Turnover Program--Some Theoretical Basis

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TURNOVER OF IRRIGATION management (IMT), from government or non-local agencies to local or farmers organizations, is by now a widespread phenomenon. Apart from rapid spread, radical reorientation has also occurred in the approach. There was a time not so remote in the past when it was believed that the external agency can legislate and enforce organizations into being. Now-a-days the interested agencies consider themselves as facilitators, or contract outside services for facilitation. To be a successful facilitator, one must know the internal dynamics of the object process. Indeed, good facilitation can develop only on the basis of such knowledge.

To some extent the facilitation process can be compared with agriculture extension. But there is a very sharp difference. In agricultural extension, the major concern is the appropriate physical and material packages. The extension agent is not required to analyze the behavioral pattern of the farmers. At the most, one is concerned with the resource position of the individual farmers, as in the [T. & V.] systems. The farmers are systematically contacted and persuaded to adopt the improved practices. No one will ever imagine inclusion of penalty provisions against the non-adopters. In IMT programs penal provision is not only common, but an essential component of facilitation. In general, IMT facilitators need also to know the characteristics of group behavior and respond accordingly. While in agricultural extension, persuasiveness at all times is the only behavioral strategy needed, in IMT programs the extension agents must also know the organizational dynamics so as to be able to respond with correct strategy at correct times. A viable IMT program is one which is designed to match farmers' behavioral characteristics.

ESSENTIAL FOUNDATION

In general, *for joint actions to exist there must be sufficient scope of joint work in the program design.* This, unfortunately, is sometimes overlooked. Let us for example, consider the cost recovery program. In some countries cost recovery was done from individual farmers. But such an approach does not require group action. Although the authority was interested, farmers were left with no activity for organizing themselves around. In contrast, in the successful cases, cost recovery was made from groups ; instead of punishing the individual defaulters, the program was designed to penalize the whole group if there was a defaulter. Another common case of an improperly designed IMT program is that of association formation along with technical improvements like the lining of channels. For the farmers , the need for joint action is reduced following lining of channels.

The second fundamental requirement is in the sphere of cost-benefit comparison. *Unless the program provides for sufficient incentive, in the form of positive net benefit realizable through joint action, farmers will not have any motivation to organize.* This must be obvious. There is a variation of this condition, in the form of reduction in net loss through joint action. The agencies interested in cost recovery might have sought farmers associations. But farmers themselves would not be interested unless the cost recovery programs had also threatened them, in some way, of penal action in case of failure.

In essence, the organization-building process consists of (Ostrom 1990) getting a set of *new rules introduced.* Corresponding to the tasks the rules consist of operative rules about boundary , allocation norms and facilities, input rules in labor and cost sharing, leadership selection and decision rules, rules regarding information circulation procedures, etc. Tasks and rules may be imposed from above. Alternatively, those may be so designed that *quasi-voluntary compliance* is obtained from the beneficiaries. Unless the rules are of the latter kind, organizations remain on paper alone.

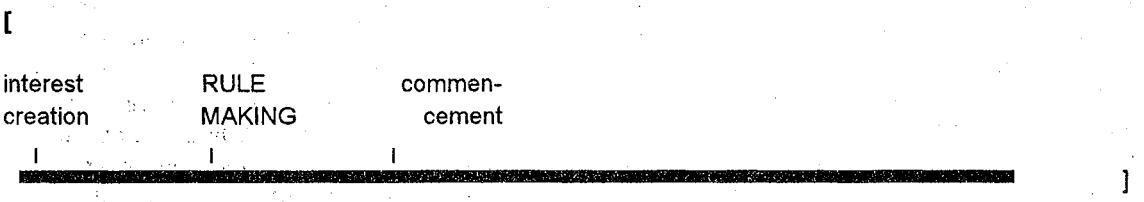
The two conditions noted above are essential pre-requisites for gaining some degree of compliance from the farmers. This is the environment within which farmers may be motivated to organize themselves and respond to IMT programs. But the complexities increase manifold because of an added dimension, which is always evident to the concerned farmers. In this situation, consequences of individual initiative may be the worst, sometimes worse than inaction. On the other hand, joint action is only better; the best option to a farmer is when everybody else undertakes the joint action, but he himself abstains and still enjoys the benefits at no cost (see Appendix)! The pre-requisites of joint action also lead to *free-riding* as the best option.

