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## **AN OVERVIEW OF CLIMATE CHANGE AND ITS LINKS WITH DEVELOPMENT, EQUITY AND SUSTAINABILITY**

*Mohan Munasinghe and Rob Swart*

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### **1.1 Background**

Development, sustainability and equity (DES) are key elements of any sustainable development strategy. In many countries, response to climate change cannot be seen independently from more general sustainable development strategies. The expert meeting on Development, Sustainability and Equity in Colombo is part of the work plan for the Third Assessment Report (TAR) of Working Groups II (impacts and adaptation) and III (mitigation) of the Intergovernmental Panel on Climate Change (IPCC). At a scoping meeting held in Bad Münstereiffel in Germany from 29 June – 1 July 1998, an outline and a work plan for the TAR were developed, which included a number of expert meetings that were intended to provide opportunities for scientists to address gaps in knowledge and discuss new directions. This outline and work plan was approved at the XIV's Session of the IPCC in Vienna, from 1-3 October, and included the Colombo expert meeting on development, equity and sustainability within the proposed budget for 1999.

At the Bad Münstereiffel scoping meeting, “development, sustainability and equity” were identified as key issues that would provide the appropriate context for the TAR. They would cut across not only the various chapters of the Working Group Reports, but also each Working Group -- most notably Working Groups II and III. As one of four so-called cross-cutting “guidance papers” for the TAR, Mohan Munasinghe

drafted a document on the question of how development, sustainability and equity issues might be considered by lead authors, for incorporation into the various chapters of the TAR. This paper was presented to the lead authors of the Working Groups II and III at their first meetings and subsequently thoroughly debated during an electronic conference. A revised version of this paper was presented by Prof. Munasinghe as a background paper at the expert meeting, and is included in the proceedings.

The meeting was intended to provide a forum for further discussing and elaborating how insights from the development, sustainability and equity debate might be used to frame the assessment of adaptation and mitigation options by the IPCC. The gathering was the first of its kind, and included about 40 participants from 15 countries. The issues were primarily addressed from a general, global perspective. Follow-up meetings in Latin-America and Africa are being considered.

## **1.2 Expert Meeting Overview**

### *INTRODUCTION AND FRAMEWORK*

The meeting was opened on the evening of Tuesday, 27 April by the Honourable Batty Weerakoon, Minister of Science and Technology of Sri Lanka. In his keynote speech, the Minister stressed the importance of sustainable development issues (like growth, poverty and malnutrition) for developing country decisionmakers. Therefore, it was important for the TAR to relate climate change to these issues, in order to receive adequate attention.

On Monday, 28 April, Mohan Munasinghe introduced his background paper on Development, Sustainability and Equity, which was developed as one of the guidance papers on cross-cutting issues for the TAR. He argued that development, equity and sustainability are integral elements of sustainable development. Sustainable development has economic, social and environmental dimensions, which need to be given balanced treatment, while DES issues need to be analysed within this framework. TAR authors might consider the following broad and long term questions:

1. How will expected development patterns and scenarios affect climate change?
2. How will climate change impacts, adaptation and mitigation affect sustainable development prospects?
3. How could climate change responses be better integrated into sustainable development strategies?

TAR authors should make a special effort to systematically search well beyond the mainstream journals, for the small but growing volume of literature in economics, sociology and ecology which seeks to bridge interdisciplinary gaps – in as many different countries and languages as possible.

Munasinghe proposed that the many impacts of climate change and alternative strategies to address the issue might be evaluated broadly in terms of their long term effects on: (a) human welfare and equity (b) the durability and resilience of ecological, geophysical and socioeconomic systems (even in the face of sudden, non-linear system shocks); and (c) the stocks of different kinds of capital (e.g., manufactured, natural, human and socio-cultural assets). The TAR will need to identify specific economic, social and environmental indicators, at different levels of aggregation ranging from the global/macro to local/micro. It is important that the indicators be multi-dimensional in

nature, practical, comprehensive in scope, and account for regional and scale differences. A wide variety are described already in the literature. Measuring economic, environmental (natural) and social capital raises various problems. Manufactured capital may be estimated using conventional neoclassical economic analysis. Natural capital needs to be quantified first in terms of key physical attributes. Then the physical damage could be valued using a variety of techniques based on environmental and resource economics. Human resource stocks are often measured in terms of the value of educational levels and earning potential. Social capital is the one which is most difficult to assess.

