferred to climate change, refers to the anthropogenic interference with the 'Earth System' i.e. the atmosphere, geosphere and biosphere. Broadly, the Global Change Programme attempts to systematically understand the long term global changes due to factors such as climate change, population growth and their impact on issues like human welfare, water and food availability, urban lifestyle and so on. It takes a multidisciplinary approach to study the human dimension and economic impact of climate change and related issues.

With this focus the Global Change Programme at Jadavpur University was launched as a multidisciplinary research programme in 2001 to generate reliable and in depth knowledge on 'global change' issues which may facilitate policy making and its implementation at the local, national and international levels. The centre has been recognized since the Tenth Plan by the University Grants Commission (UGC).

About Jadavpur University

Jadavpur University (JU) is a premier educational and research institution in India. The university has already proved its strength in multidisciplinary research and is actively participating in the research activities to support policy formulation of Ministries and multilateral funding agencies.

GCP-JU Research Projects

In pursuance of its objectives, the main thrust of the GCP-JU research projects lie in the development of the Indian economy and society, and focuses on both long term and short-term issues. The research projects primarily focus on Climate Response Strategies which in turn may be broadly sub-divided into two categories i.e. strategies for adaptation and, strategies and issues for mitigation. Various projects with GCP-JU partners also focus on damage assessment due to climate change including impact on urban areas, loss of productivity, migration and inundation. To know more about it please log on to http://www.juglobalchangeprogram.org/

GCP-JU Working Papers & Publications

GCP-JU research output is disseminated through books, monographs, occasional papers and articles in leading newspapers and professional journals. Some of these writings have also won distinguished academic prizes, nationally and internationally. GCP-JU also publishes working papers related to the ongoing project. Both publications and working papers may be easily accessed through the GCP-JU website.

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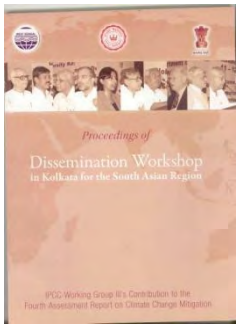

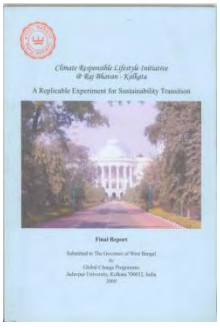

Facilities & Opportunities at GCP-JU

Global Change Programme, Jadavpur University provides an ideal platform to researchers, working professionals, governmental and non-governmental organizations to research, network and collaborate on various local, national and international global change issues.

Documentation Unit:

GCP JU has developed a small documentation unit in order to cater to the academic and research needs of the faculty, research scholars, and students.

Seminars, Meetings and Workshops

GCP-JU collaborates with various governmental and non-governmental organizations to organize state level, national and international seminars, meetings and workshops which stimulate intellectual dialogue and facilitate policy making. Since its inception GCP-JU has hosted a large number of such seminars, meetings and workshops including the IPCC Dissemination Workshop on 4th Assessment Report on Climate Change Mitigation: A Dissemination workshop in October 11-12, 2007.

Visiting Fellows

Individual researchers, doctoral fellows, faculty members of various academic institutions as well as working professionals have the opportunity to conduct a part of their research or project in collaboration with Global Change Programme, Jadavpur University. The visiting scholars/ working professionals can avail of the GCP-JU resources to facilitate their work and share their understanding of global change issues with the researchers at GCP-JU through workshops, seminars and group discussions.

Outreach Activities

- Climate Smart Entrepreneurs' Alliance (CSEA) was conceptualized as an association of budding and existing "green" entrepreneurs of the region.
- Supported EcoLife Biofuels based in California with in-depth research support to evaluate prospects of Biofuels in West Bengal.
- Economic Analysis of plastic recycling unit at HC Plastic India, the only plastic recycling unit in Eastern India .
- Working on unique projects to reduce energy, water and carbon footprint of academic and other institutional campuses in Kolkata.
- Collaboration with Bitscrape in decision tool development for footprint assessment, adaptation and mitigation options.

