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WATER AND SANITATION FOR ALL: PARTNERSHIPS AND INNOVATIONS

Goals, roles and innovations in India

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IN 1996, THE rural water supply programme in India celebrated its thirtieth year. During this period, the rural population grew from about 450 million to 692 million, an annual growth of around 2 per cent. At the same time, access to safe water increased from something less then 10 per cent in 1966 to 31 per cent in 1980 and, with a dramatic escalation during the International Drinking Water Supply and Sanitation Decade (1981 -1990), to 82 per cent in 1996. This remarkable achievement was not through happenstance, but was the realization of an extraordinary vision that linked technical innovation with industrial development and capacity building, enabling a Government-led programme to take successful demonstration rapidly to scale. It was also the result of highly effective, close working partnerships between the Indian Government, bilaterals, multilaterals, industry, Non Government Organizations (NGOs) and communities.

During these three decades of development effort, it is inevitable that success was tempered with failure and the high cost of trial and error in new programme areas. Fortunately, India does not lack the resources for research and development and has the capacity to absorb the price that must be paid for experimentation. Other countries are not so blessed. It is therefore important that the India experience is shared as widely as possible so that unnecessary experimentation - the "re-inventing of the wheel", drill rig, handpump or latrine, can be avoided. The India experience has taught us that every problem has a solution; but that each solution creates another set of problems.

I will not dwell on the failures, but speak instead of just half-a-dozen out of India's many success stories and suggest lessons that might be drawn for the benefit of other country Programmes. I have selected those examples that, in my view, reflect imaginative innovation, usually the work of a few exceptional individuals or organisations that enabled the Government of India to make quantum advances in its' resolve to provide its enormous rural population living in over 500,000 villages, with a safe water supply and a certain level of sanitation.

It may be recalled that in 1990, at the World Summit for Children, the Government of India, amongst other countries, made a commitment to provide safe water and sanitation for all, by the year 2000. The resources required for such an ambitious goal are staggering. Whatever India aims for is invariably on a grand scale. Therefore, any innovation or contribution to the Programme must be affordable, locally managed, and replicable. These are the principles that continue to guide the programme to this day.

Hard rock drilling

In 1966, a severe drought affected the Northern and Eastern Indian states of Uttar Pradesh and Bihar. Water levels declined below the floor of hand dug wells into the hard crystalline strata beneath. Villages were abandoned and communities migrated. The Government had no response to this drinking water problem. However, a number of NGOs, experimenting with the then novel technology of compressed air drilling in the hard basalt formations of Maharashtra, took their drill rigs to Bihar and were able to demonstrate that a 4" diameter borehole could be drilled unto 100 feet within a day or two and provide sufficient water to support a handpump.

Additional machines, airfreighted by UNICEF into India and deployed for the drought emergency, established confidence in the new hard rock drilling technology, so that by 1969 a major rural water supply programme, based upon handpumps fitted to boreholes, was launched by the Government of India. UNICEF supported this effort by importing over 100 drilling rigs during the next five years.

Thus, from a modest - NGO led - initiative, was born the largest rural water supply programme in the world. However, although communities in the water scarce, hard rock, "problem areas" of peninsular India appeared to have a solution to their drinking water problem, the borehole brought to light another problem so serious that it threatened the very future of the new drilled well technology and it required all the collective ingenuity of the Government and it's programme partners to find a solution. Once again, it was the NGOs that took the lead.

The India Mk II handpump

In 1974, four years after the hard rock drilling programme began, UNICEF conducted a handpump survey which showed all too clearly, that while the new drilling technology had been successfully transferred to the Government, as evidenced by thousands of bore holes drilled by state government drillers using the UNICEF supplied rigs, 75 per cent of all the handpumps fitted had broken down. In short, the Government's much vaunted rural water supply programme had nothing to show for itself except holes in the ground. The problem lay with the old fashioned, cast iron handpumps which were designed for family use, not for communities of 1000 people or more. So fragile were these pumps that they sometimes broke down the day they were installed. Government priority then shifted from

drilling to the development of a sturdy village handpump. The India Mk II was the eventual outcome; by 1979.

