Multi-stakeholder Regional Consultation on the proposed International Assessment of the Role of Agricultural Science and Technology in Reducing Hunger, Improving Rural Livelihoods and Stimulating Environmentally and Socially Sustainable Economic Growth

Sponsored by the World Bank, organized jointly by the Soil Conservation Society of India & the International Rice Research Institute and supported by the Ministry of Agriculture, Government of India

12-13 May 2003
New Delhi, India

Report of the New Delhi Consultation

I Introduction

1 The Report of the New Delhi Consultation is based upon the statements and remarks delivered at the opening and closing sessions, detailed deliberations in the four break-out groups, presentations made and discussions during the plenary sessions.[1] In addition, written comments received from participants have also been incorporated in the Report.

2 *Unique Features of the South Asia Region*

2.1 Since the exercise is being done on a regional basis, it was felt that the unique features of the South Asia region be highlighted and the specificity of the region be captured so that the outcome of the proposed Assessment be relevant and useful to the various groups of stakeholders in the region.

2.2 Of the 800 million people who live on less than $1 a day, more than one-third reside in the South Asia region. The region is characterized by a majority of small and marginal producers with land-holdings of less than two hectares. Four countries in the region account for more than 50 percent of all small farmers in the world. Land to person ratio is declining and the small and marginal cultivators will increase further in number. Water resources in most countries of the region are under severe stress both on account of biotic pressures as well as irrigation demand. The region has been identified as one of the mega biodiversity centres of the world, but the biodiversity is also under threat from human activity. The region is also very disaster prone, 50 percent of the world's disasters damage occurs in this region. Both flood and drought take their annual toll upon agriculture adding transient hunger to the numbers of chronically nutrition insecure. The region is influenced by the Monsoon system, and more than two-thirds of the cultivated area is rainfed while about one-sixth is drought-prone.

2.3 Agriculture has been the engine of economic growth in the region and will continue to be so in the next decades, because 25 to 50 percent of GDP still accrues from agriculture but more importantly more than two-thirds of the rural population derive their livelihoods from agriculture.

[1] Agenda for the New Delhi Regional Consultation may be seen at Annexure 1 and the List of Participants at Annexure 2

2.4 To feed everybody adequately, it is estimated that food production will have to double within the next 30 years. Meeting this demand will require productivity increases and product diversification to ensure broad-based economic growth capable of improving the livelihoods of the poor. As the single-largest user of the natural resource base the agriculture sector is now facing enormous challenges.

3 *Challenges to future agricultural growth*

3.1 Bio-physical constraints include (i) land degradation and declining per capita arable land which pose a threat to future productivity. (ii) water resource scarcity which is leading to a serious mismatch between irrigation demand and supply; water tables are falling and underground aquifers are being exhausted. (iii) biodiversity loss and deforestation (iv) climate change, variability and global warming and their impact on agriculture have emerged as new threats and challenges; expected sea-level rise between 15-94 cm over the century will adversely affect the coastal ecosystem and island states

3,2 New socio-economic regimes have emerged, especially globalization, liberalization and the new World Trading Order with both opportunities and threats for farmers and producers.

4 *Role of agriculture science and technology in alleviating hunger and poverty*

4.1 It was emphasized that advances in agricultural science and technology have historically played a critical role in alleviating hunger and rural poverty through increased food availability by improvements in cultivars and management practices, mechanization, and improved plant nutrient and crop protection technologies. The Green Revolution, which occurred in most countries of the region, led to unprecedented increases in food production. Wheat and rice yields increased several-fold. The incidence of rural poverty declined as agricultural growth and the purchasing power of rural households rose. Multiplier effects of agricultural growth spread beyond agriculture to the non-farm economy leading to employment generation and higher incomes.

4.2 It was noted that while significant progress was made in the past 30-35 years in raising food availability and consumption levels, improving nutrition and reducing poverty through agricultural transformation, much remains to be done. Of the 800 million people who live on less than $ 1 a day, more than one-third reside in the South Asia region. Despite the pledges made at the World Food Summits, the World Summit on Sustainable Development and the Millennium Development Goals, the grim statistics point to a wide gap between promise and the reality. If the current trends are any indication, the numbers would merely decline from 294 million to 217 million by 2015, achieving just about half the target set. It is clear that the goals for reducing hunger and poverty cannot be met without substantial new momentum and initiative.

4.3 It was highlighted that a one dimensional focus on increasing food production and food availability is not enough to solve the problem of hunger and poverty. Food and nutritional insecurity and poverty are multidimensional in nature.

