SUSTAINABILITY OF PARTICIPATORY IRRIGATION MANAGEMENT: A REVIEW OF CONCEPTS AND PERSPECTIVES

By

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Abstract

The concern with participation in irrigation system development and management is a popular concept that emerged after the 1980s among development planners, politicians and the scientists. It has been seen as an essential ingredient to implement free market economic policies. Although there is a large volume of literature available on participatory irrigation development and management, there is still an unclear picture on its sustainable aspects. However, it is essential to have a clear understanding of the factors, which impede the sustainability of this system management in order to promote, guide and make necessary alterations of this development process. The paper broadly discusses the multiple and interrelated factors affecting the sustainability of participatory irrigation management and issues need to be considered.

1. Introduction

Beneficiary participation in the development projects has been seen as a vital component of the structural adjustment programme. It is an extension of worldwide enthusiasm for privatization of services and empowerment (Vermillion, 1991). Participation is an essential ingredient to implement market friendly policies, a supportive and flexible public sector and a discreet mix of de-bureaucratization, decentralization and deregulation (Piccioto, 1992). The various governments, international agencies and the NGO's have made heavy capital investments and efforts in the process of establishing grassroots level organizations or strengthening existing organizations and mobilizing beneficiaries towards development projects.

The concept of participation was limited to political participation in the 1950s and it was not really relevant to development in most parts of the world, though peoples' participation was a remarkable feature in Sri Lanka even during the time of ancient kings. The development approach in the 1960s was based on the typical neo-classical model that relies on a production function, which relates output to the amount of capital and labour employed. The capital-intensive pattern of development has done little to achieve the fundamental objective of development-poverty reduction (Piccioto, 1992). Under the neo-classical model, peoples' participation was measured in terms of taxes, the level of production for domestic consumption and export, saving and investment etc. which gives very little space for active peoples' participation (Cohen and Uphoff, 1980). The new growth economics incorporates human capital and technical know-how as distinct factors of production which recognize the role of people, knowledge and ideas in the development process and inviting non-economists to trespass into the area of development economics.

To create legitimate participation of intended beneficiaries in a project, firstly beneficiaries should get an opportunity to play a significant role in decision making which

must go beyond mere consultation. Secondly, evolution of an appropriate form of local organization is necessary to use as a vehicle for participation. Thirdly, timing of beneficiary involvement must be right from the initial stage of the project to get most effective participation (FAO 1980).

There is a growing uneasiness among irrigation researchers, policy planners, politicians and donors of the gap between potential and actual performance in the irrigation projects (e.g. Chambers,1977; Carruthers,1983). Several reasons have been forwarded for the cause of problem. The research findings show that the primary or fundamental problem of irrigation performance is not engineering, but the formation and functioning of effective user organization (Merrey, 1979; Freeman and Lowdermilk, 1986; Uphoff, 1986).

According to Cohen and Uphoff (1980), there are four kinds of participation within the context of irrigation water management, namely participation in decision making, implementation, benefits and evaluation. The stage of participation in decision making has lasted for a couple of decades in the irrigation sector. It is now the 'period of implementation', where Water Users Associations (WUAs) in irrigation systems have to involve actively in system management and programme activities. This has led to the more complete concept of irrigation management turnover (IMT)[1]

There are historical evidences of farmer involvements in construction, management and maintenance of small-scale irrigation systems in Asia. Eighty percent of the total irrigated area in Nepal, about 15,000 minor tanks in Sri Lanka and 5,500 irrigation systems in the Philippines are traditionally managed by farmers (Siy, 1989). However, management transfer of large-scale irrigation systems from bureaucracy to people is a relatively new concept. Numerous researchers, have emphasized the importance of farmer participation in irrigation system development and maintenance, towards the realization of the potential performance in irrigaiton development.

2. Sociology of Farmer Participation

McPherson and McGarry (1987; quoted in Smout, 1990) define participation as the inclusion of the intended beneficiaries in the solving of their problems. Cohen and Uphoff (1980) define the term 'Development Participation' as "a concept which denotes the involvement of a significant number of people in situations or actions which enhance their well being, for example, their income, security, self esteem". Piccioto (1992) offers a broader definition for participatory development that, "participation is the sum of the human transactions which take place voluntarily in a society aiming to achieve sustainable and equitable economic growth". The definition itself implies transparency in the process of participation as well as accountability for its outcome.