In programs requiring joint action, farmers cannot develop a rational strategy basing merely on the state of existence of the physical and material features. Every beneficiary of a common water source, every potential member of an irrigation organization, must always try to visualize what the others are going to do. His own action must be the best response under that circumstance. The predictions of others' behavior may not be always correct. But every action of one , triggers a whole set of contingent and consequential actions on the part of the others. On

one occasion some members may make an attempt to free-ride. On the next occasion wisdom dawns and they contribute their share. But on this occasion some others may refrain as retaliatory measure. These complexities are repeated. Depending on the extent of cooperation by the members, the synergy effect is realized as organization. Sometimes the organization does not function since the threshold of members' participation is not attained. Sometimes it does, but at a feeble pace, leaving much room for improvement. At other times it is vigorously active, but with no guarantee that it will not fail again in the next period. Facilitation has to match these swings.

If they are to make cooperation successful farmers must have means to check free-riding. It should be possible to *monitor* free-riding and penalize the offender for which an *enforcement* mechanism too is necessary. Therefore, while designing new rules one cannot depend completely on the voluntary compliance of farmers. Penalty provisions and an enforcement mechanism for punishing the free-riders are also necessary components.

Essentially, IMT programs have framing of rules and collective decision-making arrangement at its core. The *collective choice arrangements* include the systems of meetings, interaction avenues, decision-making method etc. The core activity is preceded by a Pre-campaign (*Interest Creation*) phase (Johnson and Reiss 1993) where the information that cooperation of farmers would bring increased benefits to all is substantiated and disseminated. Similarly, following the introduction of rules is the *commencement* stage, when the organization starts functioning. Generally, this stage is considered as achievement in organization building.



In many IMT programs a few months are allotted for pre-campaign, followed by intensive discussions and formalization of rules. Thereafter, the associations are expected to start functioning. Agencies withdraw from the major task of organizing. We will discuss next that this action plan itself has some serious limitations.

PROGRAM INTERFACES

Communally realizable opportunities pose completely distinct challenges from private activities. Farmers may be aware that there exists some rewarding activity. If it would have been within the means of each individual many of them would take up the challenge, learn the details, invest as per required, recruit workers, enter into definite contracts with them, make necessary arrangements for monitoring their activities and retrench someone on the grounds of not having enough commitment. No doubt there is risk. But many of them would face the risk and some would succeed. Such entrepreneuring individuals however, are not able to make much dent in the area of jointly realizable benefits. There are three serious obstacles in the course of realizations (Ostrom 1990):

1. the problem of supplying a new set of institutions,
2. the problem of making credible commitments, and
3. the problem of mutual monitoring.

The *problem of supplying a new set of institution* involves investment in collection of information on natural and technological aspects, designing, cost estimation, negotiation, etc. One may look into the section on "Tasks of Organizing" for an idea of the volume and challenge of tasks. In case of private enterprise the entrepreneur supplies those in anticipation of the sizable benefit he will get. In the case of common pool resource the additional benefit is shared by many and thus, no one may be left with sufficient margin to meet the initial investment requirement.

Not surprisingly, the large shareholders often assume the position of leadership in joint water appropriation activities. He may find his cost-benefit margin still rewarding even if the work is only partially complete or if he has to incur some extra cost to complete it. Thus, the possible leadership role of large shareholders in certain circumstances of water association formation need to be recognized in IMT programs. Interestingly, the problem arises in those cases where the distribution is more equitable. In such circumstances why should one invest in

supplying something on one's own, being aware that there will be no extra share or compensation for his initiatives and any benefit will be obtained only if many others comply voluntarily to the requirements of the project ?