Contact:
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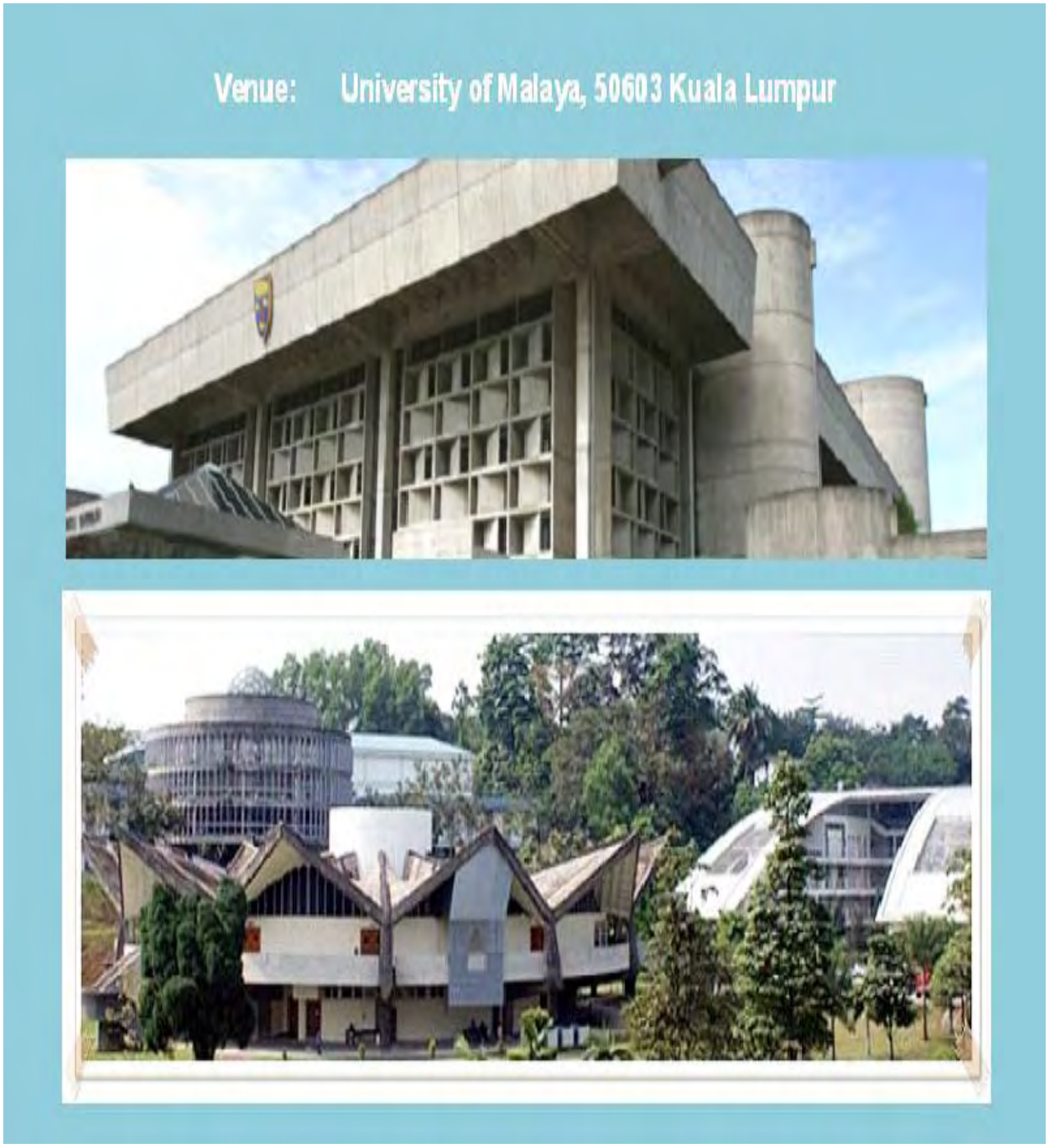
Web site: http://www.juglobalchangeprogram.org

University of Malaya: Local Organizer of the first Workshop II



Overview of Universiti Malaya (UM)

University of Malaya (UM), the first University of the country, is situated on a 750-acre (309-hectare) campus in the southwest of Kuala Lumpur, the capital city of Malaysia.The University of Malaya grew out of a tradition of service to the society. Its predecessors, the King Edward VII College of Medicine established in 1905 and Raffles College in 1929, has been established to meet urgent demands, one in medicine and the other in education. When the two came together to form the University of Malaya in October 1949, this was so that they might perform together an even greater service - to help lay the foundations of a new nation by producing a generation of skilled and educated men. Hence the University of Malaya was established on 8 October 1949 as a national institution to serve the higher education needs of the Federation of Malaya and Singapore.

The growth of the University was very rapid during the first decade of its establishment and this resulted in the setting up of two autonomous Divisions in 1959, one located in Singapore and the other in Kuala Lumpur. In 1960, the government of the two territories indicated their desire to change the status of the Divisions into that of a national university. Legislation was passed in 1961 founding the University of Malaya on 1st January 1962.The University motto, "Ilmu Punca Kemajuan" (Knowledge is the Key to Success) reflects the philosophy of the University in its constant endeavour to seek knowledge in all fields to produce successful graduates and a successful nation. For more info about Universiti Malaya, please go to www.um.edu.my

Specific venue and host of the conference

The **2011 "Innovation and Sustainability Transitions in Asia" conference** will be organised by and held at the Faculty of Economics and Administration, with suppport from other units at the university, namely: Department of Science and Technology Studies, Faculty of Science; Sustainability Science Cluster and the International Institute of Public Policy and Management (INPUMA).

