Planning Perspective of Farmers' Participation in Irrigation Management in India

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ABSTRACT

INDIA'S PROSPERITY WILL depend for a few decades to come on the growth and development of agriculture. The Indian agriculture sector is as diverse as in any continent. Out of 4 farmers in the world, one is in India. The success of Indian agriculture is inextricably linked with the development of irrigation which has helped the food grain production to increase from 54.92 million tonnes in 1949-50 to 180 million tonnes in 1992-93. Despite such achievements in the production of food grains and other agricultural items, the growth rate on the farm sector has, nevertheless, not kept pace with the rising population. The country's total food grain production will need to be boosted to a level of 210 million tonnes by the year 1997 and 285 million tonnes by the year 2007. Against such a back-drop, irrigation will occupy the center stage in the planning strategy but at the same time there are significant and difficult issues facing irrigation performance, particularly related to institutional aspects. Farmers' participation in irrigation management is now a key factor in importing water use efficiency as well as productivity to irrigated lands as a pre-requisite to sustain the country's self-reliance in food grain. On the basis of experience gained over the past 4 decades, this paper analyzes the need for and future of farmers' participation in Indian irrigation management from the point of view of the planning strategy.

NEED FOR FARMERS' PARTICIPATION AS A PLANNING STRATEGY

For India, farmers' participation in irrigation management is more a need as the planning strategy for optimal utilization of basic resources--land, water and human--than maximizing agricultural production. Indian agriculture has made major strides in the decades following independence. This was facilitated by promotional efforts of the State, that is Central and State Governments, in introducing and spreading new technologies of crop production, putting in place a fairly wide network of a delivery system of inputs in which irrigation is a critical one, supporting services, establishment of institutions to assist the farmers in adoption of improved technologies, etc. The success of agriculture is inextricably linked with the development of irrigation. Even though there has been considerable improvement in the production of food grains and other agricultural items, the growth rate of the farm sector has not kept pace with the rising population. The overall growth rate of agriculture in the same period has been 2.5 percent compared to the 2.1 percent increase in population. The share of agriculture in total GDP has gone down from 56 percent in 1950-51 to 32 percent in 1992-93. Also, the population living in villages and dependent on agriculture has shown a marginal decline from 80 percent to about 70 percent over the same period.

The production of food grain crops has increased from 54.92 million tonnes in 1949-50 with a gross cropped area of 99.28 million ha to 180 million tonnes in 1992-93 with a gross cropped area of 124 million ha. The present (1990-91) cropping intensity is about 130 percent. As per the Eighth Plan projections, the Indian population will grow from 844 million in 1991 to 925 million in 1996, 1,006 million in the year 2001 and 1,102 million in 2007, and it is further estimated that the population will be 1,394 million by the year 2,025. Accordingly, the food grain requirement will also go up from 172.5 million tonnes in 1991-92 to 210 million tonnes in 1996-97, to 245 million tonnes in 2001-2002 and to 285 million tonnes in 2006-2007. Unless there is an increase in the agriculture growth rate, it is doubtful whether enough will be produced to feed the population of one billion at the turn of the century. For this, it will obviously be needed either to expand the land area for cultivation or to increase the cropping intensity (and thereby gross cropped area) through expansion of irrigation facility or both. However, there are severe constraints in expanding the land area for cultivation, as discussed hereinafter.

There is yet one more dimension, namely poverty alleviation. In India, nearly two thirds of the work force (which is 314.9 million as per the 1991 census) is still dependent on agriculture for livelihood. At the beginning of the Eighth Five-Year Plan (1992-97), the total number of unemployed was 23 million with 17 million completely unemployed and 6 million severely underemployed. The Eighth Plan has set the target of providing additional employment opportunities to 43 million people out of which 40 percent is in the farm sector for which irrigation is a key factor. However, during the Eighth Plan period, it is estimated that 35 million will be new entrants in the unemployed labor forces. Thus, at the

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end of the Eighth Plan and after fulfilling the target of employment generation, still there will be 15 million people unemployed. With the constraint on the availability of more land area for cultivation, the planning strategy demands to go for increasing gross cropped area with expansion of irrigation so as to generate more employment opportunities and for that, the present cropping intensity level needs to be increased to 140 percent by the turn of century and 145 percent by the year 2006-2007. An acceleration in the growth of agricultural output in the lagging and poorer regions would have to come obviously from an increase in yield levels of individual crops, increase in cropping intensity and changes in the cropping pattern in favor of high-value crops. The most important factor contributing to such changes would be the availability of assured irrigation, followed by the provision of modern input and appropriate price policies. Employment implications of irrigation, through various effects like the increase in cropping intensity, yield levels and cropping pattern are found to be quite significant. On the basis of a cross-section analysis among different States, it is observed that a one percent increase in irrigated area leads to a 0.38 percent increase in employment. But field-level studies in Andhra Pradesh, Orissa and Karnataka show that an irrigated hectare of sown area uses from 50 to 150 percent more labor than an unirrigated hectare. Thus, it is obvious that for accelerating the growth of agricultural output and employment in the slow-growing regions, a major thrust on provision or irrigation would be necessary. It may also be pointed out that due to low yield and consequently low farm-income level, a good proportion of the persons already engaged in the farm sector is under the threat of becoming openly unemployed and, as such, they are the candidates for employment outside the farm sector. Therefore, besides generating new employment opportunities, it is also equally important that employment already in the farm sector should be more effective and remunerative through better performance of irrigation.

