

Dynamics of Water Institutions and Agriculture under a South Indian Canal Irrigation System

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Abstract:

The paper is about the water insecurity situation in an irrigation system, factors contributing to the scarcity condition, the role of institutions in reducing water insecurity and its impact of agriculture and livelihoods of poor. The paper also analyses the dynamics of these institutions over a period and their impact on agriculture and livelihoods. These observations are based on a study of a canal irrigation system in South India in 1980s and a re survey of it after a period of 15 years. The study rests on the premise that irrigation institutions and their role in management are significantly conditioned by the agricultural and socio-economic environment especially caste and class of the region. Maintenance of irrigation structures and regulation of water supply to tanks under large-scale irrigation system is fully the responsibility of the State. However the State is not able to undertake these functions efficiently due to its own constraints. Hence local level irrigation organisations undertake maintenance like cleaning and de silting of channels, which bring water to their tanks. Though the State is not able to regulate water to the tanks properly, local institutions themselves undertake such tasks. Collective action both in the appropriation of water from the main canal and allocation of water at the local / tank level is quite significant. These organizations called panchayat have well defined structures, rules and functionaries. The members of the panchayat are generally farmers with relatively larger land holdings and community influence in the village. They are assisted by professional watermen and watchmen, appointed during every irrigation season and paid through the farmers' contribution. Thus collective action as regards functions of water management is quite significant and brought substantial benefits to farmers including small in terms of access to water and productivity gains from irrigation. Had there not been such institutional arrangements there would have been substantial losses to farmers (especially poor) because of overall reduction in the quantum of water in the system due to the inter-state river water dispute and the increased problems due to encroachment and alkalinity of soils. Though there has been a significant change in the land control, the villagers continue to show interest in collective action as majority of their livelihood depends upon agriculture for which irrigation is the basis. Not only irrigation but also the very life of villagers depends upon cooperation among themselves for the fear of subordination by the dominant castes. The continued presence of irrigation institutions and their role in water management and other village affairs point to the fact that pessimism expressed on collective action by theorists of 'tragedy of commons' like Hardin, and Gordon is exaggerated. The resurvey shows that irrigation systems do not exist as blue prints but continue to undergo changes in which institutions are important. Though there are many changes in irrigation and agriculture, caste as an institution continues to play an important role in irrigation and other village affairs.

Introduction

A couple of villages under New Kattalai High Level Canal (NKHLC) fed by Cauvery river in TamilNadu, South India were studied in 1985-86, to understand the structure of irrigation institutions and their role in agriculture water management as a part of Ph.D. thesis of the author (Rajagopal, 1991). A few of the villages were resurveyed in the year 2000 to understand the changes in the institutional aspects of irrigation management, agriculture and livelihoods.

Theoretical Perspective

The study is based on collective action theories and their usefulness for understanding irrigation management in a large-scale canal system where both farmers and bureaucracy interact in a variety of ways.

Collective action which is the synonym of institution is concerned with the mechanism of decision making regarding allocation rules for a common resource serving several users and its enforcement and cost sharing. Basically, collective action school sought to establish that pessimism expressed on collective actions by theorists of 'tragedy of commons' like Gordon (1954), Hardin (1968) and others is unfounded. According to these theorists, ruin is the destination in the utilization of public goods, because of the inherent tendency among users not to cooperate with each other in regulating the use and sharing the costs. Refuting this strongly, some scholars of collective action school argue that cooperation is a 'spontaneous order' in the utilisation of public goods (eg. Sugden 1986, Sengupta 1991).

According to them, if individuals pursue their interests in a state of anarchy, order in the form of conventions can arrive spontaneously, no ethical or institutional factors are necessary to effect that (Sugden 1986; Sengupta 1991). Using game theoretical model (iterated prisoners' dilemma' game), they have shown that cooperative solutions can be devised to tackle problems of human beings without the intervention of a coercive state.

There are several other scholars, who have identified institutional arrangement for collective action as solutions for efficient utilisation of scarce resources of village communities. Notable among them are Hayami and Kikuchi (1981); Hayami and Ruttan (1985); Wade (1988); Runge (1992). Hayami and Kikuchi have noted collective action as an important feature of many Asian rural economies in solving problems associated with scarce resources like land, labour and water. According to them collective action was possible because of tight social structure which enables enforcement of rules without much transaction costs. Hayami along with Ruttan argue that institutional innovation, like technological innovation, is a response to changes in several environmental factors, and is determined by cost and benefits involved in it (Hayami and Ruttan 1985). For Wade, scarcity and uncertainty in the availability of resources are conditions, which bring collective action (Wade 1988). According to Runge (1991), collective management is an important a method of utilisation of resources as that of private property rights.

