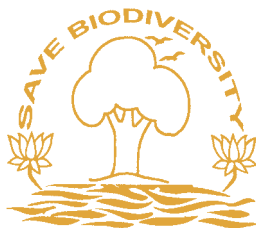


95th Session of the Indian Science Congress
January 03-07, 2008

**TOWARDS A KNOWLEDGE BASED SOCIETY
USING ENVIRONMENTALLY SUSTAINABLE
SCIENCE AND TECHNOLOGY**

**NATIONAL CHALLENGES &
SCIENTIFIC RESPONSES**



Indian Science Congress Association

I. PREFACE

The 95th Indian Science Congress (January 03-07, 2008) held at the Andhra University, Visakhapatnam with the focal theme, "Towards knowledge based society using environmentally sustainable science and technology" takes us down the memory lane to the earlier one (63rd Indian Science Congress of January 1976) organized in the same venue. In the annals of the Indian Science Congress, it will remain indelible since focal theme based deliberations of national relevance were introduced for the first time in that Congress held at the Andhra University. The focal theme chosen for discussion in the 63rd Indian Science Congress by the then General President of the Indian Science Congress Professor M.S. Swaminathan and the author of the idea of introducing focal themes was "**Science and Integrated Rural Development**". Needless to emphasize, Professor M.S. Swaminathan had, about decade earlier, harnessed the science of genetics and plant breeding to break the yield barriers and achieve dramatic yield increases in wheat, rice and other crops (this was referred to as "Green revolution" by William Gaud of the US Department of Agriculture. As the General President of the 63rd Indian Science Congress Professor M.S. Swaminathan emphasized that science and technology especially in developing countries should address the problems faced by the Society. In her Inaugural address, late Smt Indira Gandhi, the then Prime Minister of India said, "**The focal theme chosen for this year's science congress acknowledges that scientists are conscious of the unfinished tasks of their vocation!**" She also emphasized the role of science in rural development by quoting Gandhiji, "**if the village perishes, India perishes too!**" The 63rd Indian Science Congress also had the privilege of late C. Subramanian the then Union Minister of Finance addressing the scientists. He emphasized the need for "**the necessary understanding and imagination to harness science and technology in a constructive manner to benefit the (rural) masses!**"

Today knowledge is power in the political, social and economic domains. Creation and dissemination of knowledge have become vastly accelerated today in the 21st century than in 1976, when the Andhra University hosted the 63rd Indian Science Congress. It is therefore appropriate that theme of the 95th Indian Science Congress was appropriately chosen as "**Towards knowledge based society using environmentally sustainable science and technology.**"

The purpose of choosing a focal theme for serious deliberations in the Science Congress is to provide broad directions to the governmental policies. Indira Gandhi concluded her inaugural address at the Indian Science Congress in 1976 at Andhra University with a statement addressed to the then General President, "**I hope that your innovation in**

choosing a focal theme for the annual session and that the ever-relevant one of rural development will give added content and direction to governmental policies”

It is also worth mentioning that the then Union Minister of Finance late Bharat Ratna C. Subramanian provided an ad-hoc budget allocation of Rs.15 crores to start implementing the major recommendations arrived at by the 63rd Indian Science Congress of 1976 at the Andhra University. Thus, it also denotes a much closer working relationship between the Indian Science Congress and the Union government.

Some of the major recommendations of the 95th Indian Science Congress documented in this report pertain to several serious contemporary challenges (food and nutrition insecurity, depletion and pollution of surface and ground water, threat especially to agricultural productivity and production from climate change and sea level rise, etc.) These have also been raised by the Honorable Prime Minister Dr.Manmohan Singh and the Union Minister for Science, Technology and Earth sciences Shri Kapil Sibal in their addresses at the Vishakapatnam Science Congress. While a detailed report of the deliberations of the Science Congress will be published later, the present publication contains a brief description of a few **National Challenge Programmes**, which need urgent consideration and support.