In IMT programs this problem is generally met by external input - by the irrigation departments undertaking the task, sometimes through the engagement of irrigation organizers. In some other cases, the departments have entered into contracts with some suitable agencies accountable to the farmers. It is these organizers and agencies who work out the supply details and thus help overcome the dilemma. For this work they receive some compensation from the authority. The role of external agency in the matter of initiating the organizations is thus, of paramount importance and of integral significance. This should not be misconstrued as instructive involvement. Earlier we have noted the requirement of quasi-voluntary compliance of the farmers, which can come only through participatory development of programs.

Let us now turn to the *question of monitoring*. Penalizing free-riders is not possible unless they are identified. For this, there is requirement of monitoring. But monitoring can be costly, so much so, that much of the additional benefit from joint work is eliminated because of monitoring cost. If the monitoring methods are as thorough as the use of water meters for volumetric measurement, registered attendance in community labor contribution, maintaining perfect records of financial contributions etc. then the cost may become prohibitive. Joint monitoring is sought to economize in this sphere - to evolve simpler rules, quick procedures, not necessarily fool-proof mechanisms, but some methods agreed to by all the co-sharers.

Monitoring should be followed up by (graduated) sanctions. This is conducted within the associations. But the conflict may also spill out of the arena reaching formal judicial authority. Here comes the problem. The simpler methods of monitoring are usually not admissible evidence to the judiciary. Often it is rejected and in turn, the decisions of the farmers associations cannot be enforced. Many IMT programs have badly suffered on this account. Therefore, another essential component of the programs is to seek *modification in the conflict-resolution mechanisms along with formal recognition of rights to organize.*

Following rounds of discussion and rule framing the situation is all set for joint activity to commence. There is still the problem of initiation. The impasse is not easily broken because the individuals hesitate to contribute respective shares until they are sure that the others too will do the same. Hence, at this stage, there is often a need of *signalling* to other beneficiaries their intention to cooperate. This is done for example, through the show of attendance in general meetings. If a sufficient number of farmers participate, that itself signals the willingness to cooperate. But further documentation of signals will be of help in designing IMT programs in a systematic manner.

It needs to be noted at this stage that the activity is initiated on the basis of an anticipated benefit structure, not on the basis of objective reality. Even during the commencement of the project the cooperators are aware of the many limitations of these anticipated structures. Everyone knows that the physical and technical data used might have been wrong, the design may have some unforeseen weakness, the monitoring and sanction measures may not prove to be effective, and so on. Added to these are the uncertainties regarding the free-riding possibilities of co-sharers. *Credible commitment* is therefore , unlikely at this initial stage. It is only through proven success, over time, that credibility increases and commitments become increasingly binding. Thus credible commitment arises if :

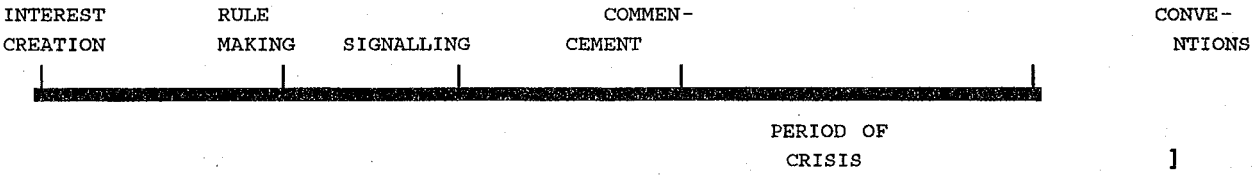
1. The proposed activity actually proves to be beneficial.

2. The internal mechanism and external support of monitoring and sanctions proposed actually work effectively towards the desired result of containing free-riding.

3. Repeated occurrence -- over time -- of the same cooperative action by most farmers increases the credibility of commitments.

Because of the lack of credible commitment at the initial stage organizations almost invariably face a *period of crisis* following its commencement. For a year or two it may perform well. But in all likelihood, after a couple of good years of organized activities, there will arise a tendency with some members to see whether free-riding or some such advantages can be extracted. The years around the second to fifth may be the crisis years. At this stage immediate monitoring and penal action against the slightest vacillation, is absolutely necessary. In most spontaneously formed farmers associations one comes to know of charismatic farmer organizers without whom the organization could not be formed. By deeper probe one is sure to learn also about the high-handed manner which they had adopted "during those days." The lack of credible commitment at the initial stage makes such phenomena inherent in the organizing process. Systematization of monitoring and sanction will eliminate the need for such unorthodox manner of obtaining credibility.

