Should Israel manage Gujarat's waters?

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Failure to harness our water resources effectively despite having spent considerably has resulted in some state governments opting for the help of Israeli consultants in this vital sector. The main cause of our investment not yielding desired results, in contrast to the Israeli success, is the inadequate attention that innovation and research have so far received in this field.

Sustainable solutions can come only by providing appropriate support to our scientists and engineers to search for innovative solutions to the various water problems. Conservation, renovation and reuse of water in harmony with our socioeconomic and environmental constraints should form the basis of such an approach.

Since the 1970s, Israel has earned a name for its well-managed modern technological base in water resource development by making the Negev desert and other arid parts to bloom. Rajasthan and Gujarat governments are now wooing Israeli expertise in water resource management. It has seen it prudent to ask the Tel Aviv-based firm, Tahal Consulting Engineers Ltd., to draw up a comprehensive long-term plan for development of water resources of this state. The project will comprise preparation of irrigation policy for Gujarat, focusing on integrated water management, conjunctive use of surface and groundwater, recycling sewage and perhaps desalination.

To us the engaging of Tahal to do all that Indian water scientists and engineers had been pleading for more than two decades marks the culmination of a process that had been in the offing for quite some time. This process reflects lack of commitment and failure of our society to deploy adequate resources on research and development (R&D) activities in the field of water and related sciences.

The Israeli approach

Tahal was formed in 1952 and has operated in over 40 countries spread over four continents. How did it become a successful multinational in just over 4 decades, propagating the Israeli approach to water management? Tahal epitomizes the essence of the Israeli system of water management, which comprises of a national water carrier, a canal system which transports water from the surplus northern and coastal regions to the deficit areas. The entire transportation of the water is based on the principle of minimizing evaporation and seepage with covered channels and piped water supply. The entire potential of water supply has been brought under control and utilized. Hydrologic exploration has been perfected adopting the most modern technology. Isotopes have been used to estimate aquifer storage, recharge and mixing rates. Computer-based models have been used to simulate the dynamic balance of water and evaluate the consequences of alternative water use scenarios Wells are monitored continuously so that there is no over-exploitation of aquifers. Artificial recharge of groundwater is practised widely. Groundwater is not considered as separate from the surface water. In fact, the canal systems depend substantially on groundwater. In addition, municipal sewage is renovated and used for irrigation and industrial purposes. An irrigation efficiency of 80% has been claimed. Water application per unit of agricultural production has been reduced dramatically through use of drip and sprinkler irrigation. Israel has thus demonstrated that spectacular results can be achieved if there is will on the part of the society and the Government, and problems are tackled on a scientific basis. In the case of Israel the will was not merely wishful thinking but was backed by a national commitment involving adequate financial resources for R&D and necessary legal and social back-up.

The Indian approach

Let us contrast this with the scenario of water management in India in general and Gujarat in particular. Irrigation engineers themselves admit that water, in case of major irrigation works, is used inefficiently. The craze for big dams and long canal systems still continues unabated despite the fact that major projects cost enormous amounts of money and take unduly long time to complete. Small-scale alternatives like smaller dams, lift irrigation schemes and water-harvesting tanks, which are less costly, easy to manage and more flexible, are not given the importance they deserve. In a resource-starved society like ours, is it not prudent to first fully exploit the potential of small-scale alternatives, reap the benefits so that the economic status of the society as a whole goes up and then plough back the benefits into larger projects when they become affordable? In smaller projects, where there is a sense of people's participation and management, the returns on the investment are usually high. The example of groundwater irrigation is pertinent. This is nearly hundred per cent privately managed but helped by subsidies for small and marginal farmers. The farmer invests his own money in sinking a well within his field and also pays the cost of diesel or electric power to run the pump. He, therefore, realizes the value of the water and uses it efficiently. It is, therefore, no surprise that the highest yields are obtained from agriculture using groundwater irrigation. This brings to fore the wasteful use of canal irrigation water, which is largely a result of the fact that farmers are kept ignorant of the costs involved in supplying this water. Therefore, they fail to see the reason or the need to adopt water conservation practices. Further, the entire irrigation system, devoid of any regulatory structures and measuring devices, is inherently designed for flood irrigation, where as much as 60% of the water stored at great cost is wasted through evaporation and percolation.