II. CHALLENGES CONFRONTING THE NATION

PRIME MINISTER



The Honourable Prime Minister of India, Dr. Manmohan Singh in his inaugural address, listed the following five major challenges for which application of frontier science and technology blended with traditional knowledge is needed on war-footing:

- (a) Food Production and utilization and conservation of water
- (b) Energy generation and utilization
- (c) Manufacturing technologies
- (d) Mass transport systems
- (e) Building and construction technology

About food production, his emphasis was on a second Green Revolution through eco-friendly pathways. He also noted that climate change and sea level rise would exert adverse impact on sustainable development, particularly on agriculture and rural livelihoods. The response using science and technology must also **“grapple with issues of sustainability, equity and efficiency”**. His challenge to the scientific community is the development and use of **“new technologies which will raise agricultural productivity and simultaneously prevent the degradation of the scarce land and water resources and in this process we must ensure that the productivity of our small and marginal farmers also increases”**.

Application of knowledge for sustainable development is needed in energy conservation and the development of sustainable energy sources. There is an urgent need for clean coal technologies (an urgent priority) as well as development of solar, wind and biomass energy by the scientific, technological and business communities. We should also launch a small farmers’ bio-energy revolution consisting of the following action plans.

- Biomass utilization through biogas plants and gasification
- Production of ethanol from sweet sorghum, sugarcane, and other appropriate plants
- Production of bio-diesel through *Jatropha* plantation

While considering the energy and emission of Greenhouse gases which lead to global warming and climate change, he referred to the relevance and significance of rapid and

convenient mass public transport. The challenge is to **“provide environment-friendly public transport solutions that are affordable by all”**.

He observed that the traditional building technologies were largely environment-friendly but **“over the years a great of what is called modern building technology is environmentally ill-suited and unsustainable”**

Urban waste management including the management of hospital wastes is a serious problem, and science and technology must be harnessed in full measure to convert Urban wastes into wealth.

Restructuring and redesigning science and technology education and skill development to meet the needs of sustainable development and eco-friendly agriculture especially amidst various challenges such as degradation of natural resources, climate change and famine of rural livelihoods, have, therefore, become national priorities. Giving utmost importance to bring about a revolution in modern education, especially science education, the Prime Minister, Dr. Manmohan Singh called **“for making the year 2008 the year of revitalizing science education in India.**

The Hon'ble Prime Minister also suggested to the Indian Science Congress Association to constitute a Monitoring Group for each of the above said five major areas of challenges to see what new ideas this congress has thrown up in each area.

WAKE-UP CALL BY THE UNION MINISTER FOR SCIENCE AND TECHNOLOGY:



The Hon'ble Minister for Science, Technology and Earth Sciences Shri Kapil Sibal delivered the keynote address. He elegantly brought out the serious set back to sustainable development by the unholy combination of prodigious consumption, unbridled monetization, untrammled energy profligacy and global warming leading to climate change. He noted with deep concern that global and local climate may change faster than our ability to adapt. Stating that economic development needs energy, and thus the human poverty is directly related to energy poverty, he emphasized that the availability of affordable, secure and environmentally responsible energy supply is key to reach the **Millennium Development Goals (MDG)** and to decrease the welfare deficit globally.

- He pointed out that our technology inefficiencies lead to squandering an embarrassing amount of energy each in domestic, industrial and agricultural sectors. He asked the scientific community to develop clean, economically viable and renewable energy sources on the one hand, and develop highly energy-saving/energy-efficient gadgets

for domestic, agricultural and manufacturing sectors, on the other.

- He also emphasized the need for the production of biomass and liquid fuels such as alcohol which have no greenhouse gas impact.
- He reminded the scientific community that little research has been conducted on how climate change will affect different parts of India, and what should be our response to it locally and nationally. He also emphasized that even a small increase or decrease in temperature could push down crop yields much further from what they are today. He stated, "Rain-fed agriculture in marginal areas, in semi-arid and semi-humid regions is mostly at risk and we could lose as much as 125 million tones of rain-fed cereal production".

Referring to about 63 million hectares of wasteland in India, he pointed out that the bio-fuel crops need very little water, and growing these in even one-third of the 63 million hectares of wasteland could yield about 20 million tones of bio-diesel.

He emphasized the need for the production of genetically modified *Jatropha* varieties with higher oil content, and optimal processing technologies.