CONSTRAINTS ON LAND WATER USE

With India's net sown area (NSA) being stagnant at about 141 million ha (accounting to about 43 percent of its geographical area) during the last two decades, the area under food grain crops has been about 118-121 million ha (about 85 percent of the total NSA), since 1970-71. Against this, the NSA is likely to decrease to about 138 million ha at the turn of the century due to the growing pressure on land use as a result of fast occurring urbanization, industrialization and developmental activities. On the other hand, the per capita water availability per year in India will dwindle from its 1990 level of 2,464 cubic meters (m^3) to about 1,496 m^3 in the year 2025 which will be less than 1,700 m^3 per capita per year, a threshold value below which a country will begin to experience periodic or regular water stress. At the same time, the share of agriculture in total water use in India will come down from its present level of 83 percent in 1990 to 73 percent in 2,025 due to competitive demands on water use from other sectors, particularly energy, domestic and industrial use. In view of such compulsions, caused by the growing population on the good grain production, land and water use, the agricultural growth strategy will have to move in two directions, namely expanding the irrigation cover and optimizing agricultural productivity from irrigated area through the improvement of performance efficiency for which the most important step is to integrate farmers' participation with effective institutional development, better maintenance and optimum utilization.

IMPROVEMENT IN IRRIGATION PERFORMANCE

Faced with the above discussed constraints on land water use, the national planners in India increasingly agree that the most effective long-term strategies for having the required agricultural growth rate, to fully meet not only the growing demands for food grains in the country but striving to achieve a greater share of exports of both agricultural commodities and processed products in the international markets, include conservation and more efficient land-water use. Before a strategy for improving irrigation performance is considered, one has to take a quick look at its present status from the angle of (i) water use efficiency and productivity, (ii) reliability, and (iii) finance.

WATER USE EFFICIENCY AND PRODUCTIVITY

On an average, water use efficiency in the existing irrigation projects is put at 40 percent which means the bulk of the water diverted to agriculture never benefits a crop. The overall productivity (as in 1992) in case of cereals in India is as low as about 1,996 kg per ha as compared to the global average of 2,791 kg per ha and Asian countries' average of 2,898 kg per ha with China's 4,397 kg per ha, Japan's 5,847 kg per ha, South Korea's 6,568 kg per ha, Saudi Arabia's 4,741 kg per ha, European countries' average of 4,006 kg per ha and North America's 4,369 kg per ha. Major crop-wise yields in India vis-a-vis some selected countries in the world over the period (1965-89) are given in Annexure I. Several studies conducted have established that productivity from irrigated lands in India can be achieved to a level of 3 to 4 tonnes per ha. For improving agricultural productivity, irrigation and fertilizers are the main actors amongst various inputs for agriculture. The total consumption of fertilizers in kg per ha per year in India has increased from a

mere of 3.68 in 1963-64 (the year after which India started using High Yield Varieties) to 65.30 in the year 1988-89 which is very low as compared to 114.7 for the Asian average, with averages of 262 in China, 415.10 in Japan and 229.30 in Europe. More details of fertilizer consumption, yearwise and countrywise, are given in Annexure II. For improving the present level of fertilizer consumption, the assured irrigation is a prerequisite.

It would be interesting to cite an example of farmers' participation in the Lower Bhavani Project in the southern State of Tamil Nadu in India. Commendable work has been done for the formation of a water users' association for managing the command under this project. The highest yield of the main crop of rice as recorded as well as awarded in the competition held in 1990-91 was of the order of 11.3 and 9.6 tonnes per ha. Also the results of crop cutting experiments done during 1988-89 showed a 146 percent rate of productivity growth in the tail end, a 142 percent rate of productivity growth in the head reach and a 118 percent in the middle reach for the rice crop. Similarly, in another irrigation project, i.e., Periyar Vaigai Command water users' associations have been fairly established and the crop yield estimation studies carried out during 1990-91 showed an increase of 48.14 percent of productivity of rice crops. Thus, all over the country, there is nevertheless considerable scope for improvement of agricultural productivity through the improvement of infrastructure for the farm sector so as to fully harness the basic resources in India, in a sustainable manner. It is estimated that management improvements including increasing water use efficiency to 60 percent alone could allow an additional 8 million ha to receive irrigation waters from existing irrigation facilities. In other words, the present yield from this newly irrigated land could be doubled without developing any new water sources. The investment as required for such management improvements could be in the range of Rs 64 billion (US$2.1 billion) to Rs 320-350 billion (US$10.4-11.6 billion), at the current price level, to create new irrigation potential for this area of 8 million ha. The presumptive annual loss comes to Rs 33 billion only on account of incremental agricultural production.

RELIABILITY

This is rather a true reflection of the level/quality of service that user farmers are provided with. If the arrival of water in the canal is unreliable and unpredictable or if farmers have not had any for a long time, not only would the productivity of crops grown on the ground get severely affected but would also dampen the enthusiasm of farmers in getting themselves associated with the irrigation management. The prevailing engineering-oriented approach or, at best, managerial approach of irrigation management has to be changed over to a productivity-management approach which is to be based on the simple understanding that agriculture is an economic activity and, to that extent, that the farmer is an economic animal who would be guided only by economic considerations. The present irrigation management owned by the government departments has the following negative aspects:

(i) Does not provide freedom to the user farmer for selecting a crop which is otherwise a major economic decision on his part.

