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Water and Regional Development

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Introduction

Water resources management, like the management of any other natural resource, has been an evolving process. As our knowledge base increases, technology improves, and societal needs, views, and aspirations change, management practices change as well. Over the past fifty years, water management practices and processes have changed, mostly incrementally. The rate of these changes has accelerated during the 1990s. It is highly likely that the world of water management will probably change more during the next twenty years, compared to the past 2000 years. Thus, it is absolutely essential to consider how best to cope with these changes, pre-emptively, correctly, and in a cost-effective manner.

If the twentieth century is considered, historically, the main objective of water resources development has been the concept of economic efficiency, and the technique used for its evaluation has traditionally been benefit-cost analysis. Thus, the Federal Reclamation Act of the United States (US) of 1902 required economic analyses of projects, and the 1936 US Flood Control Act stipulated that benefits to whomsoever they may accrue should exceed project costs. Such laws set the stage for water resources planning and decision making for decades to come. Even a century after the US Federal Reclamation Act was passed, economic analyses of water projects continue to be an essential requirement for decision-making purposes.

As the twentieth century progressed, new objectives for water resources management were added. For example, during the 1930s, water development projects were used in the US as a means to reduce unemployment, and promote regional development. By the 1950s, use of water development projects to

promote regional income redistribution was considered to be a valid objective. However, in spite of the merit of this objective, and also its conceptual attractiveness, it has not received the type of wide acceptance or permanence that has been accorded to the economic efficiency objective. During the post-1980 era, explicit use of regional income redistribution objective had already taken a back seat for planning and managing new water projects.

As the 1970s and 1980s progressed, another new objective was gradually added: it was that of environmental quality. It should be noted that this new objective was added not only for water planning, but also for all other types of development projects. During the 1990s, environmental quality considerations became an increasingly important objective, a development that should be welcomed. Unfortunately, however, the concept of using water projects as an engine for regional development and regional income redistribution lost ground steadily as an objective.

At the beginning of the twenty-first century, it is now becoming increasingly apparent that, at least for the developing countries, the role water projects can play, and should play, to promote regional development, thus improving the lifestyles of the people, especially the poor and the landless, needs to be urgently re-examined. *Prima facie*, it appears that this objective should receive as high a priority as those of economic efficiency and environmental quality.

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Mustafa Kamal Atatürk said: 'I am leaving no sermon or dogma, nor am I leaving as my legacy any commandment that is frozen in time and cast in stone. What I leave behind is reverence for scientific knowledge and decent judgement.' The water profession will do well to take note of Atatürk's recommendation in terms of 'reverence' for 'scientific knowledge and decent judgement' to meet the changing needs and aspirations of the society. It appears that the profession threw away the baby with the bathwater, when it allowed the objective of regional income redistribution to gradually fade away during the post-1980 period.

During the 1980s and 1990s, water development projects have come under concerted attacks from social and/or environmental activists, often because of wrong or dogmatic reasons, and/or due to the vested interests of the people concerned. Unfortunately, these attacks were neither taken seriously nor properly countered by water resources development professionals for at least

twenty years. Furthermore, just as the activists were well organized, the water experts were equally unorganized, thinking that these attacks on water projects were short-term developments. Thus, it was felt that the best strategy was to ignore these attacks and they would disappear, or at least decline in intensity, within a reasonably short period of time. Unfortunately, exactly the reverse happened: their silence and apathy encouraged the activists to attack water projects in even more strident terms. In addition, while the opponents of the water projects were media-savvy, the proponents were not. As a result, public perception in many places, especially in developed countries, gradually became that water projects did more harm than good to the society and the environment.

Unquestionably, these unwarranted and often misguided developments have seriously hampered the construction of many good water projects in developing countries, or at the very least delayed their implementation by years, if not decades. One serious adverse impact of the current state of affairs has been that these delays have seriously affected the poverty alleviation efforts through regional development, using water as the engine for economic growth.

Studies from different parts of the world indicate that properly planned, constructed, and managed water development projects can make significant and lasting contributions to the social and economic development of the project areas. The impacts can be primary, secondary, and tertiary, and they often vary in the project areas in terms of time, spatial distributions, and intensities. Many impacts may extend well beyond the project area, to the country as a whole, or even beyond national boundaries.