He also referred to severe floods in some parts and drought in the other parts of the country. These could be related to climate change, but no one knows how exactly. Public awareness of climate change is still low and the scientific community should help to promote climate literacy in the country.

Shri Kapil Sibal further emphasized that the resource-poor, marginal farmers are much more vulnerable to flooding, soil erosion, drought and crop failure related to the climate change. He announced that a **Centre for Climate Change** (established within the campus of the Indian Institute of Tropical Meteorology (IITM)) will address the scientific issues related to Global Warming and Climate Change.

III. RESPONSES OF THE SCIENTIFIC COMMUNITY

In response to the challenges raised by the Prime Minister and the Union Minister for Science, Technology and Earth Sciences, the scientific community came up with a few technological solutions, and also suggestions to the government for putting in place necessary policies and programmes on Food and Nutrition security, Gender justice and Gender equality, Water security, Biotechnology, Climate change and Sea level rise, Energy, Mass transportation. The Scientific Community also called for the building of an effective biosecurity system to avoid situations like the one now faced in West Bengal as a result of the Avian Influenza pandemic (H5N1 strain) devastating the poultry industry.

In as much as the bottom line of all the future human activities is sustainable development viz. reconciling development with conservation together with social, economic and gender equity in benefit sharing, the need for establishing and promoting '**Sustainability Science**' in the curricula of the Indian Universities was emphasized.

The scientific responses are briefly as follows:

III – 1A. ENHANCING AGRICULTURAL PRODUCTIVITY WITHOUT ACCOMPANYING ECOLOGICAL HARM:

At the 1968 Indian Science Congress held at Varanasi, Professor M.S. Swaminathan cautioned that environmental and ecological harm would inevitably result if agriculture involving the high-yielding varieties is practiced without adherence to the scientific principles governing soil health, irrigation and drainage, monoculture, genetic homogeneity and excessive application of inorganic chemical fertilizers and chemical pesticides. He had made these statements in his presidential address to the Agricultural Sciences session of the 55th Indian Science Congress, January 1968, Varanasi. Unfortunately, what he had feared came true by the 1990s, and the yield gains associated with the Green revolution have ceased. The increasing concern now is over the soil degradation, ground water and agrobiodiversity depletion. These led Professor M.S. Swaminathan to suggest ways and means to achieve '**productivity in perpetuity without accompanying ecological harm**'. He coined the term "Evergreen revolution" to denote this concept. Basically, it is eco-agriculture with diverse crops, farm animals, poultry, fish etc., with concurrent attention to strengthening the ecological foundations (viz. soil, water, biodiversity, renewable energy, etc).

It was therefore appropriate that a special Panel discussion on Evergreen revolution was held in the 95th Indian Science Congress.

On the basis of the discussions held, the Indian Science Congress recommends the Organization of a **National Farmer Participatory Research Network for an Ever-green Agricultural Revolution** to deal in an integrated way with the following eight aspects:

- Integrated Gene, Soil Health and Pest Management
- Higher factor productivity, with particular reference to water and nutrients
- Precision Farming and Conservation Farming Techniques
- Crop-livestock-fish integrated farming systems
- Bio-organic agriculture combining relevant features of organic farming and biotechnology, including the development of the biological software essential for sustainable agriculture
- Biomass utilization for adding economic value to every part of the biomass
- Knowledge connectivity through internet-aided rural knowledge centers
- Social inclusion and gender equity must be the guiding principles and the aim should be to promote participatory research and knowledge management with farming families in the arid, semi-arid, coastal, hill, irrigated and island ecosystems.

The Evergreen revolution has been acclaimed as the only available option to achieve enough food production for feeding the growing millions of new mouths, while at the same time conserving the rest of life (E.O. Wilson 2002, *The Future of Life*, Knoff Publishing Co., New York). The National Participatory Research Network should bring together appropriate Agricultural, Veterinary and Fisheries Universities as well as IITs, ICAR and CSIR institutions, Womens' Universities and Home Science Colleges and Farmers' Organisations. This should be a PAN-scientific organizations' effort involving ICAR, CSIR, DBT, DST, ISRO, DAE, Dept. of Earth Sciences, ICSSR and UGC.