(ii) Does not give freedom or incentive to use groundwater in the irrigated command which, at times, constrains the farmers in going for more remunerative crops; on the other hand, the conjunctive use of groundwater and surface water, although much espoused, seldom gets practiced on the ground, leading over the time, to various problems like waterlogging, salinity, etc., in the command.

(iii) Does not give freedom/flexibility in deciding as to when irrigation water is to be released in view of the rainfall and climatic conditions. This aspect is very important from the viewpoint of economic returns from irrigated lands which are subjected to the vagaries of the monsoon.

(iv) Instead of assuming the role of a facilitator, government irrigation management agencies are deciding on behalf of the user farmers who, in fact, should be in the position of a decision maker for irrigation-related matters. The farmer, in the decision maker's position, will have irrigation for his best economic benefit. But, in the present government-managed irrigation systems, the farmers' participation is remote, more dilute and not systematic.

Since the element of commercialization has now entered agriculture in a big way, farmers are obviously concerned with a high level of irrigation service. In a country like India where rainfall pattern is often erratic, affixed (predetermined) water delivery system cannot always be conducive to the farmers' needs (and the productivity) linked mainly with climatic factors. This kind of flexibility of irrigation water scheduling, responding fully to the farmers' needs, is difficult when it is to be operated by the government and, consequently, the productivity of crops gets affected. Similarly, the use of groundwater within the command is again controlled by the government in case of State-managed irrigation systems. The fundamental philosophy for irrigation is to benefit the user farmer but unfortunately the same

user farmer is not a decision maker in the present setup of irrigation management. In fact, today's decision makers, on behalf of the farmers, should assume the role of a facilitator and this calls for an attitudinal change in State Government departments managing irrigation systems. A farmer may be illiterate but he is the shrewdest judge as far as economics of his agriculture are concerned, be it in the selection of a crop or time interval of irrigation or volume of irrigation needed by crops on the ground. Therefore, distribution or delivery of irrigation water has to be decided by the user farmers. All these aspects can be met with only if there is farmers' participation in irrigation management.

FINANCIAL PERFORMANCE

Many of the water shortages cropping up around the world, in general, and in India in particular, stem from the widespread failure to value water at anything close to its true worth. Water charges in India, on an average, are very low--typically amounting to 2-3 percent of the harvest's value in most States--that they have no influence on the farmers' management decision. The cost of irrigation water on the basis of investment, on an average, works out to 91 paise per thousand liters against which at prevailing water charges, the highest water rates for rice and sugarcane are 1.2 paise (100 paise = one Indian rupee) and 11.6 paise per 1,000 liters, respectively. As against average water charges for irrigation at 3 percent of the production cost, China is charging 20 percent and South Korea 42 percent. Most of the States have not revised their irrigation water rates for the last 15-20 years. The direct fallout of such low irrigation water rates with the added problem of low recovery is that today the water charges allocated do not cover even working expenses, not to speak of depreciation charges and even a moderate return on the investment. On an average, gross revenue collection per hectare of irrigated command is found to be about Rs 68.00 against which the estimated working expenses are Rs 216.00 per ha and thereby resulting in a financial loss of Rs 149.00 per ha per year. It is estimated that the financial loss (difference between working expenses and revenue collected) as incurred by the irrigation sector during the Seventh Plan period (1985-90) was Rs 36 billion (without considering interest) and Rs 89 billion (with interest on investment). Upward revision of irrigation water rates is not only overdue but has cast its evil shadow on the performance of existing irrigation works. Understandably, such required upward revision has to be in a phased manner along with upgrading of the level of service from the irrigation works to the farmer beneficiaries.

Another aspect involved here is the revenue recovery from irrigation systems which has substantially declined since 1974-75. From Annexure III, it can be seen that the all-India average of revenue recovery as a percentage of working expenses declined from 64.2 percent in 1974-75 to a mere 7.8 percent in 1988-89. This has been further aggravated due to rising expenditure of staff involved in working expenses on irrigation projects which can been seen from Annexure IV. In some States, the cost of collection of fees is more than the revenue. The combined effect of these two aspects is reflected in the deteriorating level of maintenance and repairs of irrigation works which is evident from Annexure V which shows that, on an average, of 14 States, a little more than one third of the working expenses required for the upkeep of major (having a culturable command area [CCA] of more than 10,000 ha each) and medium (having a CCA of 2,000-10,000 ha each) irrigation projects was provided as maintenance funds in 1986-87. A classic example of such neglect of maintenance and repairs can be found in irrigation tanks, (i.e., catchment or stream reservoirs; the term "tank" is Indian English usage derived from Portuguese). While in 1962-63, the total area irrigated by 0.51 million tanks in India reached an all-time high of 4.78 million ha. It came down to 3.07 million ha in 1985-86 (in spite of thousands of new tanks added during that period) due to the neglect of upkeep of the tanks, resulting in the reduction in their capacity because of siltation, several tanks becoming completely dried up and fore-shore area being encroached by urbanization, etc. In financial terms, the loss of irrigated area was of the order of 1.7 million ha which could be a capital loss of about Rs 51 billion, i.e., US$3 billion.