- Food security is not just about production; it is also about access. It is about rural livelihoods and employment generation and purchasing power.
- It is not just about output, but also the manner in which that output is produced how broad-based it is and how equitable and sustainable.
- It is not just about the amount of food, but also the nutritional content of that food that is important, as is food safety

- It is about public health issues such as drinking water supply and sanitation and whether the food can be properly utilized and absorbed in the system
- It is not just about the generation of technology, but also the policies and institutions that enable access to and usage of that technology.
- It is not only national policies but local governance and empowerment of local communities.
- It is equally about the empowerment of women and girls' education.

5 ***Content and Context of Agricultural Science and Technology***

5.1 It was emphasized that good science and technology is necessary but not sufficient to address the issue of hunger and poverty. Other non-science and non-technology barriers that often prevent the science and technology from achieving its objective need to be simultaneously addressed. The proposed Assessment would therefore need to comprise both the "content" and the "context" of agricultural science and technology, also referred to as the "hardware" and "software" or the "core issues" and "enabling conditions".

5.2 It was also felt that the proposed Assessment should internalize Indigenous Technical Knowledge (ITK) into the realm of science and technology. The concept of the marriage of ITK and modern technology giving birth to eco-technology was underscored. This would comprise productivity, equity, economic and environmental security leading from monocropping to systems approach, from single commodity to multidisciplinary, from compartmentalized to partnership mode from green revolution to ever-green revolution.

II The following questions were deliberated upon in four breakout groups and then discussed in the plenary sessions.

1 *Is there a need for an international assessment?*
2 *If so, what would be the value of the assessment?*
3 *What should be the scope and key questions?*
4 *What should be its organization and governance structure?*

II. 1 IS THERE A NEED FOR AN INTERNATIONAL ASSESSMENT?

1.1 A consensus emerged that there was a need for an international assessment on the role of agricultural science and technology for reducing hunger, improving rural livelihoods and stimulating environmentally and socially sustainable economic growth. Its product should be relevant to the region and useful to all stakeholders.

1.2 It was felt that poverty alleviation while implicit in the title of the Assessment was of extreme importance for the region and therefore merited an explicit mention.

1.3 It was underscored that the assessment should be within the context of finding strategic solutions for increased production, reduction of hunger, alleviation of poverty and stimulation of economic growth, that would be generic in nature and therefore of global application up to a point, but be more location specific for each region and sub-region. By its very nature agriculture science and technology does not lend itself to universal application. There is need to guard against the Assessment becoming too global and general and therefore losing its value for national and sub-national application.

1.4 It was noted that the viewpoint of a wide range of producers and consumers should be incorporated in the Assessment and their concerns addressed so that the outcome would be relevant for them, the ultimate stakeholders.

1.5 The end-users of the Assessment would be the various groups of stakeholders, namely, governments, scientific community, private sector, NGOs, development banks, international agencies, producer and consumers. It was clarified that unlike in the case of the IPCC where there was a clear-cut, well-defined clientele in the Parties to the UNFCCC, the end-users in the present case were also governments as well as other stakeholders. It was further clarified that at the start of the IPCC the Convention had not existed, it came about because of the Climate Change Assessment.

II. 2 WHAT WOULD BE THE VALUE ADDED?

2.1 ***It would help provide a fresh impetus to Agriculture Science & Technology.***. Modern agriculture science and technology of the kind that led to the Green Revolution is running out of steam after having served well the cause of increased agricultural production and increased food grain availability, and required a substantial new momentum and initiative if the goals for reducing hunger and poverty in South Asia were to be met by 2015. The proposed Assessment would provide the much needed impetus.

2.2 ***It would provide a holistic view of the challenges and opportunities by addressing both the Content and Context of Agricultural Science and Technology.*** So far the focus has been on agricultural science and technology. Yet, experience has shown that in combating hunger and poverty factors external to science and technology are equally important. Studies in the past have examined the issues in a piecemeal manner. In addressing simultaneously both the "content" and "context" of agriculture science and technology, the Assessment would provide a unique holistic, perspective.

2.3 ***It would bring centre-stage indigenous technical knowledge and traditional agricultural practices.*** So far, agricultural science and technology has implied modern science and technology of the kind that ushered in the Green Revolution. The proposed Assessment would for the first time, broaden the mandate of agricultural science and technology to include indigenous technical knowledge on the one hand and frontier sciences such as biotechnology, remote sensing and information technology, on the other.