III-1B. FOOD AND NUTRITION SECURITY

The proposed ever-green revolution will ensure the **availability** of food, but that alone does not provide food and nutrition security at the individual level. Detailed analyses reveal that people should have work (economic **access**) to purchase the food. Equally important is clean drinking water to facilitate physiological **absorption** of the ingested food. Contaminated water results in enteric diseases (dysentery, diarrhea, etc.). The economic access for millions of rural poor in a predominantly agricultural country must come from **on-farm** and **non-farm** eco-enterprises. The transformation of the Green Revolution into Evergreen revolution in millions of small and marginal farms (0.5 to 1.5 ha) and integrating this with the local resources-based ecotechnologies for ecoenterprises with market linkages is the pathway.

Reducing malnutrition in India requires a holistic approach, including promoting nutrition and health education, mobilizing the community and local governance, improving drinking water, sanitation and hygiene, strengthening ICDS, Public Distribution Systems and Mid Day meals schemes (through improved monitoring and accountability) and special attention to adolescent girls, pregnant women and children under the age of

two. Appropriate horticultural remedies should be promoted to overcome the nutritional maladies prevailing in different parts of the country.

III-1c. Sustainable food and nutrition security has other dimensions as well. The impending death due to starvation of thousands of Pashmina goats in Ladakh illustrates just one of these aspects. In order to guard humans and the cattle against hunger arising from seasonal food and fodder shortages respectively, the concept of Food, Fodder and Water banks had been proposed by Professor M.S. Swaminathan in the 1990s. In fact, this concept has been operationalised by the M.S. Swaminathan Research Foundation in several villages of Orissa and Tamil Nadu. The Kashmir Pashmina goats would not have to die of starvation had there been 'fodder banks' in the area. Similarly, in the Kuttanad (an unique wetland ecosystem in Kerala), sustainable agro-ecosystem management is recommended based on an integrated rice-fish farming system.

III-1d. Sustainable food security also requires an effective Biosecurity umbrella to check, control and prevent the entry of harmful, invasive organisms into the country. This issue has been dealt in detail in the Fourth Report of the National Farmers' Commission. It has recommended that there is an urgent need to setup a **National Agricultural Biosecurity System**. Eternal vigilance is the pathway to sustainable food security. The recent havoc caused by the H5N1 strain of Avian Influenza serves as a wake-up call.

III-2. GENDER JUSTICE AND GENDER EQUALITY

Agriculture provides 57 percent of India's total employment and 73 percent of India's rural employment. Of these, women constitute 73 percent of the agricultural workforce. Agriculture is getting increasingly feminized, in view of the growing migration of men belonging to small and marginal farmer and landless labour families to urban areas, seeking alternative livelihoods because of the uneconomic nature of small scale farming particularly in rain-fed areas lacking assured irrigation. The entire burden of subsistence farming and associated poverty falls on the shoulders of women whose responsibilities of child rearing, house keeping, income earning and providing food to the household members are already immense. Thus the Mahila Kisans (women farmers) not only suffer from a multiple burden on their time but also face many constraints in their day to day work on and off farms due to lack of support services. **The future of Indian agriculture as well as food security will depend on the skills, technological, financial and managerial empowerment of rural and tribal women farmers.**

Today, the modern technology enables linking widely remote regions. Taking advantage of the Video-Conferencing facilities provided by the Indian Space Research Organization (ISRO), the M.S. Swaminathan Research Foundation (MSSRF) organized the First National Virtual Congress of Mahila Kisans during the 95th session of the Indian Science Congress. The

Mahila Kisans from Pokhran (Rajasthan), Koraput (Orissa), Wyfad and Yavatmal of Vidarbha (Maharashtra), Thiruvaiyaru (Tamil Nadu) and Moosapet (Andhra Pradesh) together with the knowledge hub of the MSSRF brought out the problems faced by them, those common to all, and also some of which were region-specific. They also expressed how their problems could be eased. Based on these, the following 9-point Charter for Mahila Kisans emerged:

1. **Title to Land:** Joint Pattas are absolutely essential for Mahila Kisans to get access to Kisan Credit Cards and institutional credit.
2. **Right to Credit,** both individuals and to women self-help groups (SHGs), and to insurance: New insurance schemes should be started for Mahila Kisans to cover them from occupational hazards, like leptosporosis infection in paddy fields.
3. **Support services like crèches, anganwadis,** etc. to take into account the multiple burden on a woman's time, such as child rearing, home keeping and income earning activities.
4. **Access to quality inputs** like seeds, organic and mineral and bio-fertilizers, extension advice, etc. at the right time and place.
5. **Training and Capacity building** and imparting quality, genetic, trade and legal literacy; engendering the curricula of agricultural, veterinary and fisheries universities and Krishi Vigyan Kendras. The agricultural university movement will be 50 years during 2008 and it will be appropriate that the gender dimensions are mainstreamed in the curricula.
6. **Jal Swaraj or water security for irrigation and domestic needs** through training in water harvesting, aquifer recharge and more income per drop of water techniques.
7. **Meeting the needs of mixed farming,** involving crops, livestock, fish and trees; special attention to fodder and feed in the case of livestock, and to seed and feed in the case of aquaculture; appropriate post-harvest technologies for processing, storage, transport and marketing.
8. **Assured and remunerative marketing;** linking Mahila Kisans to markets, ensuring fair price and timely payment; provision of rural godowns and warehousing facilities; training in safe storage and in sanitary and phyto-sanitary measures.
9. **Reduction in drudgery and enhancing income per hour of work;** Farm implements, which can help to enhance work efficiency and reduce drudgery, are urgently needed. Traveling Exhibitions and Knowledge on the Wheels programmes may be organized to familiarize Mahila Kisans with the gender sensitive implements available in Agricultural Universities, ICAR institutions, IITs and KVKs.

The Science Congress recommends that a National Network on “**Science for Women in Agriculture**” may be organized by DST in collaboration with ICAR and other scientific organizations. This Network can bring together all appropriate organizations to empower women in agriculture with appropriate technology, training, techno-infrastructure and trade linkages.

III-3. WATER SECURITY FOR AGRICULTURAL AND DOMESTIC NEEDS: JAL SWARAJ

The per capita water availability has decreased from 5000 cubic meters in 1950 to about 2000 cubic meters in 2006. It is estimated that it would further get reduced to about 1500 cubic meters by 2025. The conflicts over water resources are growing. Besides the rapidly decreasing water availability for agricultural purposes, the water quality in many parts has deteriorated. With the help of modern biotechnology, less water requiring and more efficient water-utilizing crop plants could be developed. Concurrently, low cost desalination of water, rain water harvesting and drip irrigation technologies should be developed. However, for all these to be quite effective, a comprehensive policy regarding the conjunctive use of surface water and ground water resources must be immediately put in place. This policy must specify the range of proportion of utilization of these sources depending on the objective situation at ground. A national movement for more crop and income per drop of water and per drop of diesel should be launched.

III-4. CLIMATE CHANGE AND SEA LEVEL RISE

The Indian Science Congress noted the concerns expressed by both the Prime Minister and the Union Minister for science and technology over the adverse impact of climate change and sea level rise particularly on agriculture, food and livelihood security in a predominantly agrarian country. Further, India has a long coastline of about 7600 km, and sea water intrusion would not only impede the already poor drainage of surface water, but also cause salinization of the coastal soils and aquifers. The scientific community therefore urgently calls for

- Vulnerability analysis and identifying hotspots; an assessment of the climate change induced risks should be a part of a broad based Vulnerability and Capacity Assessment (VCA). The government in partnership with other national institutions and regional NGOs can initiate such activities.
- With an increasing frequency and destructive potential of the hydro-meteorological disasters, the resilience of the farming and fishing communities needs to be substantially enhanced. In order to achieve this goal, the planning and activities of disaster preparedness should be integrated with the principles, tools and approaches of sustainable development.
- An integral approach to ensure sustainable agriculture in spite of detrimental

consequences of climate change and sea level rise is to provide genetic shielding to coastal crops with salinity, submergence and drought tolerance. The role of recombinant DNA technology is emphasized. Also, crops with higher harvest index (the fraction the total plant material that is consumable / marketable) will keep the production under the irrigated conditions quite efficient.