Wade (1987) observed that the performance of large publicly operated canal systems in most parts of the sub continent is poor and contends that institutional and managerial measures are necessary to improve the situations. Merrey (1979) encountered from Pakistan that inadequate and inappropriate organizational arrangements among water users were the major constraints hampering irrigation system performance.

Lowdermilk (1986) focuses the problem of irrigation development and management very correctly. He describes the situation as: "Engineering is not the fundamental problem underlying irrigation development in the LDC's. Engineering principles are

[1] Irrigation management turnover has been variously referred as "turn over" (Indonesia and Philippines), "management transfer" (Mexico and Turkey), "privatisation" (Bangladesh), "disengagement" (Senegal), "post responsibility system" (China), "participatory management" (India and Sri Lanka), "commercialisation" (Nigeria), and "self management" (Niger), (Geijer *et-al*, 1995)

known and can be adapted, but the major problem, however, is to discover ways to utilize farm clients more effectively in operation and maintenance and development programmes which will create rural transformation. Rural transformation essentially requires changes in farmers' behaviour, motivations and expectations, which is hardly possible until institutions exist to provide them with improved production possibilities and incentives..." This statement highlights the essence of farmer participation in irrigation development and management and emphasizes the requirement of community-based organizations and necessary economics of farmer participation.

3. Economics of Participation in Irrigation Management

Beneficiary participation in irrigation system planning, designing, construction and management has costs and benefits for both the farmers and the government. It is said, "active farmer involvement is cost effective in terms of mobilization of local resources, improvement and maintenance activities, reduction of irrigation staff time, provision of local wisdom for better design and planning of the systems, reduction in the destruction of facilities, improved fee and fine collection, resolution of disputes and provision of an organized means for extension and farmer training" (Lowdermilk, 1986). This will also contribute to greater community cohesion and empowerment, which could be utilized effectively for other development activities as well.

The question is why a farmer should participate in irrigation system management spending his/her time and resources and collaborate with his/her fellow farmers to form a WUA? He/she may not be keen on saving agency staff time and state resources, collection of state revenue or resolution of disputes. He/she will think in a rational way about the benefits to be accrued personally through saving water, the costs he/she will have to share for the collective action and the tangible benefits gained from the costs incurred and so on. The major direct benefits to the farmers from participation are improved efficiency and standard of water delivery series in terms of adequacy, timeliness and reliability. The main indirect benefit is the development of local capacity and organizational abilities that could be utilized to diversify their enterprises and increase skill to deal and bargain with government agencies. He/she would actively participate in a project, if the costs incurred are lower than the value of the benefit he/she is likely to get. Therefore, economics of participation is a crucial aspect in any participatory development project.

Piccioto (1992) viewed the economics of participation from the perspective of the production function. The output of a production function depends on various factors, including labour and resources spent in participation. He explains the model assuming a simplified model involving a community/farmer who has a fixed amount of labour time to be allocated between two activities. To achieve maximization, the marginal product of labour in the two activities should be equal. If we apply this theory to a participatory irrigation management project, the two activities could be allocation of labour time for participation in the irrigation maintenance and WUA activities or direct production activities. If the productivity of labour in direct production activities goes up, the time spent in participation would, other things being equal, go down. i.e.; the efficiency of participation need to be enhanced to justify the maintenance of existing participation levels[2].

Different kinds of production function yield different outcomes and the value of participation is likely to be different depending on the shape of the marginal cost curve for participation. For example, Uphoff *et.al* (1990) found that farmers' net benefits

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[2] This argument however, ignores any complementary relationship between the two

from participation in water management are likely to be greatest over a middle range with regard to water availability. At extremes of water surplus, it is not economical to make an effort in organizing WUAs since all farmers are receiving adequate amount of water and with scarcity it is more likely to lead to conflicts and have more costs than benefits. Therefore, users will have little or no incentive to participate in water management activities at either extreme of water availability. Water availability is only one of the factors affecting the economics of participation.