If monitoring and enforcement succeed and the opportunists find that they were not able to extract any advantage they will succumb. Under that situation, further opportunism too will be discouraged. The organization then will internalize the regulation which would rather become *conventions* and the organization will stabilize (Schotter 1981 ; Sengupta 1991). However, the fact that it has stabilized can be concluded only after watching the organizational functions for a few years. Conventions have self-disciplining effect. Once it is established it almost eliminates the need for enforcement. Once they become accepted conventions the organizations become *stable* or *sustainable*, a situation where uncertainties about the behaviors of the co-shares are removed. It is not the commencement stage, but the stage from initiation to stabilization that should be regarded as a complete (sustainable) organization extension program. Most action plans make no concessions for this complex internal organizational rhythm. In fact, there are pressures to treat turnover more as rapid adjustment than progressive evolution (Vermillion 1992).



In the long run, organizations attain self-sustained state, as is evident from many traditional organizations and the continuing success of some newer ones. But it is rather unlikely that an organization will smoothly develop into a stable state. [The past history of an object community plays an important role here.] If there is a long history of cooperation among members, or if there exists considerable community cohesion and mutual trust, credible commitment is easily obtained. Many analysts have relied on this feature while explaining organization formation (e.g. Runge 1986). These are no doubt important. But by relying solely on this factor IMT programs will restrict the possible cases to only those with the right kind of history or socioeconomic composition. Our attempt here is directed to explain that even the most unscrupulous self-seekers may find it profitable to cooperate. In general, the historical and social features contribute only to some extent, making the task of organizing simpler or more difficult.

TASKS OF ORGANIZING

In this area too, simplistic understanding is prevalent. So much so, that in many officialdoms the task is regarded merely as identifying the "fair" shares of each beneficiary and formalizing the institutional and decision making process. Experience has taught us that the task is far more complex. We will draw here some interesting guidelines using the theoretical analysis of farmers' behavior. This is by no means exhaustive.

The game theoretic analysis (see Appendix) shows that *cooperation is a more likely outcome when the game is repeated.* This has important implications for designing the program. Tasks like operations and maintenance are repetitive in nature. A good many IMT programs are, quite rightly, built around these tasks. Construction and renovation, on the other hand, are non-repetitive in nature. Though it is not impossible to organize farmers around these tasks, the chance of success is less. Instead, it is better for the authority to undertake the construction task by itself and recover the cost from the farmers in instalment payments, thus making it a repetitive task.

Whether the works to be performed by farmers are of a repetitive kind depends also on the physical designs. Recurrent and regular water supply creates conditions congenial for farmers' organization. Indeed, this makes well-managed modern systems with certainty of water supply , more suitable for IMT programs. Much has been said about farmers' organizations in the traditional systems. It is not surprising to find that in traditional rainfed irrigation systems, following a couple of drought years, farmers find it difficult to reorganize themselves. Even the habits and conventions dissipate if they are not put to use.

The number of farmers or the size of the organization also plays an important determining role in cooperation. Game theoretic literature indicates that the greater the number of participants the more difficult it is to attain cooperation. Transfer of larger systems may however, be done through *nesting* of smaller unit organizations. Apart from the number of participants the ease of communications between them plays an important role. More often close neighbors are brought together in associations. But by establishing systematic information circulation channels a wider area may be covered. In my study (Sengupta 1991) I had inquired into this aspect in some detail. In one irrigated village in the midst of a dry area, the association members were having land in the same command area, but were residents of a much wider area. Some of them were residing in villages as far as ten or fifteen kilometers away. But systematic information circulation through the engagement of messengers had made this association a

strong one. In another village, drummers were engaged for information circulation when the kind of work needed cooperation between several village associations. IMT programs may think of using the wide variety of modern communication methods.