The paper stressed that equity issues (within and among nations, and across generations) deserve careful consideration. A useful starting point would be to assess whether climate change will worsen existing inequities, even though a climate strategy cannot be expected to address all equity-related problems. The TAR needs to assess the fairness of alternative outcomes with regard to climate change impacts, mitigation and adaptation, as well as the distribution of emissions rights across nations and over time.

While much of the work on climate change issues has focused on the global or regional level, its eventual impact and ultimate responses will be relevant mainly at the national and subnational levels. Thus, climate change strategy needs to be harmonised with national sustainable development policies. The TAR could help to clarify how greater priority might be placed on adjusting the development path to reduce GHG emissions, without undermining prospects for improving human welfare. Also, the TAR will be more useful as a practical guide for decisionmakers if it is able to assess the viewpoints of not only governments but also civil society, business, NGOs and other stakeholders.

If material growth is the main issue, while uncertainty is not a serious problem, and relevant data is available, then the focus is more likely to be on optimising economic output, subject to (secondary) constraints based on social and environmental sustainability. Alternatively, if sustainability is the primary objective, while conditions are chaotic, and data is rather weak, then the emphasis would be on paths which are economically, socially and environmentally durable or lasting, but not necessarily growth optimising. The TAR analysis could help to clarify the different viewpoints and explore the potential for greater convergence and complementarity of these approaches. When all important impacts of a specific climate change option may be valued in economic terms, the usual approach of comparing the corresponding costs and benefits will provide useful insights. Where certain critical impacts cannot be valued (i.e., reduced to a single monetary “numeraire”), other techniques such as multicriteria analysis could be helpful. High levels of uncertainty and risk might be dealt with through the use of modern decision analysis frameworks.

During the discussion there appeared to be broad agreement that the systematic assessment of DES issues within the TAR needed to be carried out within an organizing framework based on the economic, social and environmental dimensions of sustainable development.

### *Sustainability*

In the first session that focused on sustainability issues, Gary Yohe presented a paper on Economic Sustainability, Indicators and Climate Change, which was co-

authored with Richard Moss. It was argued that in the area of scientific assessment for sustainability, not only government decision makers but also individuals should be addressed, at the national, regional and global levels. On these different scales, different issues are at stake. The paper focused on two main issues: efficiency and substitutability. The authors argue that there does not need to be a conflict between (economic) efficiency and (social) equity, in the sense that equity goals can be pursued efficiently. It was acknowledged that there are limits to substitutability between different types of capital, while substitution does have transaction costs. The authors discussed three different economically-based approaches to select and quantify indicators of sustainability, notably the neo-classical model, non-declining natural capital approaches, and the safe minimum standards approach. They then proposed a template for assessing climate change response options in the TAR, focusing on case studies in the area of adaptation. In the discussion following the presentation, several points were debated, including: (a) the apparent discrepancy between the inclusion of equity in economic theory and the practical reality where little attention is paid to equity issues; and (b) the relevance of mainstream economic theory to practical questions relating to sustainability -- especially in poor countries where a large portion of the population does not participate in the formal economy. The issue of scale was again brought up, since impacts of sustainable development policies at the local or national scale can have negative effects on sustainability elsewhere, or at a higher level of scale.