The India Mk II is perceived today as one of the most successful innovations that has emerged from India during the implementation of it's Rural Water Supply Programme. Initially the brain child of the Solapur Well Service, an NGO in Maharashtra, it was identified for further development by UNICEF as the most promising of a number of handpump designs being fabricated by NGOs that had been quick to anticipate problems with existing models.

The Solapur pump was reworked by Richardson and Cruddas, a Government engineering company, with technical support from UNICEF. The renamed "India Mk II" went into production in 1976. Initially produced by two companies, demand soon outstripped supply, for not only were pumps needed for new wells still being drilled, a "rejuvenation" programme had to be launched, in order to convert thousands of the old cast iron pumps to the Mk II standard. A massive effort was required. Government engineers and mechanics had to be trained on the new technology, a maintenance system had to be introduced, spare parts supplied and communities familiarized. Nevertheless, the strong partnerships that had already been forged between Government and external support agencies responded to this fresh challenge.

By 1984 a second survey showed 80 per cent of the handpumps were working. A dramatic reversal of the situation ten years earlier.

An important lesson learned from this experience, is that while the innovative NGO community could provide the solution to complex technical problems, they were unable or even reluctant to take their ideas to scale through the Government infrastructure. What was needed was an organization that could work both with Government and NGO. UNICEF with it's duel role of policy support at the national level and implementation support in the field, was well placed to fill this niche.

The Mk II development programme was only possible because a flexible and realistic Government recognized the limitations of it's own "top down" approach. It perceived the value of NGOs working at the grass roots level with user communities and the importance of an impartial facilitator that enjoyed the trust of both. It also understood the crucial role of industry for scaling up technical innovations and encouraged its' active participation in addressing this new challenge to manufacture a modern handpump. The India Mk II came into being through an effective working partnership that adopted a common goal.

By 1996, some 150,000 Mk II handpumps were being produced each year in 50 small factories in most states for the rural water supply programme in India. Built to a national standard and with quality assured through inspection by the Bureau of Indian Standards (BIS), the pump is now exported to 40 countries. Economies of scale and fierce competition have combined to achieve a quality, field proven handpump at a 1996 cost of $170.00 a unit. (Installed to 30 m). Today, the India Mk II is regarded as one of the world's most successful and durable community handpumps of all time.

The India Mk III handpump

By 1990, it was estimated that around two million handpumps had been installed throughout India. These pumps had been designed above all else for reliability. The aim had been to ensure that they did not break down for at least a year and thereby make maintenance possible

Communities were not expected to repair a Mk II. This was largely the task of the state public health engineering departments as part of the then, innovative 3 tier maintenance system, which only required the community to tighten a few nuts and bolts above ground and maintain sanitary surroundings (the first tier). The more difficult repairs were the responsibility of a local mechanic (the second tier) while the complex, below ground tasks were carried out by a mobile team that looked after some 500 pumps (the third tier). Clearly, as the pumps proliferated, the government maintenance machinery was quickly overloaded, and it's response time to attend to repairs averaged 45 days.

It was the UNDP/World Bank Handpumps Programme that was the first to reach the conclusion that centralised maintenance is both complex and expensive. It, therefore, embarked on a global effort to develop pumps that could be more easily repaired at the village level and it coined the acronym VLOM, for village level operation and maintenance. The AFRIDEV was it's brainchild. Stimulated by this concept, the Mk III ultimately emerged, in 1991.

Hydraulic drill rigs

Just as the early handpumps were evaluated for their performance, so were the small pneumatically operated drill rigs. Although highly successful in the major water scarce areas of the country where shallow dug wells had become dry and bed rock was close to the surface, it soon became clear that in places where water tables had fallen and wells had to be drilled deeper, and where heavy overburden deposits above the bed rock had to be cased off to protect the completed bore hole, the low torque rotary heads and limited hoist capacity of the rigs and the low pressure compressors that powered them, were unable to drill the quality of well demanded by the programme. In addition, the output from the pneumatic rigs was in the region of 100 wells a year. The programme needed to accelerate if it was to meet its ambitious goal.

In 1978, UNICEF concluded that the only solution to the emerging problem of low rig capacity, yet still ensure excellent manoeuvrability characteristics for gaining access to remote villages, was to use hydraulically operated machines, retaining compressed air, but at a higher pressure to raise penetration rates in the hard rock formations with down-the-hole hammers.