2.4 ***It would synthesize and bring together in a single report the major science and technology issues worldwide.*** A substantial body of literature already exists on various aspects of the role of agricultural science and technology both within the international research organizations and networks as well as in the national agriculture research systems. The proposed Assessment would for the first time synthesize and collate in a single report the important issues concerning the role of agriculture science and technology.

2.5 ***It would bring convergence of findings of related international assessments.*** There are at present several on-going international assessments and related Conventions which have a direct or indirect bearing on reducing hunger, alleviating poverty, improving rural livelihoods and stimulating environmentally sustainable economic growth. These include the Millennium Eco-Systems Assessment (MEA), Inter-governmental Panel on Climate Change (IPCC), Millennium Development Goals (MDG), WTO, CODEX, IAC-How to Feed Africa, Convention on Biological Diversity (CBD), Convention on Combating Desertification (CCD), Commission on Sustainable Development (CSD). The proposed Assessment will cull out issues relevant for the role of agricultural science and technology from these assessments.

2.6 ***It would lead to higher public and private investment in agricultural science and technology research both at the national and international level***. It was observed that both at the international as well as national level there has been a decline in public funding for agricultural science and technology. This trend needs to be reversed if adequate capacities have to be created within the research systems. The proposed Assessment in providing a 50 year vision would help in

bringing back centre-stage issues of agricultural science and technology and result in enhanced public and private investment in the sector.

2.7 ***It would help steer global agricultural research in an appropriate direction to achieve the stated goals***. The proposed Assessment, which will be based on both the global and local perspectives, will provide greater focus to international research in addressing hunger and poverty issues.

2.8 ***It would help maximize cooperation and coordination in agricultural research***

2.9 ***It would lead to the development of mechanisms for more effective sharing of science and technology and success stories***. It was felt that excellent work had been done in national agricultural research systems and several success stories existed in reducing hunger and poverty in countries of this region as well as internationally. The proposed Assessment would lead to development of mechanisms where such success stories could be shared.

2.10 ***It would bring international perspective to national policy making***. An improved understanding of trans-border issues having a bearing on agriculture science and technology such as climate change, international trade, germplasm exchange, food safety and the like would help to refine national policies to take advantages of the opportunities while avoiding the pitfalls of the international arena.

II.3 WHAT SHOULD BE THE SCOPE AND KEY QUESTIONS?

3.1 ***Content & Context of Agricultural Science & Technology.***. The scope and key questions were discussed with respect to the regional characteristics and priorities. They broadly fell into two major categories, (i) the core science and technology issues, which would comprise the content of the Assessment, and (ii) external issues, which determine the effectiveness of the science and technology in achieving its stated goal, these issues, would comprise the context.

3.2 ***Scope of the Assessment***. It was clearly emphasized that in assessing the core science and technology questions, the domain need not remain limited to the current science and technology of the kind that gave birth to the green revolution, but explore and harness the **frontier sciences** such as bio-technology, information technology and satellite imagery, as also the **indigenous technical knowledge** and traditional practices. The scope of the Assessment must therefore extend to all three domains of agricultural science and technology, namely (i) current science and technology (ii) frontier sciences and (iii) indigenous technical knowledge.

3.3 ***Time-frame of the Assessment***. It was felt that the Assessment should address the content and context of agricultural science and technology issues in terms of both a short term and long term perspective. For the short term, those issues that should receive priority should be the ones likely to bear fruit in the next 10-12 years. These would focus not so much on the development of new technologies as on making the existing technologies on the shelf and on the field, work more effectively. The short-term perspective would primarily address issues of context, i.e. the external factors that would enable effective adoption and usage of current and on-the-shelf technologies. The long-term perspective, a fifty-year time frame, would focus on the generation and development of new core agricultural science and technology issues. Since the scope of the assessment was very wide, the need for priority setting was emphasized.

3.4 **<u>CONTENT</u>: core agricultural science and technology issues – key questions**

Under the core agricultural science and technology issues the questions identified spanned virtually the entire spectrum of the agricultural chain ranging from production and productivity to climate change and rural energy.