There are several costs to be incurred by government agencies when initiating the participatory development through the formation of WUAs. Under this list of costs, there may be several activities including conduct of action research about a field situation for a socio-technical profile, mobilizing field staff, fielding Institutional Organizers (Catalysts), and organizing and providing necessary training to the WUAs as well as to the officers. In the Philippines, the research observations show that financial benefits obtained from making investment in the institutional activities were substantial compared to the cost involved (Reyes and Jopillo, 1989). In Sri Lanka, the capital output ratio[3] of software development in the Gal-Oya water management project was estimated as 1:1.5, which is well above that of most development investment. These calculations do not include intangible benefits like reduced damage to the irrigation structures, increased yields in the tail end, reduced conflicts over water and contribution of farmers to the rehabilitation process (Wijayarathne, 1985).

Costs are usually definite and certain, whereas the benefits from participation are often ambiguous and uncertain, especially determining the amount of net benefit is extremely difficult. Uphoff *et.al* (1990) writes that, "*more than economic gains need to be weighed; social, cultural, political, psychological and other benefits should be considered in any calculation. And assuming costs is not easy either, even when using economist's standard of market prices....*". They argue that the extent of collective action is seldom explained by purely material considerations.

Therefore, there are obvious benefits for both the government and the beneficiary farmers from well organized and coordinated participatory development programmes. The success is dependent on the degree, time and ways of beneficiary participation. Therefore, governments should use appropriate strategy and necessary incentives to get the participation before the WUAs are formed by direction or persuasion. Nevertheless, universal IMT experiences show mixed results in terms of rate of success and the sustainability of the programme (Geijer *et.al*, 1995). Therefore, the sustainability of PIM is one of the key issues need to be addressed to realize the potential benefits of irrigation development.

4. Sustainability of Participatory Irrigation Management

Participation of water users in decision-making in connection with the irrigation reservoir from where they draw water, is one of the key concepts of sustainable development. Abernethy (n.d.) notes that, "...when we speak of sustainability as a kind of short hand or key word in the irrigation management context, we are implying the search for some set of policies and practices under which we will feel confident that the system should continue to exist and function..."

According to the available literature on IMT experiences the world over, the sustainability of a Participatory Irrigation Management (PIM) Program basically depends on the water users activities, control structure and of organizational activities (Figure 1).

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3 This is a ratio, which indicates the productivity of capital in an investment. Higher ratio is an indication of higher output

The performances of theses activities are determined by the following factors (Aheeyar, 1996):

1. Sustainability of the Water User's Association (WUA).
2. Bureaucratic Re-orientation and political will for PIM.
3. Physical condition of the turned over irrigation infrastructure
4. Economics of irrigated agriculture

4.1 Sustainability of the Water User's Association

The vital importance of organizations in irrigation system management has been emphasized by numerous authors (Korten, 1989; Reyes and Jopillo, 1989). They all argued that development of sustainable irrigation organizations is the key feature for the development of sustainable irrigation systems. The basic incentive for farmers' motivation to involve in sustainable collective action is based on the WUAs performance in water management, operation and maintenance (O&M) and organizational management activities (Uphoff, 1986) as summarized in figure 1. Coward (1980) highlights water allocation, conflict management and physical maintenance activities as fundamental tasks of irrigation system management. He points out that these tasks are facilitated by basic concepts of rules, roles and groups.

The real and tangible benefit or reward of collective water management activities is real control over water (Hunt, 1989; Geijer *et.al*, 1995). The implication is that there must be reasonably high performance in irrigation system management activities in order to get sustainable farmer participation, in which farmers can realize, the real tangible benefit of the organization. Uphoff (1986) argues that, farmer participation will be useful and more sustainable to the extent that it is contributing to the achievement of objectives which farmers themselves value. He identifies adequacy, reliability, and timeliness in the supply of water, decreased cost and difficulty, in acquisition of water, and reduced conflicts in water use as the incentives for participation the users and the officials must have rapid access to resolve conflicts effectively among the users and between the users and the officials. This is indispensable for the organizational sustainability (Ostram and Benjamin, 1991).