Thus, a new chapter was written in the evolution of the rural water supply programme in India with the introduc-

tion of these machines. Their advent was criticized in some quarters because hydraulics were perceived as too complex and sensitive to maintenance abuse by government drilling crews. Such fears were unfounded. The small drill rigs, mounted on four-wheel drive trucks have, over a period of many years, demonstrated high reliability with between 50 per cent to 100 per cent higher output when compared to their pneumatic predecessors. They have performed outstandingly well in areas with heavy overburden deposits and difficult boulder formations and have drilled frequently to depths of 100 meters or more. Local crews adapted quickly to the new operating and maintenance demands.

It is unfortunately true, that some of the best of western technology is withheld from countries that need it most, on the grounds of over-sophistication, and suggestions that local people cannot manage it. I have seldom found this to be true where efficient logistical support and proper training have been provided. The introduction of highly complex hydraulic drill rigs in India and their efficient utilization confirms this point, as does the use in India of the most recent innovations in ground water investigation equipment.

The cost effectiveness of a borewell drilled with a hydraulic rig and fitted with a Mk II handpump provided India with the answer it was looking for as it sought a more rapid, better quality and more sustainable solution to the problem of rural water supply.

Today, the cost of a 5" diameter well, drilled by a contractor to an average depth of 60 meters in hard rock, cased to an average of 10 meters and fitted with an India Mk II handpump is US$ 1300. The cost of hard rock drilling of US$20 per meter, on average, must be one of the lowest and most affordable drilling rates in the world.

Industry once more capitalized on the new technology and in order to respond to the demands of the Government programme, numerous companies were established to build low cost hydraulic drill rigs for purchase by private parties under contract to the state governments, as well as by the state public health engineering departments themselves.

By 1987, India was virtually self sufficient in drilled well technology so that when the worst drought of the century struck the country that year and thousands of additional handpumps and bore holes were urgently needed, it had the capacity to respond without external assistance, a true indication of self reliance, through the local production of previously imported equipment. Another technology had been taken to scale via India's rapidly evolving industrial base.

Once again, it was the partnership between NGOs, which had pioneered the technology; UNICEF, which had been the catalyst urging government to take it to scale after further field testing; industry that had recognized the market potential and which had embarked upon a comprehensive manufacturing programme of appropriate drilling equipment; and Government that sanctioned large sector investments to pay for it, that achieved this result.

Today, some 2000 locally made hydraulic rigs are operating under contract to Government; while 650 rigs, of which 165 have been supplied by UNICEF over a period of 15 years, are managed directly by the State Public Health Engineering Departments.

To my mind, this is an unparalleled success story and another fine example of a small technical demonstration being taken to scale, to the benefit of poor rural communities, as well as the economy of a nation, as it achieves self sufficiency.

Well rejuvenation

As the drilling programme becomes more firmly established, concerns are being raised over the sustainability of ground water, which is the sole source of supply to the handpump. Traditionally, as boreholes silt up or dry out, or as their yields decrease over time, new wells are drilled to replace them. This is neither environmentally sensible nor cost effective. Consequently, the flushing of wells with small compressors mounted on tractors that can easily reach handpump sites without damaging the existing installation are brought into play. This is a tried and tested response to falling well yields. However, to complement these efforts, a relatively recent innovation has been the introduction of hydrofracturing. Adapted from oil field practice in the 1950s, water is injected under high pressure into existing boreholes to flush out sediments from the network of fissures, fractures and joints in the hard rock so as to improve inflow. On occasion, the high pressure is capable of extending the fractures in the formation, effectively increasing the area of the well exposed to the aquifer. Some remarkable results have been recorded in India, the US and Sweden from this well stimulation technique which represents an important contribution to the government's efforts both to optimise and sustain previous investments. The cost of hydrofracturing is estimated at about one third the cost of drilling a new well with a 70 per cent success rate.

Rural sanitation

I now turn to rural sanitation. Initially conceived as a latrine construction programme, it now embraces seven separate but closely related components that combine to protect and enhance the health of the individual, the community and the local environment. Safe water and food management, garbage disposal, drainage, personal hygiene with emphasis on hand washing and clean surroundings are all part of this sanitation "package", together with a household - but not a community, latrine.