The second speaker, Qazi Kholiqzaman Ahmad presented a paper on Social Sustainability, Indicators and Climate Change, co-authored with Ahsan Uddin Ahmed. The paper proposed the “orderly progress of society” as a working definition of social sustainability, in the absence of adequate definitions in the literature. Physical impacts of climate change can lead to socio-economic impacts which can interfere with this orderly progress. Many socio-economic developments in the past have tended to increase vulnerability, while only few have decreased it. Response options would thus focus on decreasing the vulnerability of societies. This could be pursued not only through the reduction of the physical aspects of vulnerability, but also through the increase of social and economic development, and social justice. In the exchange of views after the presentation, it was suggested that the discussion about social sustainability is still too much grounded in the stocks and flows of economic assets, whereas the quality of life rather than quantitative aspects of development are more important from the social sustainability point of view. The discussion also addressed the inequitable distribution of impacts, and the options for attributing costs of adaptation and/or mitigation to different regions. For the assessment of climate change impacts, a complicating factor is that the impacts of climate change are usually just additional to effects of other changes -- i.e., there is vulnerability to stresses in general, rather than specifically to climate change.

Robert Costanza presented the final paper in the session on sustainability. He laid out a framework to assess the ecological sustainability of systems from the perspective of ecological economics. He stressed that there is no single answer to the questions, since different people hold different visions of how the world works and how we would like it to be. Consequently, appropriate tools for analysis and appropriate response options would also be different between different visions. Adequate indicators to describe (eco-) system health ought to include three main elements: vigor (e.g. productivity, output), organisation (e.g. structure, diversity), and resilience (e.g. recovery time after shocks). It is important not to fall into the reductionist trap, by maintaining a focus on the linkages

between these indicators at all times, and recognising that preferences, goals, and values change continuously over time in an interrelated fashion. The author rephrased the three main goals of sustainable development (efficiency, fairness/equity, and ecological sustainability), noting that the use of a broad, structured set of indicators that goes beyond economic indicators has been pursued in several case studies (which however are generally outside the realm of climate change analysis).

In the round table discussion that concluded this session, Tariq Banuri pointed out that sustainability can be viewed from two vantage points that have to be taken into account in assessments: (a) some see the world as structured, and subject to effective management, e.g. to adapt to or mitigate climate change; (b) for others, the world is basically chaotic, and in order to cope with shocks such as those from climatic change, vulnerability should be decreased. Ramon Pichs-Madruga re-emphasised the key importance of addressing all economic, social and environmental elements of sustainable development in both policy development and scientific assessment, as well as in the qualitative and quantitative senses, by addressing the issues at the appropriate levels of scale. Zbigniew Kunzewics stressed the importance of being very concrete and specific when using indicators, illustrating this with examples from the area of water management. In the discussion, it was suggested that unfortunately, insufficient knowledge is available to adequately address all elements of sustainability, and all different perspectives in a balanced manner. But this should not be used as an excuse to neglect the analysis of these elements and perspectives in the TAR. This requirement may well force lead authors to venture well beyond their traditional areas of expertise and not hesitate to bring in contributors from other disciplines.

### *Development*

John Robinson opened the session on Development with his presentation on How Climate Change, Adaptation and Mitigation will affect Sustainable Development Prospects. As the work on the Special Report on Emissions Scenarios (SRES) suggests, future emissions of greenhouse gases do depend to a large extent on the development path, probably as much as on explicit climate policies. This makes the dividing line between having a climate policy and having no-climate policy very elusive, as well as the difference between climate mitigation and sustainable development scenarios. The SRES scenarios also show that different combinations of driving forces can lead to similar emissions of greenhouse gases. For any analysis of costs and impacts of scenarios, the choice of a reference baseline is all-important. It is argued that much of the literature on sustainable development deals with local issues, while the literature on climate change response is dominated by analysis at the global level. Reconciliation of these scales is crucial. Finally, the author emphasised that decreasing emissions can be achieved both by increasing resource use efficiency and by the development of less resource-intensive lifestyles. In the discussion, some elements of the SRES scenarios were clarified. As in the first session, it was suggested that in order to describe “development” adequately, a broad set of indicators is needed, including social indicators.