- *What is the potential of agricultural science and technology to make the small and marginal producer economically viable?*

- *How effective has agricultural science and technology proven compared with other sciences, say chemical or nuclear sciences?*
- *How can agriculture science and technology make agriculture an attractive profession for the rural youth? What is the potential of science and technology to integrate agriculture into rural development*
- *What is the status of the rural community in terms of their benefit from agricultural science and technology? Which sections have benefited substantially which only marginally? Large producers vis-a-vis small producers? Land-owners versus landless? Male versus female? Crop sector versus livestock and fisheries?*
- *Should biotechnology be viewed differently in developing vs. developed worlds? Biotechnology (not just GM crops) is going to be a driving factor in the future, how prepared are the institutions in the region to make full use of its benefits? Should regulatory procedures be simplified? How can biosafety concerns be addressed? Can there be better harmonization between regulations for biotechnology products and other products, e.g. pesticides from the public health and safety perspective? It appears that biotechnology regulations are more stringent thereby acting as disincentive to private investment in the area.*
- *What is the potential of science and technology to increase nutrient availability? to reduce cost of cultivation? What would be the costs of improved environment?*

3.4.1 **Production, Productivity & Profitability**

- In **irrigated areas** where the Green Revolution took place yields are plateauing and decline in factor productivity. Soils are showing signs of nutrient imbalances and declining organic matter and carbon content.

  - *Is the golden era of plant breeding truly over due to restriction in the movement of germplasm or can science and technology overcome such constraints?*
  - *How can science and technology be harnessed to overcome the yield plateaus, push back the production frontier? Breed varieties with higher response to inputs? How can factor productivity be increased? Can development of shorter duration varieties compensate for stagnation in yields? What implications do higher cropping intensities have for resource degradation?*
  - *Will increase in productivity lead to reduction of hunger and increase in farmers' incomes?*
  - *Should paddy continue to be cultivated by flood irrigation? What are the other options? Are systems of rice intensification (SRI) feasible alternative to future rice production?*
  - *How can farming systems research be promoted?*
  - *There is need to draw distinction between food security & nutritional security. How can biotechnological approaches be used for genetic enhancement? What technologies are required for breeding nutritionally improved varieties for greater nutritional security such as beta-carotene enriched rice, iron enhanced mustard etc.?*
  - *What are the factors leading to soil degradation and declining factor productivity. How may this trend be reversed?*
  - *What combination of modern, frontier and indigenous technical knowledge and practices will enable sustainable agriculture growth which allows production increases and at the same time preserves the natural resource base.*
  - *Hunger and poverty—what role for fortification?*
  - *Has successful technology necessarily been resource-degrading?*
  - *Are production technologies addressing plant health, human health, animal health and environmental health and the changing food consumption patterns in the region?*

- In **rainfed and drought prone areas**, compared to irrigated areas, technological advancement has not kept pace and has received much lesser attention and resources.

  - *What technologies and agronomic practices are suitable for rainfed regions? How to develop technologies which will enable more crop per drop of water? Scientifically and economically how feasible is 'more crop per drop' compared to 'more crop per hectare'? What are the trade-offs*

involved? How can science and technology be harnessed to develop and refine varieties of crops that are drought resistant, salinity resistant, insect and pest resistant?

- *Research in the past has focused on wheat and rice cropping systems. How can science and technology engage in according higher priority to "orphan crops" which are high in nutritional value, such as pulses (legumes), millets etc., but are unable to compete with higher yielding crops?*
- *How successful have past efforts aimed at dryland areas been? Lessons learnt?*
- *Integrated watershed development has emerged as a key strategy to development of rainfed areas, what further science and technology refinements are required to further enhance its value specially to the small producer and landless labourers?*
- *Can biotechnology be tailor-made for specific agroecological zones? What are the genuine and perceived risks associated with transgenic crops. What are the issues related to biosafety and the ethical considerations? What factors can build greater confidence in the acceptance of genetically modified crops?*
- *What are livelihood strategies of the poor and non-poor currently? How do these interact with science and technology? Employment generation?*
- *How can frontier sciences such as space technology and remote sensing and GIS be used for crop forecasting, short and long-term weather forecasting and optimal land-use planning? How can small and marginal producers benefit from them?*

3.4.2 Resource Conservation (Land, Water & Biodiversity) & Sustainability

- *How can science and technology shift gears from a production process based on maximization to one based on optimization?*
- *Are there inherent contradiction between resource conserving technologies and economic viability? What successful science and technology have proven otherwise? What further application do such techniques lend themselves to?*
- *How can science and technology factor in costs of environmental degradation while developing new package of practices? How can it be ensured that all cost-benefit analysis are conducted not merely in terms of input output economic and financial costs but also incorporate environmental costs and benefits*