While there is no question that the overall impact of properly planned water projects are overwhelmingly positive, it is equally certain that they contribute to some negative developments as well. This is not a special case for water development projects, but is also equally valid for any infrastructural development project, or, for that matter any development policy. For any development project, or for any policy, it is axiomatic that some people will benefit and equally others will pay the cost, at least in terms of higher taxes. It is absolutely impossible to consider any project or formulate a development policy that can have only beneficiaries, and not a single person will have to pay the cost.

Since all projects and all policies result in both benefits and costs, it is necessary for decision-making purposes to determine the following:

- a) nature of the beneficiaries, that is, who benefits and who pays the costs because of the construction of a project;

- b) how to make the people who are likely to pay the costs of the projects become its beneficiaries, or at the very least reduce their cost burden to the minimum possible and also to compensate them properly for the costs (both financial and intangible) they have to bear;
- c) take appropriate measures to maximize the benefits and minimize the costs; and
- d) ensure that the projects result in overwhelmingly positive benefits for the society as a whole, including the environment.

The corollary of these considerations is that if the total costs for any project or policy exceed the benefits to the society as a whole, that particular project or policy should not be implemented. This conclusion is valid not only for water policies and projects but for any type of development policy or project.

Water Development as an Engine for Regional Growth

Water resources development professionals have not seriously considered the fact that water projects can significantly improve regional development processes. As such, the various interrelationships and interlinkages between the two are not known accurately and comprehensively at present, except for a very few specific projects, and that too in a somewhat anecdotal fashion. There are at present many anecdotal evidences of positive interlinkages between the two, which also have never been studied either systematically or in-depth. In addition, an important policy issue that has been mostly ignored by both water resources and development professionals is how a water project should be planned, designed, constructed, and operated from the very beginning so that it can have the maximum possible positive impact on the development of the region concerned, and also contribute to improving the standards of living of the maximum number of people, especially the poor.

Many regional development implications, which stem from the construction and operation of water projects, can easily be identified, both conceptually and also by some available facts and figures.

Provision of reliable and clean water supply to domestic, commercial, and industrial consumers is an important issue since the developing world is becoming rapidly more and more urbanized. As the urban population increases, the catchment areas in which these urban centres are located experience concurrently both water scarcities and increased water pollution. At a certain

stage, industrial growth and the attendant employment opportunities may become constrained, unless the consumers receive the appropriate quantity and quality of water they need. If adequate quantity and quality of water is not available to the domestic consumers, they will face many problems, most important of which could be the following:

- a) Health: Incidences and frequencies of occurrence of water-related diseases may increase.
- b) Economic: People, especially the poor, are often forced to buy poor-quality water from vendors at high costs, which adversely affects their finances as well as their health. Poor health also means additional economic burden on families in terms of obtaining medical help and medicines, as well as loss of income due to sicknesses. This is an especially important issue for daily labourers, who receive no income whatsoever for the period they are unable to work because of illness.
- c) Social: In many urban areas, and in most rural areas, people (mainly women and children) are forced to spend considerable time in collecting water for domestic consumption and use. The time wasted in making journeys to collect water each day is time which could have been used for more productive activities.

The three types of problems noted here are closely interrelated: one affects the other, and, in turn, is affected by the others. These problems can be seen for both urban as well as rural families.

These three issues can be considered to be traditional, at least in the sense that they are well known to the water resources and development professionals. However, once the scope of water planning is broadened, and water development projects are specifically planned to promote regional development and to improve the standards of living of the people, especially the poor, the implications increase manifold. Among the new implications are the following issues.

- a) Food availability: Introduction of irrigation increases the total agricultural production of the area in two main ways, by increasing the yields per unit of land and also by expanding the total area cultivated.

The adverse impacts of floods and droughts are very significantly reduced by water projects.