The authority can relinquish its responsibilities below a particular physical unit. Boundary of associations therefore, coincides with hydrological units. A physical unit releases water as common property from which it is not possible to exclude some users. In this sense, the members and non-members are identified by the physical system itself. But several tricky questions are involved. The eligible members are divided in terms of socioeconomic status. Some of them might have special rights and privileges over the system. To bring all of them together needs imaginative solutions to many problems. I learnt of a case in the Philippines where two groups of farmers were required to join in a single association. They were eager but were not at ease over a past dispute. When the communal system was being constructed all of them had started working together. But after a year of effort some people lost hope and stopped working. Now, after decades, when the NIA program required them to form a single association, they could not reconcile with the idea that all of them have equal positions. The Community Organizer solved the problem suggesting that those who did not labor during construction pay the equity in terms of mandays worked by each person in that work. It was acceptable to all ; those who could not pay immediately were permitted to pay in installments.

In making arrangements for decision making etc. the farmers may not follow the usual meetings and other formal systems. Many such discussions may be conducted within their day to day life. This reduces the cost and efforts in organizing. Some rules are easy to observe within the existing local set up, some others are difficult. When appropriators can design some of their rules, they can make rules which are cost-effective in implementation under the local conditions (Ostrom 1990). In designing the IMT programs this factor need to be remembered. At present there is a tendency to adopt more formal procedures.

The physical planning consists of three different kinds of tasks: (i) production plan, (ii) implementation plan and (iii) co-ordination plan.

When a program is adopted there is only general understanding of its content (the *production plan*). Even in the pre-campaign stage when it is introduced only the benefits to the whole community can be discussed. Working out the details of each individual's share (*implementation plan*) follows this stage and may be quite complex. There are many physical, social and organizational problems here. The tail-end problem is only one expression of this. Each farmer needs to be satisfied that the program will benefit him (Seabright 1993). This necessitates rounds of discussion and thorough planning.

If all farmers find the expected net benefits to be satisfactory they will have the incentive to organize. But still there is a third problem, that of *coordination*. For example, some may prefer Sundays , some others find Thursdays suitable for attending communal works. The preferences might not have been without grounds - for some of them certain days would be the day of other business. Coordination problems arise after the farmers are ready to work in cooperation. This is the kind of problem which needs to be solved by planning and programming, not by enforcement.

While meeting the challenges of specific environments many imaginative solutions to one or the other of these problems have been reached. Case studies have documented many. Typology and systematic dissemination may be of great help. If farmers and organizers have to invent solutions again and again that will be very inefficient.

Lastly, let us point out that the supply problem may be greatly reduced if there is already a case which can be replicated to some extent. If farmer-leaders learn of such models they have to invest much less in supplying the institution. If the other farmers also know of the success of this model their commitment too is easily obtained. (Alternatively, if they know of failures of such experiments, they will be extra-cautious to adopt it). If so, the association formation needs much less initial effort and can be viable within the cost-benefit considerations of individual farmers. In that case, the spread of organization may be spontaneous , the need of an external organizer may not arise. Since farmers come to know about the happenings in their neighborhood villages , a success case is likely to spread spontaneously. In general, a territorial extension scheme is preferable, and attempts must be made to make all the initial efforts successful. Failures at the early stages will restrain the process of obtaining credible commitment to IMT programs.

PERFORMANCE

Experience will tell us how much can be efficiently managed by farmers. For that, performance measurements are necessary. However, a note of caution is in order. The existing states of affairs are not always good yardsticks. The observed performances may be far below the potentials because of the lack of right environment. The IMT programs are often improperly planned. "In some places, poorer farmers may not be able to afford additional costs for irrigation..... In some economies,....irrigated agriculture may be relatively unprofitable.....Also, effective turnover

demands strong local institutions, including clearly established water rights and conflict resolution arrangements. Where these do not exist, turnover may not induce the performance improvements anticipated" (Vermillion 1992).

In particular, I like to draw attention to the important question of system design. Poor performance of agency managed systems, originates in the inevitable disparity between supply and demand when two different parties control the two. Performance can improve if the farmers control both supply and demand. Farmers can improve the performance by a wide variety of ways , but only if they are given appropriate system designs, permitting those tasks (Sengupta 1993a). Attention must be given in IMT programs to develop suitable design modifications wherever necessary.