Irrigation Institutions and Agriculture: Perspectives from Other Studies

Studies on institutional aspects of irrigation generally focus on rules and regulations regarding operation of systems, questions concerning centralisation and decentralisation of systems management, user participation versus state-run system, and in the case of groundwater, the role of markets. There are descriptive accounts of structure and functioning of institutions in traditional local surface systems and as well state-run large systems (eg. Leach 1961; Geertz 1967; Reidinger 1974; Chambers 1977; Jayaraman 1980; Kelly 1980; Kulkarni and Lele 1980; Coward 1980; Jayaraman 1981; Pant 1983; Wade 1988; Sengupta 1991). However, most of these studies tend to view institutions per se without taking into consideration the context in which they operate. Such contextual attributes in an irrigation system include factors like physical environment of irrigated agriculture, technology of water control, agro-climatic conditions and social and economic setting. Technical factors determine the relative ease with which the irrigation source can be harnessed, conveyed to the desired place and delivered in desired time and quantity. This is essentially related to engineering aspects of irrigation. Agro-climatic factors like topography, soil condition, ground water table, rainfall, temperature etc. determine the types of crops that can be grown in the area, the quantity and time patterns of water supply required under different stages of crop growth. Socio-economic factors like caste, kinship, control over land etc. affect the ability of various groups to command the resources needed for irrigated farming and perhaps even their ability to get water; it has also a bearing on the willingness of users to take part in collective actions on water management.

In a review of literature on institutions, Vaidyanathan (1985:28) observes:

"Unfortunately much of this literature tends to focus on institutions per se with what seems to be excessive preoccupation with differences in form, eg, community managed Vs bureaucratic systems; centralised Vs decentralised systems. Not only is there no necessary correlation between form and effectiveness but the appropriateness of institutional forms cannot be decided independently of the agro-climatic, technological and land tenure conditions. Which again stresses the need for, and value of, comparative and historical studies of irrigation institutions in a variety of situations".

The importance of viewing institutions with reference to its contextual attributes was also emphasised by others (eg Ostrom 1986; Tang 1992; Oakerson 1992). According to Ostrom, the physical, community and institutional attributes affect collective actions in a configurational manner rather than a simple additive manner (Ostrom 1986). Tang emphasises the importance of this approach in the following words.

"It is necessary first to identify the types of collective action situations facing participants in the resources; then to examine how various physical, social and institutional factors affect the relationships, among the participants in those situations" (Tang 1992 : 3).

It is to be noted further that not only these aspects of irrigation are interrelated but change in any one trigger changes in others. Chambers notes, "Irrigation systems are not physical entities constructed to blue prints; they are more like organisms which grow, spreading over time, fitting the physical terrain pulled here and there by human activity, decaying and being restored" (Chambers 1988:42).

Though the importance of viewing irrigation institutions in relation to its contextual attributes and in a historical perspective recognised by scholars, there have been very few studies with such a comprehensive framework. The present study attempts to fill this gap. It is mainly concerned with institutions and their relationships with existing technical agro-climatic and socio-economic condition and their dynamics over a period of time. More specially, the study is concerned about the forms, internal structure of institutions and their relation with the larger political - administrative system and the way they function in determining control over water; make and enforce rules governing access, use and sharing of water.

With this understanding, we have studied the irrigation institutions in NKHLC surface irrigation system which forms part of Cauvery irrigation project in Trichirapalli district of Tamil Nadu.

As noted in the beginning, a couple of villages under NKHLC were studied in 1985-86, to understand the structure of irrigation institutions and their role in agriculture water management. Aravakurichipatti is one of the villages studied. The village was resurveyed in the year 2000 ie. after 15 years to understand the changes in the institutional aspects of irrigation management factors affecting changes (especially the role of caste and class) and their impact on agriculture and socio economic conditions of the area.

Irrigation and Agriculture

Aravakurichipatti is irrigated by Aravakurichi tank which receives supply from New Kattalai High Level Canal (NKHLC) system. The NKHLC is one of the four canals that take off from Kattalai *Anicut* situated across river Cauvery in Trichirapalli district. The canal is essentially meant for supplying water to a chain of tanks in the district. Irrigation under this canal is meant for single paddy crop for the duration of 4_ months in a year usually from 1st August to 15th December. The canal has got only last priority of water supply compared to other canals of the *Anicut* system. Hence irrigation under this canal is unstable in nature.

The village entirely depends upon the tank water for irrigation and well as a supplementary source is totally absent. Well irrigation has not developed in this area because the groundwater is highly saline and not suitable for agriculture. This is also confirmed by the studies done by Soil Salinity Research Center in the district (Vadivel et al.1985)

Our re survey findings show that there is no change in the source of irrigation over the period. The same is true as regards well irrigation and farmers have not gone for it because of salinity of well water. Hence the village continues to depend entirely upon tank water for irrigation. A very significant percentage (75%) of gross cultivated area is under irrigation, which indicates that agriculture in the village is carried out predominantly through irrigation. This is because dry lands are mostly salt affected and hence not cultivated. The same has been noted in our earlier survey also. Thus as regards irrigation there is no change observed.