Land

- *What is the potential of science and technology to address soil fertility? How can it address land degradation, even reverse it?*
- *What are the benefits of zero/reduced tillage? How can science and technology address its shortcomings so that there is greater acceptability?*

Water

- *What is the potential of science & technology for improving water efficiency in agriculture?*
- *How can precision agriculture be used by small and marginal farmers?*
- *How can science and technology improve potential for rainwater harvesting?*
- *What is the potential of agriculture science and technology in improving water-conserving irrigation technologies? How should traditional water-harvesting systems be rejuvenated and integrated into the irrigation systems?*
- *What can be done to address the problems of water-pollution especially arsenic/ heavy metal toxicity?*

Biodiversity

- *How can science and technology overcome the apparent contradiction between commercialization of agriculture and preserving biodiversity?*
- *How can science and technology develop anti-pollution plants? biodrainage?*
- *How can stakeholders better manage common resources, such as forest and common pasture lands and groundwater?*
- *What is the potential of science and technology in recycling nutrients through recycling of of waste?*
- *How can the use of external and energy-intensive inputs be reduced without compromising on yields?*
- *Organic farming implies lower yields. Can science and technology redress this?*

- *Organic farming for resource-poor areas? Markets seem to be showing an interest in this idea—assessment to document these experiences.*
- *Can traditional knowledge be upgraded by modern science and technology so that there is value added for the small producer?*

3.4.3 .**Diversification**

- *What is an optimal crop mix for each agro-ecological zone? One that has diversification as its main focus?*
- *How can science and technology improve livelihoods of subsistence farmers?*
- *In pursuing diversification strategy is science and technology addressing the concerns of small farmers and small livestock producers?*

Horticulture

- *Horticultural crops have the potential to provide micro-nutrients essential for nutritional security for the poor, how can science and technology enable the rural poor to improve access to such horticulture produce?*
- *What is the potential of science and technology to develop peri-urban horticulture?*

Non-traditional Plants

- *How can agricultural science and technology help in developing plant based edible vaccines? What are implications?*
- *What research is required to make aromatic & medicinal plants a viable option for small and marginal farmers?*

Agroforestry

- *How to integrate agriculture and forestry?.*
- *How can agriculture science and technology improve linkages between agriculture and forestry? What benefits can small farmers get from adoption of agro-forestry? Can farmers gain from agro-forestry under the clean development mechanism?*

Livestock

- *Is there adequate science and technology focus on the optimal mix of production system - production of appropriate variety of crops, crop diversity, livestock production, small ruminants, marine food, nutrition balancing.*
- *Similar to the case of crop production where the emphasis has been on the two major crops wheat and rice, the focus in livestock production has been on large ruminants, how can science and technology develop the smaller ruminants which provide greater sources of income to the rural poor?*
- *How can science and technology develop drought resistant breeds of livestock?*
- *Relevance of animal draft power will continue for the small producer, draft animals are a by-product of dairy farming, can science and technology further improve upon it?*
- *What is the potential of science and technology in developing pastoral and livestock based production systems?*

Fisheries & Aquaculture

- *What is the potential of agricultural science and technology in developing the comparative advantage of fisheries and shrimp aquaculture over traditional cropping systems?*
- *How can application of science & technology for freshwater and inland fisheries help in improving nutrition, generating employment and improving livelihoods?*
- *What is the potential of mixed paddy-aquaculture production systems? What implications does it have for environmental sustainability?*

3.4.4 **Post-harvest, Agro-processing and Food Safety**

- *Scope for value addition in safe disposal of bio wastes and profits? Can indigenous practices here be documented and science and technology used to improve these? Incremental approaches likely to be more acceptable to farmers.*
- *Do we lose food value due to inadequate investment in packaging research?*
- *Are we investing enough in research in food processing sector, proportionate to the investment in food production? How do we apply science and technology for standardization?*

- *How do we address post harvest losses due to lack of basic infrastructure such as electricity and roads?*
- *What is the potential of agriculture science and technology for generating wealth out of agro waste? Do science and technology place a lower premium on realizing value from by-products?*
- *Can current science and technology integrate modern inventions and traditional technologies for post harvest issues?*
- *What is the potential for generating employment and income for rural non-farmers in post-harvest, agro-processing, distribution and transport of agricultural produce and products?*
- *What is the potential of agriculture science and technology in providing value addition at farm and local sites based on technologies that are women friendyl, such as local level preservation, local storage, grain and seed banks..*
- *Is science and technology providing adequate focus to rural, small industry based technologies for immediate product value addition?*
- *Are we addressing technology issues based on the movement of value chain?*
- *To what extent is science and technology addressing product management risks – post harvest, leveraging S&T and IT inventions?*
- *Are we focusing on "On farm training, value addition at the farm level"?*
- *How can food safety be factored into agriculture science and technology research?*