The UM Faculty of Economics and Administration (FEA) was founded in May 1966 to meet the nation's growing demand for a professional workforce. Drawing the strength of four departments; Economics, Administrative Studies and Politics, Development Studies and Applied Statistics, FEA currently offers the Bachelor of Economics degree, and four programmes at the postgraduate level, Master of Economics, Master of Public Administration, Master of Applied Statistics and Doctor of Philosophy. For more info about UM's Faculty of Economics and Administration, please go to www.fep.um.edu.my

Sustainability Research at Universiti Malaya

For more than a decade, UM has built a broad capacity in the field of sustainable development from various disciplines of knowledge. In early 2009, this has culminated into the establishment of the "Sustainability Science" research cluster as a platform for the university to encourage, promote and support trans-disciplinary research for

sustainability. Members of this cluster belong to research centers and groups that are working in various dimensions of the field. This includes:

Research Centres:

Centre For Civilisational Dialogue
Centre For Tropical Biodiversity Research
National Antarctica Research Centre
Institute of Ocean and Earth Sciences
Spatial-Environmental Governance For Sustainability Research
Water Research Centre
Centre of Excellence for Biodiversity Law
Conservation & Research Centre
Center For Equatorial Sustainable Design
Centre For Smart Urban Development
Centre For Research In Waste Management
Centre For Studies of Urban & Regional Real Estate
Centre For Sustainable Built Environment
Building Performance & Diagnostic

Research Groups:

Research Group on Cleaner Production
Research Group on Science, Innovation and Society
Environmental Research Group

Specialised Research Lab

Zoological and Ecological Research Network
Environment and Molecular Parasitology
For more info, please go to www.susci.um.edu.my

UM CARES

Other than the units under the sustainability science clusters, there are also other units belonging to other research clusters that are involved in issues pertaining to sustainability, such as:

- Asian-Europe Institute (AEI)
- Centre For Poverty And Development Studies (CPDS)
- Centre For Malaysian Indigenous Studies
- Centre For Biotechnology In Agriculture Research (CEBAR)
- Centre For Transport Research (CTR)
- Centre For Energy Sciences
- University Of Malaya Centre For Climate Affairs (UMCCA)
- Centre For Smart Urban Development

Sustainable Campus

Other than research and teaching, University Malaya is also committed in improving the environmental sustainability of its campus environment, and the university has the on-going mission to encourage, educate, motivate and train the campus community to be more environmentally friendly and responsible. In line with this commitment, the Environmental Secretariat of University Malaya (UMCARES) was established on October 2009 as an official platform to achieve the universities' objectives in this regard. The main role of UMCARES is to ensure that various environmental activities in the campus are encouraged, coordinated and synergized to meet a common goal, with sufficient institutional support. For more info, please go to www.umcares.um.edu.my

Other unique attractions at the University of Malaya

Rimba Ilmu (Botanical Garden)

Rimba Ilmu or The Botanical Garden was established in 1974 out of a need to study and conserve the immense diversity of plant life found in the Malaysian tropical rainforest. Given the task of developing this facility, the University's Department of Botany set out to convert about 40 hectares of hilly areas of abandoned rubber estate into an aesthetically pleasing and scientifically oriented garden. The valley has a small stream which feeds a wetland area before filtering out through the easternmost boundary of the Campus. Apart from fulfilling its essential 'collection and curatio' function, Rimba Ilmu, through the utilization of its resources and support facilities, also works towards promoting environmental awareness among the campus community and the general public. Besides having a general collection of species from a variety of plant families selected for teaching, Rimba Ilmu is also developing various special collections ranging from those of medicinal plants, wild orchids, palms, pandan, tropical fruit trees, gingers, aquatic plants, wild citrus relatives to rare and endangered plants in need of conservation. Rimba Ilmu's peaceful and serene atmosphere will captivate and enthral, and even casual visitors will find delight in following one of the several trails which lead to most parts of the Garden. For the budding shutterbug to the serious photographer, an endless array of interesting subject matter is offered. More serious-minded visitors are welcome to visit the garden's well-labelled plant collections and a small reference library. Additionally, experienced staff members are also ready to assist you. Rimba Ilmu is open to the public during the normal office hours.
For more information, visit Rimba Ilmu at http://rimba.um.edu.my

The Museum of Asian Arts

Officially opened in 1980, the Museum of Asian Art is home to over 2,000 pieces of ceramics from Malaysia, Thailand, Khmer, Vietnam, China, Japan, India and Iran.The three-storey building situated between the Faculty of Law and the Faculty of Economics and Administration, the Museum is renowned for housing the largest collection of kendi (water vessels) in the world, as well as stone carvings and Islamic art collections from other Asian countries. The exhibits also include weaved materials and paintings by local artists, copperware, weapons and kites

For more information, call the museum at this no. +60379673936 or e-mail azizras@um.edu.my