Inadequacy in the design of the systems increases O&M cost. Funds for O&M depend on the collection from farmers; [a vicious circle of dissatisfaction, declining collection and declining performance starts]. Thus the irrigation agencies have to depend on budgetary provision for O&M expenditure which is not linked with the actual performance or higher agricultural production but is made according to resource availability. Besides, when funds for O&M are collected from the general revenue, the irrigation agencies do not feel themselves accountable to the users to provide optimal services. In this regard, a success story of water users' associations formed for irrigation management under Baldeva Medium Irrigation Project and Pigut Medium Irrigation Project located in the Bharuch District of Gujarat State in India needs special mention. Both these associations have been authorized to decide on the crop pattern, internal distribution of water, scheduling of irrigation water, fixation of water rates and collection of water rates/revenue over and above operation and maintenance of this system. In the case of Baldeva, the revenue collection as realized was 100 percent with Rs 60,000 (about US$2,000) in 1992-93 which increased to Rs 94,400 (about US$3,150) in the subsequent year, i.e., 1993-94, thereby mustering, 57 percent increase in revenue in just one year. Similarly, for the Pigut scheme, the recovery increased from 89 percent in the first year, 1989, to almost 100 percent in 1992-93. The revenue realization increased from Rs 30,500, i.e., about US$1,015 in 1989-90 to Rs 91,400 (about US$3,045) in 1992-93. Also, in case of the Pigut scheme, it is reported that the availability of "delta" (it is an expression used in India to mean the

depth of water that would result over a given area from a given discharge for a certain length of time. Alternatively, it may be defined as the total volume of water delivered divided by the area over which it has been spread) decreased from 43 cm in 1989 to 27 cm in 1993-94 as a result of improved water use efficiency achieved under irrigation management by the farmers' association.

MAJOR INFLUENCING FACTORS

Among the factors responsible for making a WUA a success or a failure, the following factors have emerged, from the Indian experience, to be major ones.

Mutual Accountability

The relationship between an irrigation department and a Water Users' Association (WUA) should be a businesslike relationship in the sense that the irrigation department stands committed as well as accountable to ensure that a predetermined quantity of water is made available at a predetermined time and place to a WUA on a payment basis. On the part of a WUA, it stands committed and accountable to pay for the water delivered by the department. This aspect of accountability needs to be reflected in the structure of irrigation water pricing, with due provision for allowing rebate (more as compensation) on the prescribed water rates in case of delay (but within a tolerable time period from the plant growth point of view) in supplying water as per the irrigation water calendar (to be decided jointly by the department and the WUA) as well as allowing overall reduction in the water rate if no water is supplied or is supplied beyond the tolerable time period. Also detailed service standards should be set out for each irrigation scheme or a group of similar irrigation schemes in terms understandable by the users and measurable at various points in the system. It is a proven principle that where comprehensive service standards are set out and enforced, service quality is high and the beneficiaries are more able and willing to pay the service charges. Where such service standards are not met by the operating entity, beneficiaries refuse charges even to meet O&M costs. Therefore, this bears heavily in any effort to transfer system responsibilities from the government to the user beneficiaries.

Legal Support

Considering water, a prime natural resource and precious national asset, India has adopted the National Water Policy in 1987 which, inter alia, states that "efforts should be made to involve farmers progressively in various aspects of management of irrigation systems, particularly in water distribution and collection of water rates. Assistance of voluntary agencies should be enlisted in educating the farmers in deficient water use and water management" (para 12). Also, under the Government of India's centrally sponsored command area development program, financial support in the form of a management subsidy of Rs 100 per hectare per year for the first two years and Rs 75 per ha per year for the third year is available for the formation of WUAs under selected major and medium irrigation schemes. A model Bill was circulated in 1976 by Government of India providing, inter alia, for water committees at irrigation-outlet level. However, as per the Constitution of India, irrigation and canals are among the State List subjects and thereby the concerned States are primarily responsible for the development and management of irrigation works. As such, the States' Irrigation Acts have to provide legal support for WUAs.

The survey of relevant legal provision in the existing States' Irrigation Acts shows that not all Irrigation Acts provide, explicitly and comprehensively, for people's participation in irrigation management. Even State legislation with the provisions for people's participation, provides for the same only in small community irrigation systems and such WUAs are required to function under the active control of the State irrigation departments. Thus, a serious legislative backing should be provided through suitably amended States' Irrigation Acts with built-in financial incentives, giving more flexibility to the working of WUAs more as a "village-level resources management," and to that effect legislation will have to provide for devolution of authority to WUAs. It would be worthwhile to mention here that a draft revision of the Irrigation Act was prepared by the State Government of Gujarat and was promulgated as the "Draft Gujarat Irrigation & Drainage Ordinance" with effect from 1.8.1989, but, unfortunately, it lapsed in the absence of the enactment of the said Act within [*] months by the Gujarat Legislative Assembly. The draft Act envisages delivery of water only to WUAs (formed at outlet level) or federations of WUAs and not to individuals as is the prevalent practice. Further, a landmark development for devolution of authority to the elected representatives of people has taken place in the form of the Constitutions (Seventy Third) Amendment Act passed recently by the Indian Parliament for the revitalization of Panchayats (elected body of people's representatives at village and district level).

Attitudinal Change

The role of irrigation departments should be that of a facilitator supportive of WUAs. The bureaucracy should undergo attitudinal change so that they are considered and accepted by the user farmers as their friends, philosophers and guides rather than as water lords. This will need intensive training of government staff/officials through short- and long-term training courses as well as by deputing them to the NGOs of good standing for a period of at least two years with the total expenditure towards their salaries to be borne entirely by the government. Similarly, the farmers should also be imparted with training to enable them to understand and sympathize with the daily problems of the irrigation agency in providing adequate and timely water and working within bureaucratic constraints. Also, annual agricultural fairs, discussions/debates, seminars, workshops, exhibitions, film shows, prize incentives for best performing farmers, etc., are among the essential initiatives to be taken by the statutory bodies to have better interaction with the farmers, besides helping in the creation of healthy competition among farmers for agricultural production and educating them in scientific irrigation agriculture.