In order to get the above benefits/performance as mentioned by Uphoff (1986), WUA should perform well in the aspects of control structure management such as design and construction, operation of structures and maintenance of structures; organizational management activities such as decision making, resource mobilization and management, two way communication and conflict management; and water management activities such as acquisition of water, allocation of water distribution of water, and drainage of water.

The research observation and past experiences show that WUAs should be developed based on hydrological boundaries, not on a village base or other administrative boundaries (Uphoff n.d.). This may facilitate the increased cohesiveness among the water users, because they have a common interest in the O&M of the irrigation system in which they have to share the water from a common facility regardless of their location in the water course. This is vital to minimize conflicts and mistrust and to increase the loyalty among the users. The benefits of the collective action would be contained within the group.

One of the important factors which determine the sustainability of WUAs is the institutionalization of the learning process of institutional building through a planned in-

tervention (Wijayarathne, 1992). The government should use a strong and appropriate intervention strategy to develop the institution right from the design and construction of the irrigation system. In Indonesia, management turn over in irrigation schemes is most likely to succeed if at the initial stage, the farmers are involved in design and construction of irrigation system improvements (Bruns and Atamanto, 1992). Therefore, development of WUAs and turn over of management responsibilities to farmers only to reduce the government recurrent cost is not a viable option. Various types of full time and part time Institutional Organizers (Catalysts) have been used for the mobilization of farmers and development of user organizations. Wijayarathne (1992) emphasizes that, "such a catalytic effort should be strong enough to generate the internal dynamism of the community and controlled enough not to dominate it". This was the approach in building Farmers Organizations (FOs) in Gal-Oya, Sri Lanka (Uphoff, 1986) and by the National Irrigation Administration (NIA) in the Philippines (Reyes and Jopillo, 1989) which are recognized as successful institutional building efforts in the recent past.

The participation of all members in the process of decision making, group activities and resource mobilization is vital for the sustainability of the organization. This is mentioned in Bottrall (1985) as, "*for effective co-operation, all the farmers in a particular water course must be members of the organization and abide by its rules. No one can opt out. As in all forms of co-op organizations, failure by any individual to co-operate with his/her neighbours will have the effect of undermining discipline and morale on which the associations development depends....*". A key element for the success in the indigenous Farmer Managed Irrigation Systems (FMIS) as described by Siy (1989) is the mobilization of members' contribution on a regular and equitable basis among all the members.

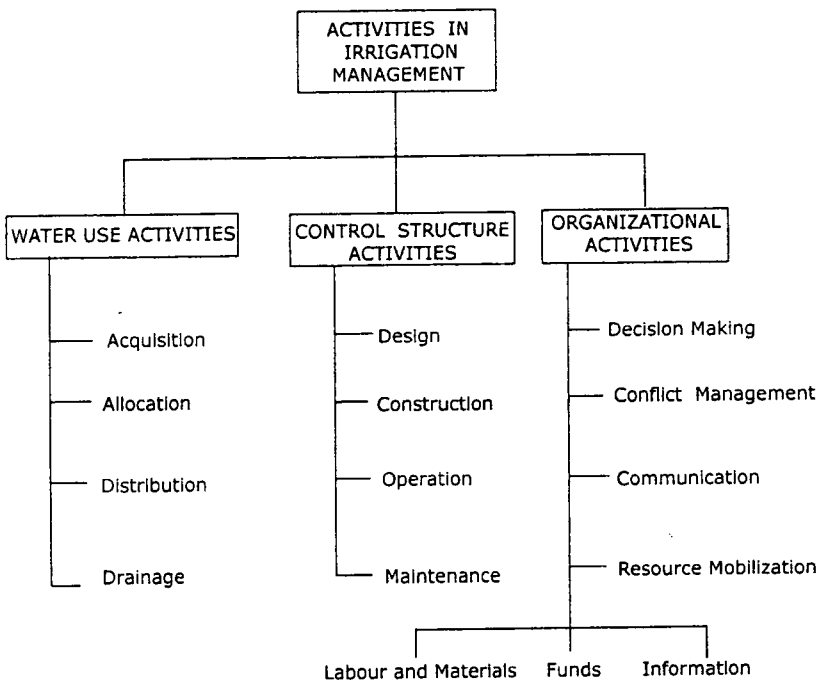
Size of the organization is an important factor affecting sustainability that varies with the layout of the irrigation system, the technology used and the socio-economic variables (Cernea and Meinzen-Dick, 1994). The size in the sense it includes the size of the organization, command area and the members of membership. There is no blue print organizational size to fit all the irrigation projects. The larger units of organizations able to aggregate greater amount of resources (labour, money, information) and the requirements of per capita resource mobilization are likely to be less (Uphoff, 1986). Uphoff writes that such organizations are however, more susceptible to the negative effects of opportunism, and feelings of solidarity and mutual responsibility will be weakened by the personal relationship. Moreover, the costs of maintaining an organization for decision making, communication and conflict resolution will increase with the size of an organization (Uphoff, 1986; Cernea and Meinzen-Dick, 1994). Uphoff (1986) and Coward (1980) conclude that fairly small units are more feasible in terms of cost of organization, effective water delivery and system maintenance, preparation of cropping calendar and plant protection etc. The group should be, however, large enough to accomplish the distinguished tasks by collective action.