In his paper on “Development Patterns in the North and their Implications for Climate Change”, Wolfgang Sachs placed the responsibility on the North -- to reduce greenhouse gas emissions in the perspective of a limited ecospace (determined by stabilisation of GHG concentrations), and to ensure a fair distribution of the mitigation

burden. He referred to the so-called factor 10 approach that may be needed to increase resource productivity sufficiently in the next 50 years, to reduce emissions along with increasing income levels. Such resource productivity would have to be reached by a combination of increased efficiency increases in the use of resources, and dematerialisation of development (“sufficiency”). This dual strategy would be needed because the positive effects of technological productivity increases are often negated by increased demands (growth of volume). The discussant D.M. Gwary stressed that a dematerialisation strategy in the north may have negative repercussions on economic development in the south.

In her paper on “How Development Patterns in the South will Affect Climate Change”, Leena Srivastava re-iterated that while the emissions of GHGs from developing countries must grow, their ability to contain these emissions is limited by several factors. In an effort to address their developmental needs, countries of the South are already implementing a number of policies and measures that are lowering their emissions growth path. However, a truly long-term solution to both reduced emissions from developing countries, as well as their participation in the global efforts to reduce adverse climatic impacts, would be to invest in raising the level of social and economic infrastructure in these countries. The discussant Luis Pinguelli Rosa observed that current development patterns in the south imitate those of the north -- the rich in both regions already have similar lifestyles, and the poor are expected to move in the same direction. Governments have relatively little control over the direction of consumption patterns and the markets that influence those decisions. Poor management capabilities and corruption hinder effective government policies. Low oil prices have even derailed moves towards increased reliance on renewable energy sources.

In the round table discussion ending this session, it was argued that, although GHG mitigation may not be required as yet in the south, it is quite possible to choose between different development pathways, and thereby reduce the growth of emissions as is happening already. Often decreased emissions of greenhouse gases can be regarded as ancillary benefits of national development choices. Here, technological leapfrogging could play a key role, but the knowledge on incentives and constraints for leapfrogging is still incomplete at best. Capacity building and education remain important strategies. From an impacts perspective, it is important for developing countries to reduce their vulnerability and increase their capacity to cope with climatic changes. Here it was argued that the synthesizing chapter on decisionmaking frameworks in the WGIII report may place too much reliance on the idea that climate change is a problem that can actively be managed, and that decision makers do make a conclusive difference. This perspective may be misleading and lead to the neglect of coping strategies to deal with the changes. It is important to report on a wide variety of ways of framing climate change and its response options in the TAR, including but not limited to those of neo-classical economics. This implies that authors would have to be more inclusive of the literature beyond their own disciplines. Eventually it was again concluded that while broadening the objectives of the TAR to include issues of development, sustainability and equity, the authors should remain within the IPCC climate change mandate.

Mohan Munasinghe pointed out the slow but steady progress by the IPCC on DES issues, over the years. In the First Assessment Report development, sustainability and equity issues were practically absent, but in the Second Assessment Report they were included to some extent (basically as separate elements). In the TAR, DES issues would

be partly integrated with climate change, while eventually in the Fourth Assessment Report the integration would be complete.

### *Equity*

Anil Aggarwal opened the session on equity with a paper “Addressing the Challenge of Climate Change: Equity, Sustainability and Economic-Effectiveness: How Poor Nations Can Help Save the World”, prepared together with Sunita Narain. He discussed three “benchmarks”: (a) ecological effectiveness -- “what actions are needed to prevent climate change?”, (b) equity and global solidarity -- “how do we equitably share the proposed actions given the two basic facts that there is an enormous disparity in per capita emissions of different nations in the world and, as long as the world remains within a carbon-based energy economy, these emissions are closely related to economic growth and standards of living?”; and (c) economic effectiveness -- “how do we make sure that any action plan that is developed is cost-effective and does not disrupt either the global economy or any individual nation’s economy?”. In this context, Aggarwal suggested with respect to the Kyoto Protocol that the poor nations must insist: (a) on the principle of equitable entitlements, (b) that the problem of convergence should be accepted within the Kyoto Protocol, (c) that the Kyoto mechanisms must be pegged to a non-carbon energy transition, and (d) that no banking of emissions which are obtained through the Clean Development Mechanism from developing countries will be allowed. Much of the discussion focussed on basic approaches to define equitable atmospheric and emissions entitlements.