- The panel recommends that in order to achieve an effective climate management, it is essential to develop appropriate methods for dissemination of knowledge and information at the grass root level. In this context, it would be appropriate to train **one male and one female member in each Panchyat** of India's villages **as climate managers**.
- There is also a need to organize **National Consortium for the Scientific Management of Climate Change** with senior representatives of all the major scientific organizations such as DBT, DST, CSIR, ICAR, ICMR, ICSSR, the Ministry of Earth Sciences, Indian Meteorological Department, UGC etc. This will be the PAN Scientific Organization.

III-5. BIOTECHNOLOGY AND HUMAN WELL BEING:

The contributions of biotechnology in India towards genetic shielding of crops against biotic and abiotic stresses, genetic fortification of cereals with micronutrients and vaccines for healthcare are already significant. Further, noteworthy achievements in the near future are almost certain. However, identifying priority areas to accelerate the social benefits particularly for economic development and rural livelihoods is now quite essential.

- A process of decision making that safeguards both human health and environment should guide both the research and application in biotechnology. **A scientific, rigorous, transparent and efficient regulatory mechanism for biosafety evaluation and release system / protocol** is quite necessary for achieving the multiple benefits of biotechnology.
- With the rapid growth in the R&D efforts in biotechnology, **a statutory and autonomous National Biotechnology Regulatory Authority (NBRA)** is the urgent need of the hour.

III – 6. ENERGY GENERATION AND UTILIZATION:

Energy plays a key role in achieving the goals of sustainable development and poverty alleviation. India is faced with the formidable task of meeting the increasing (domestic and industrial) demand for energy. The effort should be to enhance supply and to use resources available in an optimal and economical manner and on the demand side we should look at ways to save energy. Technological advances can contribute significantly to this process. The process of manufacturing should aim at cutting down on energy consumption at every stage. There is an urgent need for manufacturing energy efficient gadgets.

Increasing the generation of renewable 'clean' energy and also enhancing the energy use efficiency are important for our development. Our own policies should focus on promotion of energy efficiency, increasing the share of renewable energy and changing the fuel mix. Fossil fuels will continue to play a dominant role in the energy mix in the decades to come. The development and use of advanced and cleaner fossil fuel technologies should be increased, including a renewed focus on energy diversification and efficiency.

Promoting research and development in the field of various energy technologies particularly with regard to renewable energy is urgently needed for the sustainable energy security of our country.

We must educate our people that energy is a resource that needs to be used judiciously. There are multiple requirements for energy and all citizens have a duty not to waste this precious resource.

The rising cost of fossil fuel, the substantial contribution of automobile exhaust to greenhouse gases leading to global warming and the menacing levels of traffic congestions in almost all the major Indian cities clearly warrant an immediate national policy, and accelerated implementation of mass transport systems as are found in European cities, Japan etc. In cities like Chennai, the ground water mined for domestic use is transported by tankers, instead of pipelines. The "wake-up call" is that the urban infrastructure development should be based on a comprehensive 'systems approach' that integrates efficient management of providing clean drinking water, disposal of sewage, mass public transportation, use of solar energy for street lighting, etc. Appropriate R & D to achieve better control over the problems in this sector will be prudent.

III- 7. MASS TRANSPORTATION:

The Prime Minister's concern over the chaotic transport system in the Indian metros is readily understandable. The growing number of private transport in the Indian cities and towns is fraught with chaos and congestion of roads, increase in fatal road accidents, generation of Greenhouse gases, heavy drainage of fossil fuels and the precious foreign exchange to import these.

Firstly, the scope for reducing all these deleterious aspects could be greatly minimized taking advantage of the **21st century work culture**. The computer and satellite-based modern communication system provides the way to execute the work, and transact business while sitting at home. This greatly reduces pressure on fuel and roads.

Secondly, effective and rapid mass transportation systems viz. fuel-efficient trailer buses, metro trains should be put in place so that large numbers of commuters will take to these and reduce use of private vehicles.

Thirdly, new innovations (e.g. nano automobiles) that occupy less space, more-fuel-efficient and eco-friendly also are quite essential.

The present chaotic and absolutely unacceptable conditions of traffic in the Indian metros should be taken as 'wake-up' call, and the central and the state governments should initiate immediate action in order to avoid steep rise in the pollution levels, and accidents killing millions of road users annually.