Water users in an irrigation system are interdependent for water and its management process within a water course and between the water courses. Water wanted in one part of the system might deprive farmers in the other parts. It has been emphasized by several authors of the significance of having federated or system level nested organizations with effective horizontal and vertical linkages (Ostram and Benjamin, 1991; Wijayarathne, 1992; Cernea and Meinzen-Dick, 1994). Wijayarathne (1992) writes that, federated organizations are useful to develop the new skills to enhance the collective bargaining power and to undertake business-oriented activities with economies of scale. This may help to reduce, avoid or remove the outside pressure such as political threat.

To develop and manage a strong viable and functional user organization, it is vital to have strong, sincere and visionary leaders with a long term programme (Uphoff, 1986; Balltista *et.al*, 1994). The leaders must have the capability to carry out managerial and organizational tasks such as planning, decision making, resource mobilization and management, communication and conflict management. They should have special skills and experience in water management and a strong commitment. Instead Coward (1980) identifies three elements as the basis of the accountability model of irrigation leadership; - small scale, local selection and direct compensation by the organization. Leaders often serve for long time; they nevertheless are subject to review and replacement. The choice is always based on their proven capability rather than their wealth or status.

The accountability of the organization is necessary to shape their performance in the direction acceptable to the irrigation group. As mentioned by Cernea and Meinzen-Dick (1994), accountability of an organization to the entire memberships not just a subset of farmers, is the most crucial principle for long-term viability. Otherwise one cannot expect the farmers' participation by providing their resources, and the organization will be weak without active member participation. Accounting skills, financial control and auditing are some of the necessary skills required for the organization. Since farmers are understandably reluctant to part with their money and suspicious about what will happen to it, the organization must follow systematic procedures in financial management and be accountable to the members (Smout, 1990).

Figure 1: Activities of Farmer Organizations in Irrigation Management



Adopted from Uphoff (1986)

There is emphasis from social science researchers that irrigation based WUAs should take water management as a base function, but it is necessary to diversify the organizational activity (Uphoff n.d.; Wijayarathne, 1992; Turral, 1995; Helmi, 1996). The WUAs can involve in the provision of services to the farmers such as the provision of

agrochemical, fertilizer, seed materials, credit etc. and undertake maintenance and rehabilitation contracts from the line agency, livestock enterprises and fisheries, marketing of agricultural products, operation of farm machinery and so on. The provision of multiple services would in theory strengthen the WUAs and assist in their sustainability through the buildup of necessary finance to manage the irrigation system as well as the organization (Turral, 1995). Therefore, other things being equal, the quality of performance of local organizations appears to be somewhat greater for multi-functional organizations (Uphoff, 1986).

The government commitment, political will, formal supports towards organizational development and farmer's self-management and legal backing are necessary conditions for the sustainability of WUAs (Wijayarathne, 1992; Restrepo and Vermillion, 1994). Opportunistic behavior of users in the irrigation system management was one of the main factors, which caused failure in the past initiatives of organizational development (Carruthers and Morrison, 1994). There are three types of opportunistic activities namely free riding, rent seeking and corruption behavior (Ostram, 1990). These activities validate the argument on the importance of having a well-crafted institutional set-up to reduce the scope for opportunism.