The India sanitation programme was a late starter compared to the water programme. It commenced in 1986 as a national programme, with a focus on the then, novel twin-pit pour-flush latrine. This became the national standard. More expensive than many rural houses and heavily subsidised, it was no wonder that sanitation coverage in terms of latrine construction on the Government pro-

gramme had only reached 3 per cent by 1990. What was needed was a shift in the mind set - away from subsidies, away from a preconceived notion of what a latrine should look like and how much it should cost.

It was the pioneering work of the Ramakrishna Mission in West Bengal, yet another NGO, which with UNICEF support devised a range of latrine options from the $100 twin pit to the $ 10 single pit water seal and do-it-your-self latrine. The strategy worked. It has been conclusively demonstrated that poor families are willing to pay for their own simple latrine in order to secure dignity, privacy and security. In addition, the Mission set up production centres for pans and traps, to satisfy local demand for latrines.

As the Ramakrishna Mission was successfully demonstrating their new approach, UNICEF was experimenting with a concept that was equally innovative. A 1989 national sample survey had clearly shown that more latrines were being constructed from private means than under the subsidised Government programme - 8 per cent against 3 per cent. An idea germinated. To capitalise on this initiative, UNICEF assisted in the setting up of specialised rural outlets for the sale of sanitary ware, construction material and the provision of technical advice. From early beginnings in the state of Uttar Pradesh, some 80 Rural Sanitary Marts, or RSMs as they are called, have started business with initial support in the form of a revolving fund. So popular have the RSMs become, that once again, the Government has taken ownership of a new concept and is taking it to scale. Five thousand RSMs and Production Centres will be built throughout the country during the next five years.

Another initiative which is taking advantage of this renewed sanitation thrust is the development of a cadre of women masons to take up construction activities including toilets which, hitherto, was a part of the male domain. In some states, women masons have formed themselves into cooperatives and have started successfully bidding for relatively major construction jobs in rural areas. This has not only changed their economic condition but also their status in the family and the community.

Promoting sanitation through cooperatives has been a very recent phenomenon. Some of the Dairy Cooperative Unions of Gujarat which played a vital role in India's "White Revolution" have now taken up the task of promoting sanitation and hygiene through their village cooperative network. Linking hygiene with milking cattle and handling milk has been a part of the strategy.

The Sanitation Programme now has a very high employment potential. The establishment of RSMs and Production Centres has become a bankable proposition with commercial banks financing these interventions.

Marketing the concept of Sanitation Upgradation has been the most recent social marketing strategy which is fast gaining ground. This approach encourages latrine construction according to the affordability of the individual, "upgrading" a single pit, pour flush latrine into a more elaborate facility over time.

India still has a long way to go to achieve universal latrine access. Nevertheless, rural coverage is now estimated at 20 per cent, a very significant advance over the level five years earlier and a portent of accelerated pace.

Future challenge - environmental concerns

The advent of the small hydraulic drills has seen the expansion of the agricultural sector and the increasing use of big hydraulic rigs capable of drilling large diameter bores to great depth for power pump installations. Once again, the solution to one problem has led to another, or in this case a series of interrelated problems that are potentially environmentally damaging, may be long lasting unless strategies are devised to retard the trend; or which may be altogether irreversible. I speak of the withdrawal of ground water in excess of recharge, the lowering of water tables below the level at which handpumps can operate and the deterioration of water quality as concentrations of arsenic and fluoride exceed safe limits. These then, in summary, are the threats facing the rural water supply programme in India today.

One can not turn the clock back, but I do believe that if more attention had been paid to protecting the environment, for example the management of watersheds, in the early years of the programme, we would not be facing such complex problems today. We will not escape with an isolated technical solution this time, although certainly, technical innovation is called for. Instead, the solution is likely to be found through legislation, policy change, community awareness of their rights to, and responsibilities for, a safe environment, monitoring and surveillance of water quality, changes in agricultural practice, the revision of subsidies for irrigation and a curb on deforestation.

The urbanisation of India also poses a threat to rural water supply as 50 per cent of the population will be living in urban areas by 2020. From where will water be drawn if not from rural areas ? And again, unless we are careful and sensitive, it will be the rural poor, those with the smallest voices and the least political clout, who will be the losers. We have a responsibility to prevent this from happening and it is the partners with Governments that must take the initiative.

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