Steve Rayner in his paper on “Climate Change, Poverty, and Intragenerational Equity - the National Level” discussed 7 propositions: (a) climate change and poverty are linked by the issue of vulnerability, (b) the hardest equity issues arise because of qualitative differences in the nature of climate change and policy impacts on the poor and those who are better off, (c) poverty cannot be understood in terms of lack of goods or income, or even basic needs, but must rather be understood in terms of people’s ability to participate in the social discourse that shapes their lives, (d) emerging multi-dimensional measures of poverty are much better than those based on income or needs, but may continue to underestimate socio-cultural factors, (e) eliminating poverty and developing societal resilience require building social diversity, (f) climate change and policy impacts on the poor do not conform very well to analytic dichotomies of national and international, or intragenerational and intergenerational, (g) in the final analysis climate protection and poverty elimination may be most effectively achieved through local-level actors and their global networks. The discussions focused on the need to help the truly poor in the south, with specific programs to reduce their vulnerability.

The last paper of the session “Climate Change, the Rights of Future Generations and Intragenerational Equity: an In-expert Exploration of a dark and Cloudy Path” was presented by Irving Mintzer. It was co-authored with David Michel. The author stressed that the impacts of climate change would be distributed unevenly over future generations in a yet unknown way. He also discussed the limitations of mainstream economics to deal with issues of intergenerational equity, noting the possibilities of different ways to select an appropriate discount rate. Giving these limitations, great care must be applied in using tools from mainstream economics on the problems considered. The author then looked into ways that international law defines intergenerational equity. He noted how Weiss’

three basic principles: conservation of options, conservation of quality, and conservation of access can be used for the implementation of a system of “planetary rights”. Finally, different models of operationalizing the concept of common, but differentiated responsibilities from the perspective of ethics were discussed -- utilitarian, realist (power relations), equitable commons, fiduciary trust, and earthrights.

### **1.3 Synthesis and Recommendations for the IPCC Third Assessment Report (TAR)**

In the concluding session, rapporteurs Rob Swart, Neil Leary and Atiq Rahman presented their interpretation of the main issues discussed during the expert meeting. Together with information from a questionnaire that was distributed during the meeting and with additional feedback from the participants, the main findings were formulated in the form of 21 summary recommendations for lead authors of IPCC’s Third Assessment Report. There was a strong consensus that the results of the meeting should be taken into account very seriously, especially by WGII and WGIII lead authors.

During the meeting, it was evident that the three issues of development, sustainability and equity are strongly overlapping and interdependent, and hence the recommendations do not necessarily follow the structure of the expert meeting program. Also, many of the main issues that were discussed were generic with respect to the different types of climate change response (coping with impacts, adaptation, mitigation). Hence, the recommendations do not distinguish between Working Group II and III.

Clearly, the substance of the assessment is the sole responsibility of the writing teams of the TAR. Nevertheless, it is hoped that the recommendations from this expert meeting could not only improve of the structure of the TAR by facilitating the more comprehensive and systematic treatment of an important crosscutting issue, but also strengthen the balanced analysis of development, sustainability and equity issues which are pertinent to climate policies. The TAR could take a major step forward (as compared to the Second Assessment Report), by following the recommendations below,

1. ***Elements of sustainability.*** The vocabulary, literature, and modes of discourse are disparate and isolated amongst the issues of development, sustainability and equity. However, there is broad agreement on the usefulness of distinguishing between three main elements: economic, social and environmental forms of capital; TAR Lead Authors are encouraged to (a) structure their assessment accordingly, (b) select associated concrete indicators to go beyond the conceptual level, and (c) analyze the crucial linkages among the three elements.
2. ***Equity issues.*** The fact that the gap between north and south in terms of per capita incomes and emissions is very large and is not decreasing, is a reason for very serious concern. Authors are particularly encouraged to include aspects of equity into their evaluation of climate change response options; the view that “while climate change cannot ensure equity, it should not worsen it”, could be a point of departure. Equity issues can relate to income groups, nations and regions, generations and gender. The SAR addressed equity in a relatively theoretical, stand-alone chapter. In the TAR, equity would be one of the considerations in all chapters that consider impacts, and adaptation and mitigation options.