All these well-known aspects relate to physical performance. It follows from the previous discussions that a set of organizational performance criteria too are implicit in the IMT programs. These are :

(a) degree of responsibility

(b) scale of integration

(c) equity

(d) participation rate

(e) sustainability

We have already dealt with the question of organizational sustainability. Suffice it to add that this cannot be achieved without sustainability of the physical system. If the physical system deteriorates the associations are left with little ground for existence.

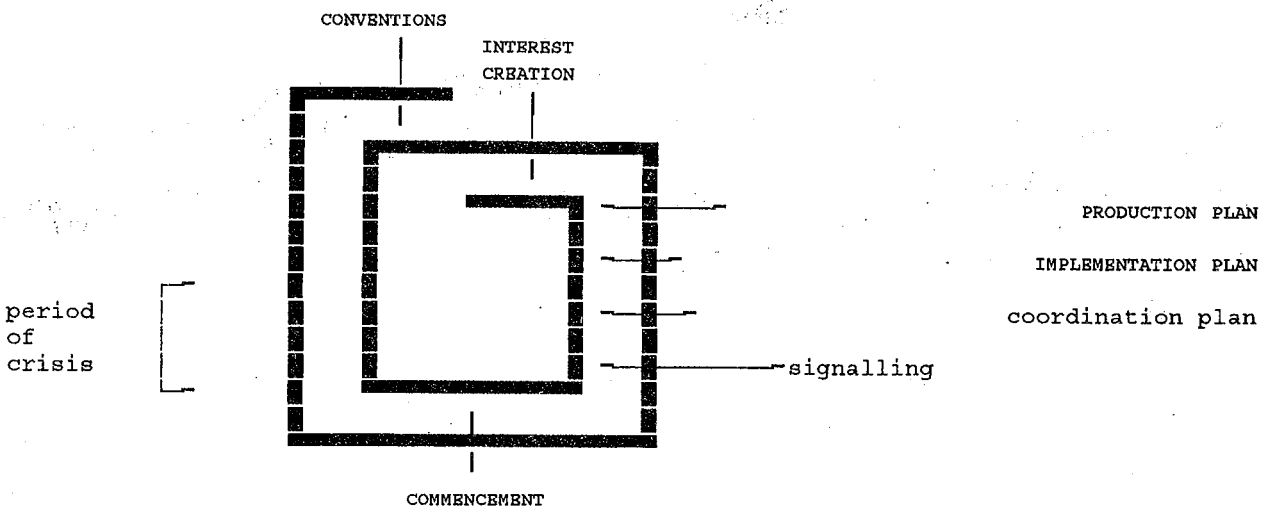
The responsibilities assigned to farmers associations range from irrigation service fee collection to privatization. It may extend to diversified economic and marketing activities. If these are sufficient for system maintenance and are performed satisfactorily, the physical system becomes sustainable. The scale difference ranges from local hydrological unit to the system level or even basin level. As discussed, it may need nesting of organizations.

The equity question is indeed, an organizational criterion. Requirements of a particular production plan may be met by several different implementation plans (See Appendix). Given any specific definition of equity, one of these may qualify for being equitable. There is nothing within the institutional features, which helps define equity. It has to come from externalities, either historically or from currently acceptable social choices. Good management does not necessarily accompany equity. It may be desirable to change even a good performing organization if it does not meet the desired criterion of equity (Sengupta 1991). Indeed, it is the high cost relative to benefits, short of making irrigation unattractive, which influences the equity in distribution. If the cost is very close to marginal productivity of irrigation then need arises to use water very efficiently. In a common property situation that leads to sharing of water and sharing of cost.

Stable organizations are often based on partial cooperation and permits some amount of free riding (see Appendix). If those do not tend to increase, endangering the very existence, the organizations may not be very stringent in monitoring and punishing. I have shown (Sengupta 1991) in several case studies of traditional and well-established modern irrigation associations that free-riding is permitted to some extent. But these free riding tendencies do not increase. The situation may still be undesirable on the ground that in many cases of partial cooperation one finds that only nominal tasks are being undertaken.