- b) Nutrition and food security: Overall, both nutrition and food security improve in the irrigated areas because of crop diversification and more reliable food production. Per capita food production in the area increases, and families grow more food in their land, as well as more varieties of crops.
- c) Employment generation: Employment opportunities for skilled and unskilled labour increases significantly in the project area because of: (i) construction-related activities for dams, canals, drainage systems, other hydraulic structures, roads, and other related infrastructures; (ii) irrigated agriculture which significantly increases the need for labour, and thus employment opportunities; and (iii) increased agricultural production which brings new agro-industrial developments to the region, thus further increasing its employment needs. All these, in turn, contribute to the growth of all types of service facilities, and thus further increase the employment potential of the area.
- d) Transportation: Transportation facilities increase very substantially during the construction of a project and immediately thereafter. Dams are normally constructed in the upper catchment areas, which often suffer from the lack of adequate transportation and communication facilities while the lower catchment areas which are generally more populous, have greater employment opportunities and better standards of living. One of the very first activities of water development projects is to link the dam sites in the upper catchment areas to the towns and cities in the lower regions. This immediately links the highlands with the lowlands in terms of trade, commerce, access to educational and medical facilities, introduction of new ideas and technology, and numerous other direct and indirect linkages.

Road systems are generally built at least on one side of the embankments of the canals. This links up the villages in a way that did not exist before. The development of new transportation networks open up new opportunities for increased commercial activities and social interactions. As these activities increase, more and better transportation networks have to be built, which further improves the transportation facilities within and between towns and villages of the region. Thus, as

construction begins, transportation facilities of the region start to improve, often dramatically. In other words, construction of a water project acts as a catalyst to open up areas that were somewhat inaccessible before by improving very substantially the transportation facilities that existed earlier.

- e) Energy availability: Water development projects increase the energy availability of the region in three distinct ways. First is the generation of hydroelectric power. Electricity is an essential requirement for improving the lifestyles of rural and urban people, and also increasing the opportunities for commercial and industrial development. At present, the electricity needs for most developing countries are increasing exponentially. In recent years, even for populous countries like Brazil, China, India, and Turkey, total electricity consumption has increased at an annual rate of 5–12 per cent compounded.

Water projects not only generate electricity, but since hydropower is a non-consumptive use, water released after power generation is subsequently used for agricultural, commercial, and industrial purposes, as well as for domestic consumption. Furthermore, hydropower is a renewable source of energy, which means that non-renewable resources like oil, gas, or coal can be saved. This is an especially important issue for most developing countries, which do not have adequate hydrocarbon resources nationally for power generation. Foreign exchange in hard currencies is thus saved by not importing petroleum and natural gas from other countries.

For most large dams, electricity generated is significantly more than what can be efficiently used in the region. Thus, the electricity generated is transferred through the national grid, which means much of the country benefits from such development activities.

There are other ways through which the energy situation improves the social and economic conditions of the region. One is through increases in crop production and higher cropping intensities. Changing rain-fed agriculture to irrigated agriculture means that one crop a year is replaced by two or three crops per year. Both the higher cropping intensities and increased agricultural production result in the generation of significantly higher quantities of agricultural residues. Experiences from India, China, and Thailand indicate that poorer households burn these agricultural residues for cooking purposes, thus reducing the need for fuelwood.

Another indirect energy-related issue is that the use of commercial fuel increases with increase in the incomes of the people due to the new economic opportunities available. Poorer people move from exclusive use of fuelwood for cooking to commercial energy like kerosene and bottled gas. All these developments contribute to reduction in deforestation rates. These are very positive changes which occur frequently due to water projects. Regrettably these have been mostly ignored by professionals in the field of water resources development and environment.

- f) Availability of better social facilities: Social facilities like better healthcare and education invariably become an important by-product of water development projects, even when these projects are not planned as an integrated component of regional development. When the Atatürk Dam in Turkey was constructed, the first pharmacy of the region was established near the construction site. This meant that people of the area did not have to travel for hours, using poor transportation facilities, to get the required medicines. With improved transportation and communication facilities and higher levels of economic activities, educational levels of children improve for a variety of reasons. Among these reasons are: (i) more primary and secondary schools are opened because of increased economic and commercial activities, and immigration of people; (ii) access to schools is improved. For example, before the Atatürk Dam was constructed, many young people had to walk 4-5 km each way to go to schools, but as soon as proper roads were constructed, students started to travel by buses. These improved facilities have also meant that more girls are going to school than even before; (iii) quality of teaching improves. Before the projects are constructed, teachers from outside the project area often refuse to come because of the isolated nature of the region. However, once the area opens up, more and more teachers decide to move to the region, thus improving the quality of teaching in schools.
- g) Gender-related issues: The indirect and tertiary impacts on women from water and regional development has been a totally neglected issue. The evaluation of the Bhima Command Area Development Project in India indicates that it had a very high impact on the education of children, especially girls. Before the project was completed, many families had to continuously travel from one place to another, looking for employment opportunities. Girls invariably moved with their families, and thus they seldom, if ever, attended schools.