Level of Participation

Experience shows that if the size of the WUAs is too small, say less than about 200 ha, the proposition may not be viable. If the size is too large say more than 500 ha, it may become non-homogenous and difficult to manage. Hence, WUAs on minors covering an area of about 300-500 ha may be most appropriate as they will cover only about one or two villages. In the case of minor irrigation projects, the size of project is usually about 500 ha and, hence, one WUA for the entire minor irrigation scheme may be sufficient.

Registration of WUAs

Another important issue is the registration of a WUA. Although it is not always necessary to register a WUA, especially at first, such registration becomes necessary for a WUA to acquire legal status enabling it to make contracts and Memorandum of Understandings, get bank loans, acquire fixed assets and, most important, to assure the members of financial responsibility in the legal sense. However, due to the tardy and comparatively complicated procedure of registration under the relevant Act, the farmers many a time get frustrated and disgusted with the whole procedure. To avert such a situation and at the same time to facilitate the purpose, "a Two Phase Registration" would be a practical remedy. Under this, the first stage is for a WUA or any sort of farmer water management grouping to be recognized by the authorized government department and on being certified to be made viable for the purpose by the appropriate field officer. The certification should take into account the purpose of such grouping/association, list of members, provision for annual meetings and the support of its farmer members. The second stage is the legal registration by the authorized government departments after a WUA is found to be viable and ready for legal registration.

Autonomy in Working of WUAs

The WUAs should have authority to fix their own water rates, collect revenues, decide on internal distribution including deciding scheduling of water, selecting a crop pattern to be adopted by all member farmers and using groundwater in the command under a legal instrument. Under the Memorandum of Understanding to be signed between the government department(s) and WUAs, the water rights should be granted to the WUAs for each crop season with in-built incentive that if during a crop season the WUA saves water by better water management, such saved water is available in addition to the sanctions for the next crop season or in hot weather seasons.

Role of Women in Farmers' Participation

Of the total agricultural labor force (which is estimated to be about 210 million on the basis of the 1991 census), women constitute nearly 50 percent of whom 37 percent are cultivators. The majority (nearly 75%) of women work force belongs to families of small (having landholdings of 1-2 ha) and marginal (having landholdings less than 1 ha) farmers. An evaluation, under the Indo-Dutch Cooperation Program on "Women in Irrigation Projects" in the States of West Bengal and Uttar Pradesh has revealed that women's contribution to agriculture is estimated to be 54-60 percent depending upon the cropping pattern and the technology involved and that taskwise women participate almost in all activities except in ploughing. The women are quite knowledgeable about various agricultural inputs and operational details. However, such a productive role of women in agriculture is unfortunately not taken into account in a systematic manner in models of farmers' participation in irrigation management in India.

Multifunctional Nature of WUAs

WUAs that have a formal structure need to have a reliable income to manage and maintain the water distribution system. If they do not raise their own income, they can hardly be sustainable. Some WUAs handle very modest sums of money, particularly in informal organizations where all maintenance except that of field channels is undertaken by the ID and the farmers just contribute labor. The objective in the turnover process is that WUAs will manage distributaries or at least minor canals, get enough additional profit from the improved management, and raise their own resources. If a WUA does not result in perhaps 20 percent additional income to the farmer, it is probably not worth his time and trouble to participate in such organization, considering the social, emotional, time and monetary costs and the WUA will not be sustainable. By definition, a successful WUA is one that the farmers find profitable above what it costs them in time and money to maintain the society. There is no exception to this. To achieve this objective, WUAs functioning after an initial stabilization period should not remain restricted only to water distribution and water rates collection but must diversify its role to become a broad based "Farmers' Organization." They can undertake commercial activities like the sale of certified seeds, fertilizers, pesticides, etc., as well as other agricultural implements, marketing, taking contracts for maintenance or repair, extending a loan facility on interest to its members, and so on and so forth, relating to village/area development and thereby accomplishing the ultimate aim of becoming an effective vehicle of "village-level resource mobilization."

Model of WUA

There is a large variety of possible ways farmers can organize themselves. These differ by States, administrative areas, irrigation projects, cultural regions, settlement patterns, crop regions, and ecological regions and according to water source and water quality. The farmers themselves have to decide locally what kind of organization they feel they can support. In each region, the most effective ways may have to be worked out in action research (where the principle should be the testing of alternatives) through existing WALMIs (Water and Land Management Institutes), as well as by building on existing social institutions in the States. Some private agencies, especially in Maharashtra and Gujarat, have done well in working through alternative models. In each case, once the farmers decide to organize, they will have to make decisions on a wide range of alternatives by which their society can function.