The physical performances of an association can be improved by extending proper support, training and by improving their resource positions. In case of organizational performance improvement, except the question of sustainability, one has to start reorganizing. Any effort towards improving the level of organizational performance will have to start from precampaign, rule making, enforcement and close monitoring, thus repeating the whole cycle. In essence, organization building is a continuous process, with these cycles repeated.

However, the challenges in the subsequent rounds of improvement are not likely to be as much. As was indicated, the commitment and trust, once developed, helps securing cooperation. Once the climate of cooperation is established, the improvements may be easier. Countries like China, where because of historical reasons, culture of cooperation exists, are in a much better position. The more difficult challenges are in the other developing countries where individualism has been encouraged so long, where traditional cooperation may exist, but in undesirable segmented basis which has more subversive effects for IMT programs.



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Appendix

COOPERATION REQUIRES CONTRIBUTIONS from the farmers, either in financial, physical or intellectual effort. This may be expressed as a cost component. Unless enough contribution is made by all the farmers the joint work cannot materialize. In other words, we may express that a total cost C must be incurred in order to realize the joint work. The joint works bring extra benefits. Let us indicate the marginal total benefit by B. If the task is economically meaningful

$$B > C$$

Rules are made allotting shares to each individual farmer. Let us denote the share of the i-th individual by b_i and c_i so that

$$B = \Sigma b_i \qquad C = \Sigma c_i$$

The i-th individual will have sufficient incentive to participate in the joint work if the rules made can bring him net benefit. For the irrigation work to be chosen among other economic opportunities it need bring not only positive but also greater net benefit compared to other economic opportunities. The necessary condition therefore, is -

$$b_i - c_i > \delta_i \geq 0$$

There are numerous ways by which B can be divided into b_is and C into c_is. Many of them will satisfy the inequalities as above. In other words, there may exist numerous feasible implementation plans. Which one is just and equitable ? There is nothing within the theory that helps identification of one of them as just. The justification criteria can only be externally given.

Description of the common situation needs some additional qualifications (Sengupta 1991). There are several farmers involved. If some of them participate and a few others free-ride there may still be some benefit. Let us denote the total benefit in case of partial cooperation as B^p. This is not a single value. Depending on the extent of cooperation B^p may have many different values. If everyone cooperates except one or two B^p may be almost or even equal to B. But if a sufficient number of farmers don't cooperate the task may not be realized at all. In that case B^p is equal to zero. Thus

$$B^p \in [\, B, 0 \,]$$

With this description let us study the opportunities available to the i-th individual. He may contribute his share or he may not. Let these two situations of partial cooperation be denoted by p(1) and p(2). Depending on the contributions made by others he gets his share of benefit. The net benefits received by the i-th individual are :

$b_i - c_i$ in case of full participation of all

$b^{p(1)}_i$ all others contribute their shares, only the i-th individual free-rides.

$b^{p(2)}_i - c_i$ some farmers free-ride, but the i-th individual pays his share of the cost

$(1-\alpha)\, b^{p(2)}_i$ the same as above, except that the i-th individual does not pay his share of the cost. $\alpha \in [\, 1, 0 \,]$ indicates the reduction in his benefit due to free-riding by himself.

Thus the benefits in different strategy options available to the i-th individual may be described as :

farmer	other farmers i-th	
	all contribute	some do not contribute
contributes	$b_i - c_i$	$b^{p(2)}{}_i - c_i$
does not contribute	$b^{p(1)}{}_i$	$(1-\alpha)\ b^{p(2)}{}_i$

The last column is a general expression. The number of farmers who do not contribute may range from just one to all other farmers.

From the above payoff structure one finds that if *both* of the following conditions are satisfied -

$$b^{p(1)}{}_i > b_i - c_i \quad \ldots\ldots \quad (1)$$

$$(1-\alpha)\ b^{p(2)}{}_i > b^{p(2)}{}_i - c_i \text{ or } c_i > \alpha\ b^{p(2)}{}_i \ldots(2)$$

the i-th individual has a dominant strategy in not contributing his share. *Only then it becomes a Prisoners' Dilemma* kind of Game where everyone follows the dominant strategy of not contributing ones' share and in consequence, the joint work never materializes. This is the result which became infamous as the "tragedy of the commons" (Hardin 1986). By now, however, several other studies are available which show that cooperation may be possible even in this kind of circumstances.