Having a clear legal entity and effective sanctions against rule breakers can substantially reduce opportunistic behavior (Uphoff, 1986; Korten and Siy, 1989; Lonsway and Amadou, 1994 and Balltista *et.al*, 1994). The government has to create necessary conditions and suitable legal reforms to enforce sanctions against the opportunistic farmers. In the Philippines, legal recognition of irrigators' association was a precondition for their active collaboration with the government in irrigation development (Korten and Siy, 1989). Lonsway and Amadou (1994) view that one of the reasons for the non-realization of viable self management of irrigation system by the WUAs in Niger is non-implementation of prescribed sanctions which provokes a laxity of discipline on the system. The legal framework should be strong and transparent which provides farmer's rights and benefits as well as duties and responsibilities (Meinzen-Dick et-al, 1995).

From the light of the above analysis it is clearly evident that the evaluation of the sustainability of the WUAs is a difficult aspect. It is dependent on the various multiple factors, which are ambiguous and interrelated with each other. Different authors have proposed different indicators and frameworks for such an analysis.

Razaak (1992) observes that, the WUA programme implemented in the Gal Oya water management programme in Sri Lanka showed a cyclical evaluation with the rise of performance in the initial phase and thereafter a decline in performance. He has found four major reasons for the success and failure of this institutional building effort.

1. Degree of catalyst support for promoting local organization.
2. The political capacity of farmers to maintain autonomy of their WUA.
3. The amount of benefit offered to membership by the local organization.
4. The degree of co-operation of system managers with local organizational activities.

Carruthers *et.al* (1985) mentioned the factors, which complicate the development process of the Water Users Associations (WUAs).

1. The roles and expected objectives of the associations are inconsistent with each other or unfocussed.
2. The responsibilities of the association might be too trivial or undesirable to generate farmer commitment.

3. Farmers may be too heterogeneous or too large to function.
4. Technical capability of farmers may not be sufficient to pursue their duties.
5. Farmer leadership may be weak, inexperienced or faction ridden.

In addition to the above factors which lead to weaknesses among the farmers, Carruthers *et.al* (1985) write that there may be a question of sharing of power and information between officials and farmers.

Sustainable organizations have the following criteria as described by Ostram and Benjamin (1991):

1. Clear boundaries for service area and water right.
2. Fair proportioning between the benefit received and the contribution made by each irrigator member.
3. Collective decision making arrangements.
4. Accountable monitoring.
5. Graduated sanctions against rule violators.
6. Conflict resolution mechanisms.
7. Governmental recognition of the irrigators' right to organize.
8. Nested Organizations.

According to Carruthers and Morrison (1994), there are five reasons, which caused the failure in the WUA programme in the past initiatives:

1. Opportunistic activities of farmers.
2. Inequitable water distribution and benefit through collective action between head and tail end of the system
3. Use of farmer or paid labour for the collective action depending on the opportunity costs in other farm activities.
4. Imposition of organization by donors or governments.
5. Neglect of farmer involvement at the planning stage.

4.2 Bureaucratic Re-orientation and Support.

The water user participation in decision-making and water allocation is not sufficient for effective irrigation system management (Chambers, 1977). He argues that, it requires a well-disciplined organization at the top level, which is responsible for executing, policing the system and persecuting delinquencies. The core of his argument is the critical requirement of Bureaucratic Re-Orientation (BRO) and agency support for the sustainable participatory irrigation system management.

Indigenous systems had often been operated and maintained without any government support. The technologies of the physical system of the Farmer Managed Irrigation Systems (FMIS) were very simple. The publicly operated canal irrigation systems are however, often very large and technologically very complicated. These physical factors and other socio-cultural factors of modern society hinder the full self-management of the systems by the farmers alone. The situation obligates the continuous support of the bureaucracy in the irrigation system management. Under the current IMT programme, main system management is the responsibility of the bureaucracy. Therefore as Wijayarathne (1992) pointed out, closing the gap between the bureaucracy and the poor, poses formidable requirements for the re-orientation of the organizational structure and management systems of a large public bureaucracy.