Adequate and reliable data, both on the availability of water and the extent of its utilization for various purposes (agricultural, industrial, domestic) in a given region, is a primary requisite for

making an efficient management of water resources of the region. In our case, stream flow information is inadequate; the information on size and recharge of groundwater aquifers is no more than 'guestimates'; the data on optimum water requirement of various crops in different soil and climatic regions is again inadequate and, even when specified, is not applied in actual practice. It must be emphasized that every water resource development project will affect the environment and modify the hydrological cycle; the larger the project, the greater will be its impact

It may sometimes be necessary to implement a specific project even with a limited database, particularly when the considerations of development are overriding or there is a crisis situation. But here every project appears to meet a crisis situation rather than being the outcome of a well planned out strategy. No systematic efforts are being made either to monitor the environmental impacts of the various development projects and/or to create a sustained database that may be useful for a better understanding of the hydrological system through a scientific analysis involving computer-based models to simulate the dynamic balance of water and evaluate the consequences of alternative water management scenarios. Over-exploitation of aquifers is common and no systematic efforts are being made for artificially recharging the aquifers. Innovation and experimentation that brought Israel to the forefront of water science is missing in the Indian approach. While the Central Government does spend some money on R&D through a few institutions (e.g. NIH, CWPRS, PRL, NEERI, universities, etc.) and also through sponsored projects, the states that actually spend a very large share of their budget on development of water resources support little R&D activity. Even the little money that is spent by the state governments in the name of R&D is usually for routine activities, with no emphasis on innovation and experimentation.

Our recipe

The maladies afflicting the Indian water resources development programme as mentioned above are not unknown to our scientists, engineers, bureaucrats and even politicians. Why then do we find that water scarcity keeps aggravating year after year and the society is continuously battling with the water-related problems adopting a 'fire-fighting' approach? For example, having to transport drinking water by special trains and lorries, emergency drilling of tube wells and hand pumps, outbreak of water-borne diseases, the increasing need for unplanned expenditure in combating floods and droughts are some of the more visible instances of the fire-fighting approach. In our opinion, the problem is an inevitable consequence of the lack of a holistic approach to managing resources, environment and development.

The holistic approach would no doubt include a scientific assessment of the resources and natural constraints using the most modern methods, innovative improvement of the traditional techniques of water conservation and utilization to make them conform to the present-day lifestyle and discouraging unproductive and unsustainable projects. Imbibing the philosophy of conservation, renovation and reuse should form an essential component of the holistic approach. All this implies that we have to develop new technologies based on innovative ideas that take into account the socioeconomic conditions of different regions. These ideas must then be translated into experiments, improved upon to become practical solutions in harmony with the environment and needs of long-term development. The technologies so developed could then be disseminated into the society. For this charter to become a reality, a higher level of commitment from the society/government is required. The commitment must be backed not merely by higher allocation of financial resources but also through involvement of people so that necessary legal and social measures can be initiated to mould the political will.

Where such commitment from the society has been forthcoming, our scientists and engineers in diverse fields of agriculture, dairy development, molecular biology, radioastronomy, nuclear research and space programme have shown that they are equal to the best in the world. Our success in agriculture is highlighted by the green revolution, which has transformed our country from a begging bowl case to a net exporter in less than two decades. Similar success has been achieved in dairy technology, which has ushered in the so-called 'white revolution'. Our achievements in the field of immunology have benefited the society through decreased child mortality and increased life expectancy in spite of progressive deterioration in sanitation. The television is the most visible example of the success of our space programme, which can also boast of highly successful remote-sensing application in the field of forestry, water resources, disaster management, etc. To an extent the national commitment in other fields with significant science and technology component manifested itself through the launching of the various technology missions by the Central Government about 7 years ago. As a result of the national drinking water mission, safe water is now available in large parts of rural India, but a lot more remains to be done. Capitalizing on the limited success, we should enlarge the scope of the drinking water mission to a more comprehensive water technology mission which will encompass all aspects of water and develop technologies for conservation, renovation and reuse and apply the same to solve the various water-related problems of the state.

The time is ripe now for Gujarat to take a lead in water resources management by making a commitment to utilizing the locally available talent in the most effective manner through supporting indigenous research on evolving appropriate technology. This approach alone will provide a long-term solution to the various water-related problems of the state in a sustained manner. Any consultant can come up with seemingly sound schemes but sustainability works only with popular participation backed by sound technology rooted in traditional ideas and blending with the socioeconomic environment. This is not to say that people-to-people interaction between Israeli and Indian technologists should not be encouraged, but we should learn the principles involved in their approach and adapt them to our conditions which impose different kinds of constraints of geography, climate, social and economic backgrounds and resolve our problems with a missionary zeal.