After the Bhima irrigation project was completed, employment opportunities within the region expanded exponentially (Biswas, 1987). As a result, it was no longer necessary for families to move from one location to another in search of jobs. These nomadic labourers have now become sedentary. One direct impact of this permanency has been that they are now sending their daughters to schools, without any encouragement from the government or any donor agency. Similar progress can be noted due to the constructions of the Teesta Barrage in Bangladesh.

- h) Environmental impacts: Much has been written on the environmental impacts of water development projects. There are few issues that are worth noting.

Very few large water development projects have been scientifically and objectively assessed for their environmental impacts. In contrast, thousands of environmental impact assessments (EIA) are now available. These EIAs are forecasts. Regrettably, no one checks if these forecasted impacts are correct. For example, an objective review of the environmental impacts of the Aswan High Dam in Egypt, after some thirty years of operation, indicates that most of the forecasts were hopelessly wrong (Biswas, 2002). In the absence of such serious ex-post impact studies, errors in forecasting the environmental impacts have continued to be perpetuated.

Environmental impacts, in the context of water development projects are always considered to be negative. The positive impacts are never considered. This mindset of the analysts needs to be changed. What is needed in the future is identification and estimation of both positive and negative impacts in an objective and unbiased manner.

The negative impact of water development projects, both real and imaginary, have received extensive coverages. Accordingly, in this chapter only the positive impacts are outlined here based on studies carried out by the Third World Centre for Water Management.

- i) Reduction of deforestation: Assessment of the Bhima Project indicates that it has reduced the rate of deforestation very significantly (Biswas, 1987). Need for fuelwood for cooking has declined because of the reasons mentioned earlier. In addition, as the incomes of the people have increased, and more fodder is now available, livestock holdings have exploded compared to the pre-project conditions. Dried cow dung has

now become an important fuel for cooking. Thus, numerous families who depended upon fuelwood for cooking, now do not use them, or have reduced their use, because of: (a) increased availability of agricultural residues and cow dung; and (b) higher income, which has allowed them to move up the economic ladder, and thus use commercial fuels like kerosene or cooking gas. These two unexpected developments have reduced the rates of deforestation in the area significantly.

- j) Increase in biodiversity: For the Bhima Project and the Indira Gandhi Nahar Project in Rajasthan, India, both constructed in highly arid areas, all the available anecdotal evidences indicate that they have significantly increased the biodiversity of the area. What is now needed is serious and thorough scientific studies which can compare the levels and the natures of biodiversity before and after the projects were constructed. Regrettably, not even one such authoritative study of biodiversity has ever been carried out anywhere in the world, to enable comparison of pre- and post-project conditions.

Water-Based Regional Development: The Case of Bhutan

One of the best examples of using water development as an engine for economic growth of a region is the case of Bhutan.

Bhutan, often known as the Hermit Kingdom, was basically inaccessible to the world until 1960. In 1961, it initiated its first five-year development plan. In 1960, it had one of the lowest per capita income for any country, not only in south Asia but also in the rest of the world.

Bhutan is a landlocked country in the Himalayas. Because of the topography, its agricultural potential is very limited. It has a hydropower potential of about 20,000 megawatts (MW), which is slightly less than one-quarter of the potential of its western neighbour, Nepal. The country realized long time ago that water development is not an end in itself but a means to an end, where the end is to improve the lifestyles of the people of the region through a variety of pathways. Poverty alleviation and income distribution are two important objectives of such water-based regional development.