Therefore, for a successful participatory irrigation management, there must be a strong commitment from the agency and the need to share knowledge, information and authority with the farmers. Moreover they must fulfill their role in the system manage-

ment. The weaknesses in the maintenance and water distribution at the main system level have a significant effect on farmers' ability to manage water at the farm level. The main system management is canal irrigation's 'blind spot.' An irrigation system as a socio technical profile requires more than just farmer involvement. The involvement of farmers in the system management will not be fruitful unless the main system management is effective and responsive to farmers' needs (Bottrall, 1985; Uphoff, 1986). Therefore the government has to allocate sufficient funds for proper O&M of the main system without curtailing the allocations due to budgetary constraints. Smout (1990) writes as ".... Participation is difficult, but if done properly from the outset it results in a better-designed and sustainable scheme. The key is for the agency to commit itself to making participation work".

4.3 Economics of Irrigated Agriculture

Economics of irrigated agriculture provides incentive for care and management of irrigation facilities. As Korten (1989) correctly pointed out, the key performance measure of irrigation management is willingness of the farmers to pay (WTP) for the irrigation services. The basic factor affecting the level of WTP for O&M of irrigation system is the profit margin obtained from irrigated agriculture. Profit margin also determines the farmers' capacity to mobilize resources for the sustainable maintenance, which requires mobilization of adequate resources including cash and kind (Aheeyar, 1999). The findings of an assessment of a participatory irrigation management package adopted in Mahaweli H areas of Sri Lanka shows that, introduction of PIM with clear arrangements for the roles and responsibilities for both the farmers and the line agency has yielded tangible benefits to the farmers in terms of improved crop yield, increased cropping intensity and higher return from irrigated agriculture which have highly motivated the beneficiary farmers to mobilize sufficient amount of resources for the sustainable O&M of the irrigation system (Aheeyar *et.al*, 2006).

Incentive to mobilize cash and materials towards the WUAs is highly dependent on the economics of irrigated agriculture. Therefore, irrigation management component should be adopted as an integrated package with other aspects of irrigated agriculture such as extension, input supply, credit and marketing which influence the farm productivity and income level. There must be parallel programmes to solve the farmers' agricultural problems which bound the achievement of high productivity and increased income.

4.4 Physical Condition of Irrigation Infrastructure

The physical condition of the irrigation infrastructure has an effect on timeliness and reliable supply of water deliveries, which is the major tangible benefit of the farmers for their participation. Thus, functional irrigation facilities is one of the major factors determining the sustainability of participatory irrigation management (Geijer *et.al*, 1996). Further, physical condition of the infrastructure should be able to be operated and maintained by the user community within the limits of their resource capacity and technical know-how. Otherwise the farmers have no options other than neglecting the operation and maintenance of the irrigation systems, which indeed leads to deterioration of the infrastructure. The success of past WUAs initiatives shows that the irrigation systems which are rehabilitated before management turn over to the WUAs were more successful than deteriorated systems (Razaak, 1997).

5. Concluding Remarks

PIM and IMT are a worldwide trend in the irrigation sector development and management. The various governments have made considerable amount of investment for institutional development for mobilization of farmers, and for legal and policy reforms.

