option is to construct storage tanks[5] at appropriate places where a part of the floodwater could be stored and then released or reused subsequently. The second option is construction of seepage holes and wells, similar to those made for groundwater recharge, through which a part of flood water could be transferred to sub-surface aquifers. In both cases, the space requirement and disturbance to the existing environment is low and the structures are easy to make even in the densely urbanized condition. An additional advantage will be of replenishing the water table, which is on decline in most of the urban areas.

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# Paradigm shift in water resources development and management

Rapid population growth, changing living standards and irrigation requirements were mainly responsible for the enormous expansion of water resources infrastructure in the twentieth century. Water resources development in the past century completely ignored the hidden costs of the environmental loss, viz. the destruction of ecosystems, dislocation of human population, inundation of cultural sites, disruption of sedimentation processes, etc. Economic analyses were generally done with incomplete information.

But, in the past two decades, there has been a major paradigm shift in water resources development and management. The old paradigm based on the philosophy of larger dams and reservoirs has begun to fail. People are now more concerned about environmental loss and economic and social issues. High value is placed upon the maintenance of the integrity of water resources and the flora, fauna and human societies that have developed around them. Both Union and State Governments are under tremendous pressure to ensure equitable distribution of costs and benefits of water resources development projects. Efforts are constantly being made to understand the diverse interests and fulfil the needs of the affected stakeholders.

The new paradigm is directed towards 'water use efficiency' by reducing wasteful applications of water, by changing cropping patterns, by reducing losses between the field and the source and by many other methods. Water use could be sustainable by increasing the efficiency with which current needs are met and by increasing the efficiency with which water is allocated among different users. Where additional or new supplies are necessary, major new projects must now compete with innovative small-scale approaches, including micro-dams and other locally-managed solutions. Greater reliance on groundwater resources could be an excellent solution, and efforts should be made towards new source finding and its development. In addition to this, non-traditional sources of supply could play an increasing role, including harvested rainwater, reuse of recycled wastewater and desalinated seawater.

The greatest drawback in the twentieth century water policy was the failure to understand the connections between water and ecological health. The objective of the twenty-first century water management should be to understand these connections and make a balance between the ecological health and human water needs.

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# Research in biotechnology: A lucrative career option

The biotech sector is the fastest growing industry in the world today, surpassing the growth of the IT industry. Given the global environmental conditions and the increasing demand for safer and better products, millions of dollars are being invested to find solutions to critical problems of health, food and environment.

Scientific research in biotechnology and related areas has come of age and is emerging as a career which can prove lucrative and provide a social stature. Indian molecular biologists working in research institutes, universities and laboratories have begun to develop indigenous technologies and selling them to companies at prices which may be meagre on a global level but unheard of in India. Technologies developed and sold for anthrax vaccine and blood clotting streptokinase are just a couple of examples.

The biotechnology sector, propelled by the growth in agriculture, pharmaceutical and medical industry, growing annually at a rate of 45%, would bring in revenues worth $5 billion by 2010 and create close to 1 million jobs[1].

This being a research-oriented field, there is a demand for researchers, scientists and trained technicians with excellent laboratory skills. To meet the requirement of skilled technical cadre, the government provides incentives at every level of education to make this career choice attractive.

Starting at the post-graduate level, scholarships are available in biotechnology. Scholarships are also provided at the doctorate and post-doctorate levels. Overseas Associateships are given to scientists for undergoing advanced training in the best research organization in the world.

To promote research and innovation the government offers a number of schemes and various options are available with the scientist for working towards excellence in his chosen field. In fact, scientific research is no longer limited to public institutions; the biotech industry is increasingly focusing on research and development.

Thus, research in biotechnology and related fields would have placement openings with multinationals, pharma majors, research institutions, laboratories and organizations both government and private in the country. The options do not end with research; managing offshoots of the biotech research sector is equally challenging and wide in its scope. MBA in biotechnology has immense potential. In the coming years technology transfer expertise would be much sought after by public institutions and private industry.

Other specialists relating to biotechnology could be patent attorneys, clinical researchers, bio-information technologists and social scientists who can create social awareness, be it for genetically modified organisms, transgenics, vaccine development, clinical research, bioethical issues or biosafety concerns.

To meet the challenges of a growing industry, allowing the pursuit of research and monitoring the esteem and position of science in society, it is crucial to evolve an educational system which is flexible and diverse in its options and allows students to choose and exploit the opportunities of a relatively new but fast-expanding industry.

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# The Berlin group on genetically modified crops in developing countries

The Commission on Green Biotechnology is a constituent of the Union of the German Academies of Sciences and Humanities (UGASH). The InterAcademy Panel (IAP), a worldwide network of 92 Academies of Sciences, with its Secretariat in Trieste, Italy, advises citizens and politicians in their home countries on current problems of global relevance. The 'Berlin Group' are the participants of a workshop on 'Genetically modified crops in developing countries', jointly conducted by UGASH and IAP in Berlin (27–29 May 2006). The Berlin Group has now issued a statement that is being circulated for adoption by various academies in Europe and elsewhere.

The Berlin Group has taken the position that 'Molecular engineering of crops has brought revolutionary advances in agriculture. In just ten years since their introduction, many GM crop varieties have been grown on about 5 per cent of all global arable cropland in 21 countries by 8.5 million farmers, 90% of them being resource-poor. Some developing countries have benefited from GM crops and are now in a position to affirm their need and their will to adopt GM crops'. Based on this assertion, the Berlin Group states that:

– Foods from GM crops are more extensively tested than any other and have been shown to be as safe as, or even sometimes safer than, foods derived from the corresponding conventional plants. Ten years of human consumption and extensive nutritional testing amply support this conclusion. Any food, GM or other than GM may certainly involve some risks for human health. There is presently not the least scientific and/or medical evidence that the risks possibly entailed by the former would be higher than those entailed by the latter.

– The environmental impact of GM crops is no greater than that of traditional crops. In some cases GM crops have diminished the negative effects of current agricultural practices. Insect-resistant cotton requires substantially decreased applications of chemical pesticides while herbicide-tolerant crops permit no-till practices, cutting energy use and promoting healthy soils. Seed-incorporated technology is particularly suitable for small farmers in developing countries. GM crops resistant to pests and diseases reduce farmers' exposure to chemical pesticides, particularly when applied by hand sprays. The successful cultivation of GM cotton in the developing countries shows how subsistence farmers have significantly increased their income and improved the quality of their life.

– In both developed and some developing countries, organic farmers have already been operating in an environment subjected to influences from neighbouring activities. With proper separation safeguards, the presence of genes encoding GM traits in organic products is trivial. Nothing in GM agriculture prevents organic farmers from pursuing their normal practices. There is no evidence-based justification in the rules of organic farming to exclude the use of GM crops.

– GM crops can make a major global contribution to the quantity and quality of food. In developing countries, farmers suffer major crop losses caused by insects and diseases. GM technology has already shown that such losses can be significantly reduced, leading directly to improvements in food quality and safety (e.g. insect-resistant maize has appreciably lower levels of highly carcinogenic fungal toxins).

– Just as each consumer ought to have the right to adopt or reject GM food, farmers should be able to decide for themselves whether to plant conventional, organic or GM crops. For such a choice, appropriate regulations including labelling of GM products must be in place, and such regulations should be proportionate and not excessive. The safety assessment procedures now enacted in developed countries for GM crops and products result in needlessly high costs and hinder the application of this valuable technology to the many crops grown in the developing world. For developing countries to have access to crop biotechnology for their own agriculture, international and non-profit organizations must help governments to formulate appropriate regu-