Bhutan and Nepal have followed different paths to develop the water resources of the international rivers that flow through them. Short on capital and expertise, Bhutan initiated a plan around 1980 to develop the hydropower potential of the Wangchu cascade of Chukha in collaboration with its southern

neighbour, India. The Chukha is a 336 MW project constructed by India on the basis of 60 per cent grant and 40 per cent loan. The cost was estimated at Rs 2,450 million. A 220 kilovolt (kV) transmission line links the Bhutanese capital Thimpu and the city of Phuntsholing on the Indian border, from where electricity is supplied to four Indian states. The electricity generated is used first to satisfy Bhutan's own needs, which earlier was supplied by diesel and mini-hydro stations. The country's total electricity requirement has more than doubled since its initial use of 12 MW. In addition, the unit cost of electricity has steadily declined because of this higher and more economic scale of production. Gradual expansion of the electric network to different parts of Bhutan has meant reduced use of fuelwood than what would otherwise have been the case, as well as of diesel which had to be imported. Reduced fuelwood use has had a beneficial impact on the forests and the environment.

The electricity produced in excess of the requirement of Bhutan is purchased and used by India as peak power through its eastern electricity grid. Initially, the two countries agreed to have different pricing patterns for firm and secondary powers. Later, the two tariffs became the same. Subsequently, the tariff was increased. The revenues that Bhutan has been receiving from its electricity sales to India not only has serviced its debt load without any difficulty, but also left enough surplus to finance other development projects and support some social services, including, increasing the salary scales of its civil servants.

The Bhutanese development policy in recent decades has been to ensure that national economic development proceeds parallel to the country's social, economic, and institutional absorptive capacities. Environmental conservation has been considered to be another important national objective. The King of Bhutan wishes to ensure that there is no excessive tourism and industrial development, which could adversely impact on its culture, general lifestyles of its people, and the environment. The main focus is thus on developing the hydropower resources of the country, which could enhance the economic and social development processes of the country. The excess electricity generated will continue to be sold to India, which faces serious energy shortages.

India has further assisted Bhutan with the construction and funding of a 45 MW run-of-the-river power station at Kuri Chu. Similar collaborative efforts have taken place, or are under active consideration for Chukha II (1000 MW) and Chukha III (900 MW with a storage dam). An agreement was signed with India in 1993 to study the feasibility of a large storage dam on the Sunkosh River. If all these projects are completed, and assuming that unit price paid for electricity

will continue to increase periodically, Bhutan can easily earn over \$100 million per year from the export of its hydropower alone during the post-2010 period. For a country with a small population, this is indeed a very significant income which will accrue regularly year after year.

The 'win-win' approach adopted by Bhutan and India is a good example of how water resources can be used by a region (two countries share this region) to improve the lifestyles of the people, contribute to poverty alleviation, and simultaneously protect the environment. The developments were not narrowly focused on water only: it encompassed other primary water-related activities like hydropower, agricultural and industrial development, intermodal transportation system, within which navigation could be an important component, and environmental conservation. These, in turn, could directly lead to secondary impacts like employment generation, regional development, capacity building of the nation, and poverty alleviation. Viewed from any direction, the collaboration between Bhutan and India has been most beneficial to the two countries, including ensuring regional peace and stability. All these developments have resulted in Bhutan's per capita income increasing from one of the lowest in south Asia to almost one of the highest within a very brief time span of only two decades. The future looks even brighter if the focus on water-based regional development continues with associated safeguards.

Conclusion

If properly planned and implemented, water projects can act as the engine for regional development, especially in the arid areas of developing countries. If water development projects are to be successful in improving the lifestyle of the poor, and in ensuring environmental protection, they need to be carefully planned and executed within an overall framework of integrated regional development. This can be done, and this needs to be done, but this cannot be done until and unless water resources development professionals, regional planners, and development experts concurrently accept this thesis. Fortunately, current indications are that all the three groups are proceeding in this general direction. There is thus a convergence of ideas, and the time has come to use water development as the engine for economic growth for the regions concerned.

Even without direct and deliberate integration of water and regional development activities in the past, current indications are that water

development projects have an impact on regional economic growth. For many underdeveloped areas in arid regions of developing countries, water development projects should be designed in such a way from the very beginning so that they become an integral component of an overall regional development framework. This will not only accelerate development activities of such areas, but will also improve the standard of living and the quality of life of millions of people.

References

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