CONCLUSION

On the one hand, faced with constraints on the use of both land and water resources by 2025 AD and, on the other, with serious deterioration in irrigation performance during last four decades, water use planning has acquired a significant place in the Indian economic planning for sustaining the growth rate of agriculture against the rising population. Experience over the years from the world's largest irrigated area that India possesses has conclusively shown that farmers' participation should be in the center stage of the planning strategy not only to pull back from sliding down but also to place the irrigation performance at the level required to sustain the growth rate of agriculture, particularly to meet the growing demand of food grains which will be 285 million tonnes by 2007 AD against the present level of food grain production of 182.40 million tonnes. Bureaucratic attitudes of state-owned irrigation management, inherited from 190 years of British colonial rule, have not changed enough with changing needs of farmers for irrigation over the years and particularly in the wake of the present commercialization of agriculture. There are about 4,420 WUAs in various forms in the States of Andhra Pradesh, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu, Himachal Pradesh, Karnataka, Uttar Pradesh and Assam in India and the total area as presently managed by these WUAs is reported to be about 0.234 million ha which account for just 0.33 percent of the total area being presently irrigated in India. The growth of WUAs has not only been sluggish but also scattered and mainly site-specific in the sense that even in the case of successful WUAs, it has, curiously enough, not spread further to other areas or even to the adjoining blocks of the same command. Several evaluation studies, conducted to understand the working of, as well as problems faced by WUAs in India, show that major factors, if not deterrents, influencing the future of WUAs in India are comprehensive changes in laws and policies, rending legal support, mutual accountability, particularly of irrigation departments, towards WUAs as well as attitudinal changes in bureaucratic functioning, and autonomy in the working of WUAs so as to place the user-farmer in the decision maker's position for irrigation water use.

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Annex I

Yields of important crops in different countries of the world vis-a-vis of India (in kg/ha).

Country	1965			1970			1975			1980			1985			1989		
	Paddy	Wheat	Maize	Paddy	Wheat	Maize	Paddy	Wheat	Maize	Paddy	Wheat	Maize	Paddy	Wheat	Maize	Paddy	Wheat	Maize
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
India	1300	910	1000	1660	1210	1120	1858	1338	1203	2010	1436	1137	2329	1870	1146	2590	2241	1345
Pakistan	1650	860	990	1830	1180	1000	2290	1320	1296	2418	1563	1271	2350	1612	1256	2269	1865	1287
Bangladesh							1853	926		2020	1899		2170	2075		2502	1632	
Indonesia	1850		900	2040		930	2629		1187	3301		1448	3942		1774	4228		2130
Thailand	1540			1870			1825			1899			2061					
China	NA	NA	2200	NA	NA	2900	3507	1367	2990	4200	1878	4038	5263	2937	3607	5537	3054	3720
Japan	4950			5640			6187			5128	-		6225					
Philippines	1310		660	1780		980	1721		863	2338		950	2663		1100	2705		1296
UK		4070			4130			4334			5878						6600	
Italy	4020	2280	3230	4730	2230	4350	5806	2711	5938	5385	2687	6836	6052	2789	6889	5577	2510	7749
USSR	4770	850	2530	5100	1440	2830	5826	1068	2763	4946	1597	3176	3833	1553	3214	3861	1900	3552
USA	2640	1790	4630	3640	2090	4500	4019	2057	5420	4191	2249	5711	6068	2519	7407	6444	2203	7023
Canada		1540	5010		1790	5290		1800	5740		1725	5671		1766	6204		1788	6309
Mexico			1120			1200			1264			1780			1861			1678
Brazil	1640		1380	1640		1470	1428		1562	1570			1898			2106		
Argentina		1320	1680		1250	2330		1626	2508		1549	2570		2627	3563		1847	2803
Egypt	5033	2640	4070	5430	2770	3730	5480	3472	3617	5755	3225	4038	5948	3759	4601	6490	4997	5816
Syria		860			470			916			1536			1355			1171	

Annex II

Fertilizer Consumption in India and Global Comparison (in kg/ha).

Country	1963-64				1969-70				1974-75			
	N	P	K	Total	N	P	K	Total	N	P	K	Total
1	2	3	4	5	6	7	8	9	10	11	12	13
India	2.62	0.75	0.31	3.68	6.15	1.45	0.92	8.52	10.70	2.90	2.10	15.70
Pakistan	4.31	0.42	0.23	4.96	11.28	1.76	0.88	13.92	18.50	2.10	0.10	20.70
Bangladesh									9.10	3.90	1.20	14.20
China									30.20	10.10	4.30	44.60
Japan	119.60	81.63	96.45	297.68	160.09	123.04	123.15	406.28	123.00	123.30	128.50	374.80
Philippines	4.29	2.23	2.86	9.38	8.29	7.49	4.41	20.19	17.20	4.60	5.80	27.60
Asia Average	5.77	2.86	2.34	10.97	10.96	4.97	3.68	19.61	19.60	8.00	4.70	32.30
U.K.	82.16	62.03	61.33	205.52	89.46	63.41	63.56	216.43	128.40	62.30	66.30	257.00
Italy	24.33	23.71	8.49	56.53	36.69	32.41	12.97	82.07	54.70	30.00	18.80	103.50
Germany	88.52	89.62	133.47	311.61	132.68	104.80	137.03	374.51	148.60	108.50	144.90	402.00
Sweden	39.67	32.70	27.74	100.11	67.14	45.55	42.16	154.85	77.80	43.70	38.60	160.10
Netherlands	293.22	122.26	148.38	563.86	431.85	120.71	138.06	690.62	516.10	108.50	131.90	756.50
Poland	19.79	15.58	22.13	57.50	51.52	39.13	68.48	159.13	76.00	58.90	95.70	230.60
Europe Average	35.07	34.47	34.93	104.47	61.30	49.30	47.74	158.34	78.40	55.60	57.20	191.20
USSR	5.91	4.21	3.92	14.04	16.29	8.22	9.94	34.45	29.00	13.90	15.90	58.80
USA	21.75	16.11	13.73	51.59	38.35	23.49	20.75	82.59	37.70	19.70	19.40	76.80
Canada	2.95	5.38	2.70	11.03	5.64	7.37	4.38	17.39	11.80	11.20	5.30	28.30
Mexico									23.90	8.10	1.60	33.60
North America Average	17.66	13.28	10.78	41.72	30.65	18.84	16.39	65.88	32.40	17.20	15.60	65.20
Chile	6.22	9.65	2.28	18.15	19.37	4.43	32.89	9.10	17.40	17.40	2.60	29.10
Peru	39.55	18.38	63.00	25.29	3.82	1.37	30.48	30.48	39.50	4.50	4.30	48.30
Latin America Average	3.47	2.93	1.73	8.13	4.75	5.38	3.58	13.71	8.50	11.10	6.80	26.40
Egypt									126.10	22.80	1.90	150.80
South Africa	5.86	12.47	3.23	21.56	12.44	21.68	7.40	41.52	30.30	6.30	16.00	52.60
Africa Average	1.65	1.18	0.51	3.34	3.45	2.56	1.17	7.18	5.10	3.30	1.30	9.70