III.8 BIOFUELS:

With the escalating cost as well as depletion of fossil fuel resources, there is growing interest in bio-energy resources. Biofuels represent the photosynthetic pathway to sustainable energy security. The ongoing food versus fuel debate in relation to land use, can be avoided **if national bioenergy policies are based on concurrent attention to food, environment, livelihood and energy security**. Food occupies the first position in the hierarchical needs of human beings and hence nothing should be done to undermine food security. A pro-nature, pro-poor, pro-women and pro-livelihood orientation is essential for promoting an environmentally and socially sustainable biofuels programme. The programme should be supported with appropriate technologies, techno-infrastructure, training and trade linkages.

III- 9. SUSTAINABILITY SCIENCE:

The purpose of emphasis on the word "Sustainability" is to manage for a longer lease of existence of humans on the planet Earth which now is at the crossroads. The way forward to achieve this goal is to manage the Earth's resources in a manner that our future generations will also be left with these for their own needs and development. Promoting the goal of sustainability, in turn requires the emergence and development of the new field of **sustainability science**. It seeks to improve on the significant, but still limited, understanding of nature- society interactions gained in the recent decades. Hence, Professor M.S. Swaminathan aptly described it as "**action education**" (i.e. developing educational material based on field experience and experiments). Naturally, it requires new styles of institutional organizations, to foster and support interdisciplinary research over the long term, to build capacity for such research and to integrate such research in integrated systems of research planning, assessment and decision support. There is urgent need to involve multidisciplinary scientists, practitioners, and other stakeholders, in setting priorities, creating new knowledge, evaluating its possible consequences, and testing it in action, as part of the activities in the new field of sustainable science.

This Action Education or the sustainability science is, a multidisciplinary and multisectoral study of development processes focused on the conservation and integrity of the ecosystems.

Besides education and training, the principles of sustainability should be integrated in every facet of our day to day life.

IV. WHAT NEXT?

The 1976 Science Congress, hosted by the Andhra University developed a blueprint for the scientific transformation of rural India. The then Union Finance Minister, Shri C Subramaniam, introduced this strategy as a separate paper among the budget documents and made an adhoc provision of Rs. 15 crores in the Union budget for 1976-77 for preparing detailed district level plans for strengthening ecological security through the sustainable management of natural resources, and livelihood security through concurrent attention to on-farm and non-farm employment.

The 2008 Science Congress, again hosted by the Andhra University, has proposed several concrete programmes to give meaning and content to environmentally, economically and socially sustainable development, keeping Indira Gandhi's exhortation at the 1972 Stockholm Conference on the Human Environment, that environment can be saved only if the poor receive as much attention as the Penguin and the Panda. While preparing the programmes, the Science Congress participants have taken into consideration the national priorities indicated by the Prime Minister in his Inaugural Address and the wake-up call given by the Union Minister for Science, Technology and Earth Sciences in his Keynote Address.

In keeping with the tradition set up by Shri C Subramaniam, the Science Congress requests the Hon'ble Union Minister for Finance, Shri P Chidambaram to make an adhoc provision of Rs. 100 crores in the budget for 2008-09, to implement the following:

A. ACHIEVING SUSTAINABLE FOOD AND NUTRITION SECURITY:

1. Organise a National Farmer Participatory Research Network for enhancing productivity of the major farming systems in perpetuity, without associated ecological harm
 2. Organise a Rural System Research Programme (RSR), to give concurrent attention to natural resources conservation and enhancement and to skilled non-farm employment.
- B. Develop an effective **National Biosecurity System** to safeguard the livelihood and health security of our people at a time when transboundary pests are becoming major threats.
- C. Keeping in view the growing feminization of agriculture, malnutrition and poverty, implement a 9-point Charter for the technical, livelihood and nutritional empowerment of Mahila Kisans and organize a ***Mahila Kisan Shashaktikaran Pariyojana***.

D. JAL SWARAJ OR WATER SECURITY:

Expand the ongoing Farmer Participatory Action Research Programme for achieving more income per drop of water and per drop of diesel. This will help to spread both