3.4.5 **Climate Change**

- *What is the potential of agricultural science and technology to adapt to climate change? How to develop varieties for higher temperatures, more extreme events, and higher levels of GHGs?*
- *How can agricultural science and technology be harnessed for mitigating climate change? Can crop varieties and cropping patterns be developed that have potential to act as carbon sinks?*
- *What agronomic practices help in retaining carbon in the soil?*
- *What role can agro-forestry play in adaptation to and mitigating climate change?*

3.4.6 **Rural Energy**

- *Mechanization and its implications for livestock?*
- *What is the potential of agricultural science and technology in improving rural energy availability? Further for value addition to agricultural produce at site?*
- *What is the potential of agricultural science and technology for developing and refining biofuels?*
- *How can science and technology be harnessed for developing more energy efficient technologies at all levels in the agricultural chain from production, post-harvest to processing?*

3.5 CONTEXT: enabling conditions

3.5.1 **Market Access and International Trade**

- *To what extent does market access influence adoption of technology of subsistence farmers versus commercial farmers?*
- *How can market conditions be incorporated into generation of technology?*
- *What are the options available to small farmers to improve market access?*
- *Is the diversification process being adversely affected by lack of access to markets of high-value (perishable) produce, what implications does this have for agricultural science and technology?*
- *What are the national and sub-national policy implications?*
- *How effective is contract farming as a marketing option and what factors lead to successful contracts? How can the interest of small farmers be safeguarded without discouraging the private entrepreneurs?*
- *What policy reforms will ensure greater transparency and competition in both input and commodity markets as well as in the provision of agro-services?*
- *What kind of public-private partnerships are workable in improving market access? How can private resources be mobilized for creating market infrastructure?*
- *Will small and marginal farmers benefit through the mechanism of futures markets?*

- *What conditions ensure the success of cooperative/ group marketing mechanisms?*
- *What kind of new, regulatory regimes are required to safeguard the interest of small and vulnerable producers in an increasingly market regime?*
- *What are the implications of the WTO on small and marginal producers and landless labourers and what conditions are required for small producers to benefit from the trade opportunities and safeguard against the threats?*
- *What are the implications of non-tariff barriers, such as food safety issues, methods of productions, food preferences, in generation and adoption of agricultural science & technology?*
- *Is science and technology creating non-tariff trade barriers, e.g. milking of cows be done through machines otherwise it is "unsafe" for consumption.*
- *How to ensure that IP regimes do not hurt developing country agriculture?*

3.5.2 **Institutional**

Research

- *What institutional mechanisms will ensure more effective linkages between science and policymaking? What institutional mechanisms are required to ensure that research priorities appropriately address of regional, sub-regional and local needs? Are policy frameworks effectively addressing the issue of research duplication?*
- *Are research priorities determined on holistic basis? What institutional factors constrain the process? Is there adequate integration of socio-economic-environmental issues into agricultural research priority setting? To what extent is agricultural research demand-driven? What institutional arrangements can further improve this process? How do we strategize and implement farmer led on – farm research? How do we choose between centralized vs. decentralized research Institutions?*
- *Are we recognizing and appreciating indigenous knowledge in research and product development? What institutional arrangements can bring indigenous knowledge application more centre-stage?*
- *Complexity is increasing requiring more sophisticated solutions. Genomics, IT, How are the NARS prepared to absorb these changes and build capacities? Lack of social scientists and multi-disciplinary approach will be a major constraint in the future.*
- *What will be the role of partnerships and networks in future? How can they be made more effective?*
- *How can we develop a decision support system wherein appropriate technologies for appropriate crops are determined? Is there adequate research on the management of science and technology?*
- *Who is going to produce products, which are based on pro-poor technologies?*
- *Are current institutions effective enough to ensure that while research has focused adequately on science, there is an equally sharp focus on converting them to "end products" through technology?*
- *How to create scientific awareness to ensure reliability and acceptability of biotechnology among all stakeholders?*

Extension and Agro-service provision

- *How effective have been extension reforms?*
- *What should be the relative roles of the public and private sectors in the delivery of agro-services? What are the lessons to be learnt from current innovations in extension and the public-private partnerships? Are farmers advised to produce products which find acceptability in the markets?*
- *Outreach and communication is generally lacking in bringing technology to farmers – How effective are the institutional mechanisms in identifying knowledge gaps and creating capacity to bridge these gaps*

Institutional finance & micro-credit

- *How can flow of institutional credit in agriculture be improved?*
- *What factors support the spread of micro-credit, especially to rural women?*

Risk Management

- *What institutional arrangements and mechanisms are effective for risk management in agriculture? What safety nets need to be provided for the poor and vulnerable? In a scenario of*

food surpluses and food scarcity how can the Public Distribution System be improved to ensure adequate food to the poor?