3. **Options for fairness.** After assessing distributional aspects (intra- and intergenerational) of consequences of future climate change, and of adaptation and mitigation options, lead authors can describe what the literature says about the fairness of this distribution; this includes as relevant factors the influence of a range of possible discount rates when assessing costs, and the equity implications of different options to distribute emissions quotas over regions and time.
4. **Different decision makers.** While decisionmakers other than governments (e.g. individuals, firms, families, NGOs) may not be the primary clients of IPCC, writing teams are encouraged to also take these actors into account in the assessment. Here, the applicability of scientific, technical and economic analysis for real-life decision making could be addressed, acknowledging the differences between decisionmakers in the real world, and analysts using theoretical models and other scientific methods.
5. **Different views, different tools.** It is advised that in the report, the existence of different views on alternative development pathways is acknowledged and presented, with the associated research tools and preferred policy options (which can be different for different views); this information would be presented as complementary rather than conflicting.
6. **Different decision frameworks.** Climate change is a relatively new problem, and lead authors are encouraged to recognise the full scope of available decision analytical frameworks for analysis, including emerging innovative ones; different tools for different questions may be appropriate and their advantages and limitations – notably in the context of DES – should be spelled out. An example discussed at the expert meeting was the difference in emphasis between the optimality approach (maximising economic efficiency) and the durability approach (minimising environmental and social risks). Are these approaches convergent or basically conflicting?
7. **Different levels of spatial scales.** A synthesis is needed to reconcile the mainly locally-nationally oriented literature on sustainable development and the climate change literature which is mainly focusing on the regional and global level. Eventual solutions to climate change have to be at the local level. Lead Authors are encouraged to take these different levels of scale and their interactions into account when drafting their chapters. This would capture (global, regional) top-down analyses and (local, national) bottom-up studies.
8. **Different regions, different mitigation focus.** From the perspective of stabilising concentrations of greenhouse gases, evaluation of long-term mitigation options in the industrialised countries would need to consider eventual deep emissions cuts. In addition, the assessment of mitigation options in the developing countries could focus on the possibilities and incentives for capturing early GHG mitigation opportunities in order to avoid future GHG emissions at the historic level of the industrialised countries (seeking to “tunnel” through the environmental Kuznetz curve that hypothetically depicts increasing emissions of GHGs at early levels of development and decreasing levels at high levels of income). However, the right of developing countries to develop economically cannot be compromised by climate change mitigation concerns. Since the two regions are closely tied together in various ways, the mutual impacts of such developments have to be carefully considered [WGIII].
9. **Regional differences in indicators.** In the assessment, lead authors should recognise regional differences in relevant indicators as much as possible, particularly with