Annex II (Continued)

Country	1979-80				1986-87				1988-89			
	N	P	K	Total	N	P	K	Total	N	P	K	Total
1	14	15	16	17	18	19	20	21	22	23	24	25
India	20.40	6.00	3.20	29.60	38.70	13.20	5.10	57.00	42.80	16.20	6.30	65.30
Pakistan	40.00	11.40	0.50	51.90	66.40	19.80	2.10	86.30	63.40	18.70	1.20	83.30
Bangladesh	28.40	13.00	3.20	44.60	46.20	16.80	4.40	67.40	59.50	20.60	6.10	86.30
China	106.20	19.70	3.00	128.90	137.80	31.10	7.30	176.20	191.60	53.40	17.00	262.00
Japan	158.30	169.30	150.00	477.60	145.20	156.40	125.50	427.10	136.70	155.10	123.30	415.10
Philippines	22.90	5.20	6.40	34.50	30.90	5.80	5.80	42.50	46.70	9.70	6.90	63.30
Asia Average	43.00	13.20	5.30	61.50	62.90	20.50	7.50	90.90	77.30	27.00	10.40	114.70
U.K.	190.20	66.20	66.70	323.10	238.00	63.50	78.20	379.70	209.20	62.00	74.60	345.80
Italy	88.90	66.80	33.50	189.20	82.90	54.80	31.50	169.20	76.10	58.90	37.20	172.20
Germany	196.60	121.50	169.50	487.60	211.50	91.60	124.80	427.90	206.30	86.20	118.80	411.30
Sweden	85.60	43.20	40.60	169.40	81.10	26.60	28.90	136.60	77.60	24.70	25.10	127.40
Netherlands	564.00	97.50	143.50	805.00	556.90	96.80	115.90	769.60	467.20	81.60	101.00	649.80
Poland	88.40	63.60	66.30	218.30	23.00	52.10	79.60	224.10	102.90	63.90	78.50	245.30
Europe Average	193.10	65.70	59.00	318.70	18.67	56.90	61.30	230.80	11.70	55.80	60.80	229.30
USSR	32.20	23.60	19.00	74.80	49.40	36.00	28.70	114.10	49.90	36.80	30.30	117.00
USA	54.90	26.00	29.70	110.60	49.40	19.20	23.20	91.80	50.80	19.70	23.10	93.60
Canada	18.20	14.10	8.70	41.00	25.00	14.00	8.50	47.50	25.80	13.40	7.80	47.00
Mexico	35.60	11.00	2.60	49.20	53.50	16.60	3.70	73.80	51.40	16.00	3.80	71.20
North America Average	46.50	22.10	23.40	92.00	45.80	17.80	19.10	82.70	46.70	18.10	18.90	83.70
Chile	9.70	12.60	2.30	24.60	19.80	17.50	2.70	40.00	36.70	31.90	5.70	74.30
Peru	25.10	4.30	2.70	32.10	23.10	5.00	3.20	31.30	41.30	10.60	5.90	57.80
Latin America Average	10.60	16.60	10.20	37.40	13.00	15.60	11.10	39.70	13.10	15.20	12.80	41.10
Egypt	175.60	34.20	2.40	212.20	259.30	48.10	11.90	319.30	309.40	78.90	11.90	400.20
South Africa	27.50	28.20	8.70	64.40	27.50	25.50	9.10	62.10	28.90	23.40	10.40	62.70
Africa Average	8.30	5.30	2.00	15.60								

Annex III

Statewise and yearwise percentage recovery of working expenses through gross receipts in Irrigation and Multipurpose river projects.