The arguments rest largely on repeated games. The self-interested individual may find that in the long run, he has more to loose if the jointly realizable work is not achieved. The necessary condition is that the future returns (considered mathematically in terms of discount rate) from the activity must matter enough to the concerned individual. But this is not sufficient. It can be shown mathematically that in the last round of the game defection is the best strategy ; if all of them defect in the last round then defection is the best strategy in the previous round, and so on. This is known as backward induction. Whether this part of the mathematical analysis is a good representation of human behavior is open to question. Even by leaving that aside another situation need to be considered. If there is no visible end of the game then this backward induction does not work. This is often a better description of the concrete situation : most farmers expect their irrigated agriculture to last throughout the foreseeable future. It also suggests that those who do not have any such long term interest, e.g., temporary tenants or short term lease holders will have free-riding as the dominant strategy. Also, noteworthy is that backward induction will act strongly if the supply of water, the physical structures, etc. are not maintained properly and the farmers feel that the deteriorating system will not last long.

Also, if one of the inequalities (1) and (2) is not true the pay-off structure is not a Prisoners' Dilemma type and free-riding is not a dominant strategy. This is important to note since the two person Prisoner's Dilemma game has been used much too frequently to establish that defection may be the dominant strategy in common property resource management. In an n-person situation the results are not as drastic.

Let us first consider the second condition. If there are too few participants then $B^p = 0$

hence $b^{p(2)}{}_i = 0$ and therefore $c_i > \alpha\ b^{p(2)}{}_i$.

If there are enough contributors, far more than what is needed, then the total $B^p = B$. In that circumstance it does not matter if one or two persons free-ride. Here $\alpha = 0$ if the i-th individual free-rides. In this case too $c_i > \alpha\ b^{p(2)}{}_i$.

But there may exist a range in between these two extremes where the contribution of one or two individuals may make the difference in realization or non-realization of the benefit. In this case the reduction in total benefit due to free-riding by the i-th individual is almost total. For each individual therefore, $\alpha = 1$ or very close to it. In this case we get

$$c_i < \alpha\ b^{p(2)}{}_i$$

i.e. the inequality (2) is not true. Free-riding cannot be a dominant strategy in circumstances where the contribution of the individual is of crucial importance to the realization of the opportunity.

Let us now turn to the other inequality. If the i-th individual of our concern is the major shareholder then others' contributions may not make up for the loss due to his failure. In that case the benefits from a partial cooperation, where he alone free-rides, will be nil or near zero. Hence

$$b^{p(1)}_i < b_i - c_i$$

In this case the inequality (1) will not be true and therefore, the shareholder would not have a dominant tendency to abstain.

If the i-th individual is a small share holder in the proposed farmers association, by the non-availability of only his contribution the jointly realizable benefits are not much affected. In this case $b^{p(1)}_i = b_i$ and the condition (1) is true. Thus, free-riding tendencies may be more prominent when there are only small holders. In theoretical analysis of common property management it is often implicitly assumed that all members of the community are small holders. But in reality there are also cases when the community consists of many small sharers and a large one. In those cases, association formation may be initiated by the large shareholder.

A final note is in order. Much apprehension has been voiced about the dominance of elites in farmers organizations and monopolization of benefits by them. But this is not an inevitability. If the cost is sufficiently high he will always have greater opportunity in sharing the cost with others. Cost cannot be shared without sharing also the benefits. As long as the marginal productivity of irrigation is higher than the unit cost the incentive to use irrigation remains. But if the two are very close, economic viability can be attained only when water use efficiency is very high. A major share holder will find that after using water efficiently for his own holdings the rest must be extended to others, who will then share the cost. Thus by increasing the cost, but without making irrigation unprofitable, the elites too may be motivated to use water efficiently and share the rest of it with other farmers.