- regard to social welfare indicators. It should be acknowledged that GNP is only weakly related to well-being; as far as the literature allows, indicators of poverty have to be multidimensional, going beyond income levels, access to goods and services, or basic needs.
10. ***Adequacy and specificity of indicators.*** It is recommended to pursue a set of indicators as comprehensive and concrete as the literature permits. Definitions of indicators have to be explicit and transparent. For example, reporting of costs should reflect as much as possible total social costs, but if this information is not available, this should be clearly stated.
  11. ***Managing or coping.*** Authors are encouraged to acknowledge the view that the world can only be marginally managed at best, in addition to the more common view that the world can be effectively controlled to mitigate or adapt to climate change. In this way, what is known about increasing the ability to cope with changes (rather than trying to manage them), would be better reflected in the report. This particularly refers to the adaptive capacity of the most vulnerable groups [WGII].
  12. ***Most vulnerable groups.*** TAR Lead Authors are encouraged to pay attention to the poorest and most vulnerable parts of the population in various regions when assessing the distributional aspects of the impacts of climate change, and adaptation and mitigation options to the extent possible. They should take into account that available global and regional analysis may provide little guidance on this.
  13. ***Instabilities and non-linear changes.*** In addition to gradual changes, authors are advised to take into account the possibilities of changes affecting the stability of both socio-economic and biogeophysical systems, e.g., because of non-linear system behaviour.
  14. ***Increasing overall resilience.*** Increasing countries' resilience to global change in general – e.g. increasing socio-economic development and social justice, and reducing physical vulnerability - can be recognised as a means of also increasing resilience with respect to climate change, especially with respect to the most vulnerable countries and groups [WGII].
  15. ***Governance and institutions.*** Lead authors dealing with adaptation and mitigation options are encouraged to take into account governance issues at various levels of scales. Institutional effectiveness is crucial for addressing climate change at all scales.
  16. ***Integrating climate change into development policies.*** Conversely, policies for national development, or for mitigating local problems (economic, social and environmental) can mitigate climate change and GHG emissions. New SRES scenarios suggest that differing development pathways can have at least as large an impact on greenhouse gas emissions as explicit greenhouse gas control policies. It may be assumed that human choice can influence these development pathways. Consequently, TAR writing teams could consider policy options that go beyond explicit climate policies in their assessment [WGIII].
  17. ***Technological and social change.*** Any effective solution to the climate change problem in terms of mitigation is likely to include (technological) resource use efficiency, and social/behavioural/lifestyle changes, amongst other reasons because efficiency increases are often compensated for by increases in activity levels. Both types of change are interrelated, for example at the level of consumer demands. Effective solutions include both dematerialisation and decarbonisation options.

Authors are encouraged to be comprehensive in their assessment of options in this respect [WGIII].

18. ***Incentives and constraints for technological change.*** Lead authors are advised to assess the economic, social and environmental incentives and constraints for technological leap-frogging, both for north-south and south-south technology transfers and distribution, as well as for adaptation and mitigation. It is often forgotten that such technological advancement involves both hardware and software. This may require new perspectives on alternative development paradigms.
19. ***Long-term perspective for short-term actions.*** It is important to maintain a long-term perspective throughout the TAR, because of the very long time frames for: (a) manifestation of climate impacts, (b) achieving income convergence, and (c) the need for eventually needed deep GHG emissions cuts to achieve stable concentrations. This context should also be kept in mind when assessing shorter term response options.
20. ***Literature limitations.*** The assessment should be as comprehensive, rigorous and precise as the literature permits. Because (particularly quantitative) analyses in the mainstream literature tend to focus on just a subset of the full spectrum of economic, social and environmental aspects of response options, lead authors are encouraged to include literature in the assessment beyond those areas of expertise represented in the writing team -- for example by involving contributing authors from other disciplines. Integrating the information from a mainly scattered and disparate disciplinary literature is important, to make the TAR an effective interdisciplinary report. It is also important to note gaps in knowledge, e.g. in the form of research recommendations (e.g. non-monetised aspects of response options and impacts, quantification of social capital).
21. ***Climate change mandate of IPCC.*** “Development, Sustainability and Equity” issues are now widely accepted within the main context of the IPCC TAR, and the TAR objectives would be broadened as compared to the SAR. At the same time, the focus of the assessment necessarily has to remain within the climate change mandate of IPCC, avoiding a comprehensive assessment of (sustainable) development strategies. The IPCC may not be the best vehicle to deal comprehensively with development, sustainability and equity issues, but there is room to significantly improve our understanding in this area.

## **1.4 Public Symposium**

A public symposium was organised after the expert meeting. At the symposium, WG-III co-chairs Bert Metz and Ogunlade Davidson, and vice-chair Mohan Munasinghe gave presentations on climate change and its potential implications for Sri Lanka to a large and varied audience of representatives from the Sri Lanka government, industry, NGO community and academia.

Following the IPCC expert meeting and public symposium, Honourable Batty Weerakoon, the Sri Lankan Minister of Science and Technology, announced his intention to launch a new programme of climate change studies under the aegis of his Ministry.