- *In moving towards a market regime how should insurance issues be handled both for crop and livestock producers and for fishers? What are the implications for small producers?*

3.5.3 Governance

- *Are the legal, policy and regulatory system generally lagging behind the pace of scientific innovation? Are food processing regulations currently at extremes? How best to ensure public health as well as support for private enterprise? What regulatory mechanisms need to be in place to monitor abuse?*
- *Are the policy mechanisms effectively engaging in allocating adequate resources for research and commercialization?*
- *Are policy planners engaging in creating a framework for public private partnership in research and product utilization? Are policy planners engaging in creating a framework for public private partnership in research and product utilization? Uniform policies for public sector and private sector research and commercialization! Does the creation of a level playing field for both public and private sector result in greater resource mobilization for agricultural sector? To what extent the resources so mobilized flow to the small and marginal producers?*
- *Is there clarity in policy and programs in integrating farm and non-farm sector at the grass root level?*
- *Is CODEX inimical to biodiversity?*
- *Are policy issues addressing IPR, technology transfer and commercialization issues? Harmonization of transparent policies in areas such as PVP, Bio-diversity, Bio-safety protocols?*
- *How to ensure that the process of clearance for GM products is perceived to be impartial and credible? Document best practices world wide?*
- *Livestock policy, breeding program policy, extension policy, biotechnology approval policy, market mechanism creation, standards regulatory, agricultural trade policy – are they all integrated?*
- *How do Governments' transform from "doer" and "driver" to "enabler" and "facilitator"?*
- *Are we emphasizing adequately commercializing technologies that are already well validated?*
- *Who should be doing the research in biotechnology?*
- *Every DNA of value is now getting patented. How are we going to address the FTO issues in research?*
- *What mechanisms would strengthen and empower grassroots producers' institutions to influence research and extension agendas and make the generation and dissemination of agricultural technology more demand-driven?*
- *What policies and legal framework will help in the generation and accumulation of social capital? How should groups other than Panchayats be integrated in local governance and rural development?*
- *How to rationalize pricing of scarce natural resources, especially water, to ensure their optimal utilization*
- *Are forecasts of variety of agricultural production based on certain predictability model of food habits, food consumption pattern and economic development?*

3.5.4 Information

- *What are the implications of information-technology based dissemination? How to ensure that the small and marginal producers are benefited by the IT revolution?*

3.5.5 Infrastructure

- *To what extent is lack of infrastructure influence access and usage of technology? What are the short term alternatives to lack of rural roads, electricity, storage ? How can private investment be mobilized?*
- *Is technology addressing customized infrastructure designing and installation?*

3.5.6 **Gender mainstreaming**

- *What is needed to improve the gender balance in the development and access to and benefits from agricultural science and technology?*

3.5.6 **Disaster Management**

- *What institutional arrangements can help the rural poor in coping better with natural disasters so that the adverse impact on food and nutritional security is minimized?*

- **Legal issues as they relate to land rights, water rights, IPR**

  - *What kind of land reforms are conducive to diversification and which simultaneously safeguard the interest of the small and marginal producers?*
  - *What models ensure intellectual property rights protection for end users and by end users?*
  - *When do intellectual property rights enhance or inhibit investment in agricultural research and development?*
  - *Need to make a scientific and economic value based decision on where to store products and where to add value!*
  - *How can we secure the intellectual property rights of the poor?*

II.4 WHAT SHOULD BE ITS ORGANIZATION & GOVERNANCE STRUCTURE?

4.1 Governance Structure

4.1.1 Since the Assessment must ultimately be of value to the different category of stakeholders and the findings of the report be relevant for policy initiatives and reforms the majority view was that an intergovernmental organization would be the most suitable since it would ensure the involvement of all governments. To a few who advocated a non-governmental structure it was pointed out that issues of food security, entitlements to food and their enforcement are within the government domain. Agricultural policy is shaped significantly by governments in developing countries as such their buy-in into the process would result in the ownership of the end-product. After discussion the majority view prevailed that an intergovernmental structure with participation of all other stakeholders would be the most acceptable.