The initiative in our society has obviously got to come from the state government, but matters cannot and should not be left entirely to the government. In fact, other organs of the society, namely, panchayats, municipalities, the big industrial corporations and builders, and social groups – all spend considerably on water resource exploitation and development. Even a tiny fraction

of their expenditure spent on experimentation with innovative ideas and scientific solutions to water-related problems within their own jurisdiction would not only yield sustainable results for long-term benefits to their constituents but would also go a long way towards advancing the scientific ethos of the society.

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Application of biotechnology to medicine in India – A concern

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The applications of biotechnology in the fields of health and disease, food and agriculture, environment and industry are not dreams anymore, but are fast becoming a reality. In our country application of modern biotechnology has required a base in research and it is a matter of gratification that the quality of research in modern biology has significantly improved over the last decade, mainly due to the support received from DBT and DST. We do have a long way to go since we have problems of having a critical mass in specific areas of research, lack of indigenous capabilities to provide adequate infrastructure and the lukewarm attitude of the industry to research, although there are some signs of awakening.

Among all areas of applications, the area of health and disease has registered the most impressive gains internationally. Apart from the striking advances made in understanding the life cycles of pathogens at the molecular level, recent years have seen dramatic success in solving the molecular abnormalities underlying several genetic disorders. These advances have and will pave the way for newer strategies for therapy. While development of newer drugs, vaccines and newer strategies for therapy are slow processes, the development of diagnostic methods to detect diseases based on all the molecular information obtained has seen a phenomenal progress and a huge global industry with millions of dollars turnover is now functional.

Development of diagnostics for a variety of diseases has been recognized as a priority in India as well. This has led to the development of diagnostic methods for at least a dozen infectious diseases in different laboratories in the country. Many have been developed into kits and MOUs have been signed with industries for manufacture. A new phenomenon is the opening up of small or one-man companies to make identified diagnostic kits, while the established ones do a roaring business with imported kits. Signing of MOUs with industry in this area is no more an exciting proposition for academics, since none of the indigenous kits really reach the market. One reason is the mutual lack of rapport between the two parties, the industry blaming the academia for overclaims and release of half-baked technology, the academia blaming the industry for lack of expertise or help other than putting a nice wrapper on the final product and cooling of interest once the technology is transferred. It is obvious that a diagnostic kit to be used in the field cannot be developed in totality in the laboratory of any academic institution. The problems in the field are understood only through hard experience and these can be overcome only by repeated feedbacks by both the parties. With at least some of the industries having established good laboratories for research and development, many of the field and scale-up problems can be overcome. It is not as if the imported kits were developed to perfection overnight. They have also gone through several iterations. Knowledgeable workers in the field state that many imported kits do not perform as well under the Indian conditions in the field, but by and large one can get away with selling such kits since there is no one to really check on the consequences of wrong diagnosis dished out by diagnostic centres. It is true that the average public feels that the imported kit, costing more, should perform better than the indigenous version. It is also true that often patients approach academic institutions for correct analysis as a personal favour, since two different diagnostic centres give two different values even for standard biochemical parameters.

The main question is whether there is a real commitment to indigenize. While many leaders exhort the scientific community to develop indigenous technology, the field conditions are not exactly congenial for this development. A small example will illustrate the point. Medical diagnostic kits consisting of microtitre plates coated with antigens etc. can be imported free of duty (life saving!) along with other reagents. But if the microtitre plate alone has to be imported, so that the kit can be produced with biologicals generated with indigenous expertise, one has to pay fabulous duty! Therefore, the industry does not have motivation to make the kit in India, apart from the fact that trading with hefty commissions is more lucrative than going through all the hassles as an entrepreneur. As an aside, the polymer chemists in the country should look into this business of microtitre plates, since I am told that the plastics generated in the country are fit only for buckets and not for tissue culture or diagnostic plates.

There is yet another angle to the whole issue that can be highlighted taking the development of AIDS kit in the country as an example. Many countries are vying with each other to produce their own kits, since the market is huge. In India, too, government funding agencies have supported research projects for the development of AIDS kit. As mentioned earlier, a few individuals (mostly former academics) have floated companies and with hard-earned money have ventured into this field with technical help from academic institutions. In addition, imported kits promoted by established companies are doing their rounds. Interestingly, there is no easy mechanism by which the indigenous AIDS kit can be certified for use. It is suggested that one should become a bulk supplier to the WHO to gain entry into the Indian market. The mechanisms involved in becoming a bulk supplier to an international agency are beyond the reach of a small entrepreneur. In be