Sl. No.	Name of the States	1974-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Andhra Pradesh	15.5	16.9	7.5	7.7	8.7	7.6	7.0	6.6	6.8	120.2	21.8	26.9	10.0	7.7	1.1
2	Bihar	72.5	94.4	61.2	74.0	39.5	47.4	63.2	39.8	49.3	58.4	29.8	29.3	15.1	19.6	12.1
3	Gujarat	71.1	94.3	84.1	90.6	71.3	70.6	34.4	16.0	30.8	35.7	35.4	25.8	44.6	6.5	5.7
4	Haryana	55.3	77.9	86.6	69.4	66.2	55.2	64.4	57.5	43.5	42.9	37.7	46.8	57.0	9.1	16.6
5	Jammu & Kashmir	6.0	2.0	3.2	4.1	3.1	2.2	1.8	1.5	1.9	0.6	5.8	8.0	13.7	4.9	7.1
6	Karnataka	97.6	129.2	20.8	76.4	95.5	85.9	7.6	77.3	33.2	50.9	29.7	6.8	38.7	10.1	10.3
7	Kerala	51.2	69.6	50.8	135.9	58.7	139.2	49.5	24.4	32.0	82.9	37.8	24.9	16.5	6.3	11.8
8	Madhya Pradesh	129.3	539.9	*	*	1401.8	*	45.5	30.7	39.8	44.8	30.2	41.8	33.3	31.8	35.1
9	Maharashtra	166.0	134.4	98.8	97.2	79.8	93.5	93.8	94.1	78.7	61.1	47.3	48.9	43.3	5.9	5.2
10	Orissa	30.7	86.4	71.9	75.7	60.9	46.3	46.8	69.8	79.3	95.0	64.3	134.9	209.0	45.8	46.2
11	Punjab	63.2	113.4	106.7	106.5	92.3	81.8	73.8	69.3	26.6	50.0	81.5	48.3	51.5	21.0	25.5
12	Rajasthan	49.6	104.9	105.7	57.0	65.5	66.0	55.9	46.5	51.2	43.7	43.6	19.3	16.1	11.3	9.7
13	Tamil Nadu	22.5	9.9	8.6	6.9	5.3	6.4	15.6	2.5	11.0	6.4	7.7	6.8	4.3	1.9	2.0
14	Uttar Pradesh	123.3	184.9	286.4	201.7	218.2	187.7	134.4	152.7	111.7	186.9	48.4	169.8	48.8	6.8	10.0
15	West Bengal	38.2	46.8	35.0	31.5	11.2	20.8	11.0	8.1	16.5	13.1	8.8	7.3	4.6	3.8	3.6
	ALL INDIA	64.2	91.1	92.9	76.2	69.6	71.7	45.8	45.3	49.3	60.3	38.8	46.0	34.1	9.9	7.8

Source: Combined Finance and Revenue Accounts of the Union and State Governments in India.

Remarks 1. Due to more credits in irrigation projects (Non-Commercial) which resulted in negative working expenses, such figures are not given.

2. Working expenses for the years 1987-88 and 1988-89 are inclusive of interest on capital at the end of the year.

Direction and administration as percentage of working expenses of major and medium projects (1974-75 to 1986-87).

S. No.	State	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Andhra Pradesh	21	20	5	18	22	18	59	62	46	42	33	52	59
2	Bihar	52	44	53	49	56	59	55	64	64	67	69	68	70
3	Gujarat	24	28	29	29	27	29	25	7	26	39	40	47	45
4	Haryana	22	23	24	24	21	19	24	20	26	37	20	35	27
5	Jammu & Kashmir	36	25	20	27	19	18	14	13	19	13	16	9	5
6	Karnataka	8	23	15	14	13	12	2	20	18	28	11	7	36
7	Kerala	23		56	29	7	32	26	39	61	58	68	84	73
8	Madhya Pradesh				100	100	100	100	100	100	100	100	100	100
9	Maharashtra	49	50	46	42	50	49	54	52	54	50	54	54	55
10	Orissa	10	9	11	11	7	6	6	14	9	11	33	8	8
11	Punjab	67	70	60	59	62	61	67	56	65	60	64	63	68
12	Rajasthan	42	36	19	21	12	21	36	33	30	29	24	8	15
13	Tamil Nadu	13	14	23	11	13	28	27	10	38	8	37	35	19
14	Uttar Pradesh	46	42	38	42	33	28	28	33	38	27	15	43	47
15	West Bengal	11	5	83	1	75	91	11	8	88	86	73	78	86
	ALL INDIA	34	32	30	30	30	31	26	28	41	37	32	33	43

Source: Central Water Commission (Statistics Directorate).

Annex V

Maintenance and repairs as percentage of working expenses as major and medium irrigation projects during 1974-75 to 1986-87.

S. No.	State	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Andhra Pradesh	66	73	84	68	73	76	71	72	49	55	62	64	63
2	Bihar	40	52	47	48	40	38	41	45	35	32	31	32	30
3	Gujarat	53	52	59	41	54	61	48	11	40	47	44	39	38
4	Haryana			76	75		81	76	80	74	63	79	64	72
5	Jammu & Kashmir	36	46	50	55	47	60	55	55	59	62	34	38	40
6	Karnataka	91	73	84	84	85	86	14	80	81	70	87		
7	Kerala	53	69	21	41	42	34	34	28	19	17	17	15	12
8	Madhya Pradesh	No expenditure reported for maintenance and repairs												
9	Maharashtra	43	49	48	46	36	36	40	36	34	38	43	38	37
10	Orissa	52	51	56	60	67	73	78	84	85	87	54	90	84
11	Punjab	28	36	39	32	47	43	47	38	50	42	37	44	34
12	Rajasthan	46	52	61	58	71	38	41	42	44	40	45	19	14
13	Tamil Nadu	81	78	71	51	37	50	58	17	76	19	60	45	37
14	Uttar Pradesh	43	60	64	55	59	58	66	62	54	71	24	14	44
15	West Bengal	No expenditure reported for maintenance and repairs												
	ALL INDIA	46	51	63	57	51	58	43	41	52	46	46	22	36

Source: Central Water Commission (Statistics Directors).