4.1.2 The mechanism for ensuring the participation of the other stakeholders could be through advisory bodies comprising of various stakeholder groups which would assist the intergovernmental body. A suggestion was also made for creation of specific sub-groups to advise the inter-governmental body such as technology generators, technology managers, technology users, technology and service providers, policy planners, facilitators (input & output end) and the media.

4.2 International, Regional, National, Sub-national and Village Level Assessment

4.2.1 Unlike the Intergovernmental panel on climate change where the subject was narrowly focused, the subject of the proposed assessment on agricultural science and technology was very wide and location specific. Hence it was felt that the Assessment in addition to being global in nature should also have elements of regional, national, sub-national and village level perspectives. Suggestions were made that parallel assessments be carried out at the national and sub-national levels which would be attentive to agro-climatic features as well as administrative units, and be free from the politics of international agriculture.

4.2.2 In identifying the international institution to act as the nodal agency and facilitate the process, various suggestions were made. One view was that the CG secretariat should undertake this task as the objective of the proposed Assessment matched the objectives of the CGIAR system. However, after deliberations it was agreed that the World Bank would be the most suitable for facilitating the process of the International Assessment, while agencies such as the CG secretariat and FAO etc. would provide the necessary inputs and support.

4.2.3 At the regional level it was felt that regional institutions/ consortiums/ networks could be involved such as ICRISAT/ IRRI / APARI/ Rice-wheat Consortium /CORRA/ CURE with assistance from other regional bodies. It was felt that as the largest number of poor and under-nourished lived in the South Asia region there was a case for enhanced representation for this region.

4.2.4 It was felt that in countries such as India, it is the sub-national governments or the State governments that will drive agricultural policy and implementation since agriculture is a state subject. Hence, the involvement of state representatives and state level experts and consultants in the assessment process will be needed. Similarly, some selected village level studies might also help provide a grass roots perspective and thereby make the Assessment more complete.

4.3 Build on Existing Literature

4.3.1 It was felt that excellent work has been done within international as well as national level research and development institutions. The Assessment would be well served to build on, synthesize the relevant outcomes of the earlier works, and identify the gaps. A priority setting process among identified S&T gaps may assist in narrowing down the assessment focus and help to derive higher impact.

4.3.2 In areas such as indigenous technical knowledge, where the record and documentation of work is relatively limited, case studies may be used. Case studies may also be used to reflect all stakeholders, demographic spectrum to capture an oral history/ dynamics; be sensitive to agro-ecological specifics.

4.3.3 Three major studies in India were mentioned that could prove useful to the Assessment: the very comprehensive Report of the *Commission on Agriculture* in 1972; the on-going *Millennium Study on Farmers* being conducted by the Ministry of Agriculture; Government of India and the *Role of Agriculture* study being conducted in India and selected other countries by the FAO.

4.4 Technical Accuracy & Transparency

Technical accuracy would be ensured through an impartial selection of experts and peer reviewers. It was felt that there be both a nomination and selection process. Also experts and peer reviewers be drawn from all stakeholder groups. One suggestion was that while the management of the Assessment should be inter-governmental, the execution should be primarily non-governmental. There was discussion on how the experts and peer-reviewers were to be selected. It was mentioned that in the IPCC model, the Bureau/ Board, which is comprised of a representative geographic subset of all the governments, accepts and selects nominations for authors from all sources. If someone from a Sri Lanka ministry, for example, is selected, that person still serves in his or her individual capacity as an expert. There is need for communicating the outcomes of the assessment to a wide spectrum of stakeholders and customized strategies for communicating to different stakeholder segment.

4.5 Financial Resources

4.5.1 On the issue of financing the proposed Assessment, it was felt that the resources would by and large have to come from the developed countries or multilateral funding bodies. Private sector can buy-in – provide tax break and goodwill advantage. The funding pattern itself can be an example of Public-Private partnership. While the developed countries could support the process through funding, the developing countries could provide in-kind contribution in terms of experts, information possessors, and knowledge bodies.

4.5.2 It was noted that "discussion without finances is only conversation" implying thereby that not only are funds required to finance the proposed International Assessment, but also to implement the policy relevant findings of the Assessment. "Walking the talk" will also require funding from both the international as well as national agencies.