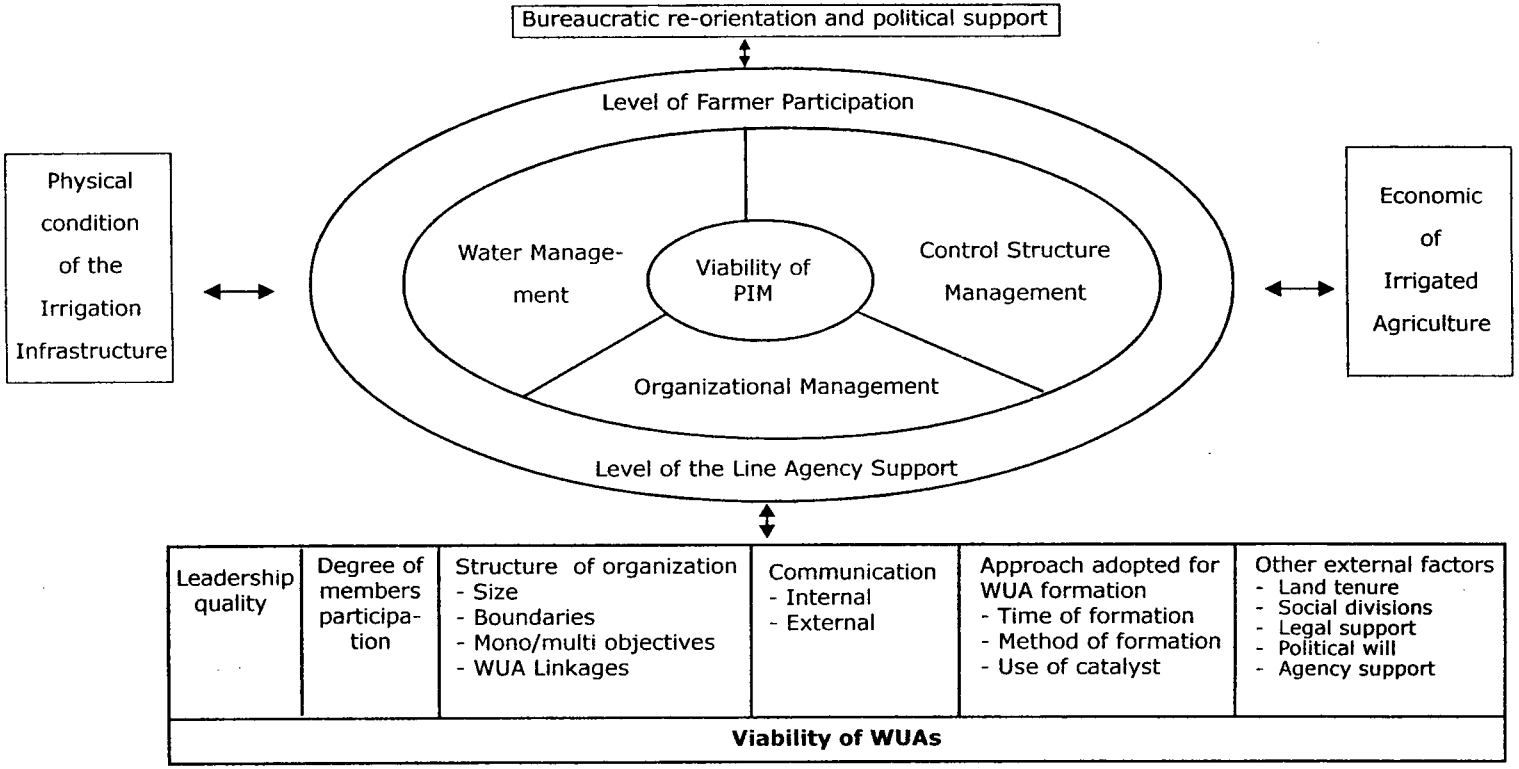
Therefore, sustainability of the PIM is a crucial aspect in the irrigation and water management sector.

The sustainability of PIM is determined by many interrelated factors. The factors that determine the sustainability of PIM are illustrated in the figure 2. Basically the WUAs should perform very well in water management, control structure maintenance and organizational management activities. To achieve these objectives, the WUAs must have a talented, visionary, and dedicated leader who is accountable to its entire membership. All farmers in the water course must be members of the WUAs without any socio-economic obstacles and they should actively participate in irrigation and organizational activities, mobilizing cash and kind. The WUAs have to be developed by a bottom-up approach at the initial stages of the planning of irrigation development/ rehabilitation.

Structure of the WUAs should be normally small in size and based on hydrological boundaries with vertical and horizontal linkages at the system level. The WUAs should diversify its activities from mono to multi objectives, and should be politically neutral. A successful WUA must be financially and technically sound to manage its activities and have the ability to meet internal and external threats. The WUAs should have strong and transparent legal framework to implement incentive and sanctions.

Sustainability of the WUA and the PIM is also affected by the degree of agency support and the economics of irrigated agriculture which gives incentives for the farmers to mobilize resources to care for and maintain the irrigation system. The irrigation system should not be seen as an isolated entity from the entire agriculture production system, rather it has to be developed by an integrated approach to maximize the profitability and to improve the resource use efficiency.

Fugure 2. Factors Affecting the Sustainability of PIM



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