Changes in the Control over Irrigated Land

The Aravakurichi tank irrigated 228 acres most of the lands were owned by villagers themselves when we conducted the first survey. Now it is reported that about 70 acres were sold to outsiders - the buyers were mostly from nearby town. Loss in

agriculture is reported to be the main reason for sale of land. Thus there is a change in the control of land over the period. Absentee-ownership is now an important aspect of agriculture in this village. It is reported that outsiders buy the land for the purpose of getting paddy for self-consumption and also the 'prestige' associated with the ownership of land. However, the main reason may be real estate business interest due to the expansion of nearby industrial town.

Factors affecting changes in the Control over Land

One of the main reasons attributed by farmers for the sale of lands by them is loss in agriculture due to salinity of soils of irrigated lands. It is reported that soil salinity of lands has increased due to irrigation, which has in turn affected the paddy crop yields. This is especially noted in some pockets under tank irrigation, which is more prone to alkalinity problem. Continuous loss in agriculture due to this problem has made them heavily indebted. According to farmers, the increase in cost of cultivation in recent years and un-remunerative prices for paddy have resulted in heavy indebtedness, which ultimately forced them to sell their lands. The main factor, which inflated cost of cultivation, is the increase in agricultural wage rate, which forms substantial part of the total cost. As the village is located nearby Trichirapalli industrial town, labour absorption in non-agriculture sector has affected the labour availability in agriculture, which has increased the wage rates. This also has become boon for those who sold their lands and become landless. Most of them are employed in ancillary industries, which came in large numbers around the Bharat Heavy Electrical (BHEL), which is in a nearby town. Introduction of public transport services to a significant scale also favoured employment in urban industrial areas. Earlier there were only four times buses were flying to the village. Now it has increased to twelve times.

Another reason noted for the large-scale sale of lands is real estate boom in the area due to industrial expansion. As the tank ayacut lands are situated near the main road, which connects the city, the lands fetch good prices which induce farmers to sell their lands. Thus though farmers have sold their lands, they find alternative livelihood from the urban industrial area and hence no migration from the village.

It is reported that most of the buyers are from the Trichirapalli town and they are merchants and real estate business people. Some of them are reported to have bought the lands for the purpose of agriculture also as the village is free from any conflicts in water management which frees them from the problem of day to day supervision of lands. Also the presence of well functioning institutional arrangements for water distribution and management take care of irrigation of lands without their presence in the village as we shall see later in this paper.

Agriculture

It is seen that there is no change in the cropping pattern over a period. Paddy is the only crop grown under tank irrigation in the village. As the canal water is meant for about 4_ months only one crop is grown in the village. The same was reported in our earlier survey also.

However there is a change in the varieties of paddy grown over the period. In our earlier survey it was reported that about two third tank ayacut area was cultivated under paddy varieties like Ponni and IRZO and the rest (1/3) by traditional varieties viz. Kodivellai and Kudiraival. Our resurvey shows that there are changes in the

varieties grown. An important change is that traditional varieties which were grown significantly in the village have disappeared. Also short term varieties like ADT36 and CO 43 are grown significantly (about 25%); the duration of these is about 90 days whereas the duration of Ponni is 135 days. The main reason for the change is reduction in the reliability of water supply in the irrigation system due to Cauvery water problem. Non-availability of traditional seeds has also contributed for the disappearance of traditional varieties. Disappearance of traditional varieties is also noted in other villages.

Traditional varieties are all long duration crops – though drought resistant, being long term variety it requires some minimum water supply for longer period. In the case of medium term varieties like Ponni, they are both drought sensitive and require water relatively longer period. The unreliability of water supply from the canal has discouraged farmers in growing these varieties.

Not only the canal supply has become unstable but also utilization of available water also become difficult due to encroachment of channels, conflict between tanks, uncontrolled weed growth in the tank bed etc. The inefficient management of water allocation by bureaucracy has also added to the problem.

Irrigation Institution and its Role in Water Management

An important finding of the re survey is the continuance of the traditional irrigation institution in the village with the same levels of activities as found in the original survey. The traditional 'Oor' (Village) *panchayat* is still intact and looks after village affairs including tank management.

Structure of Irrigation Institution

The irrigation organization is based on the caste structure of the village. The village belongs to a single caste and hence the caste organization acts also as a village organisation. The village organisation ('Oor' panchayat) consists of four members viz 'Karais'. They represent four different clans or kinship groups. As the villagers belonged to a single caste viz Chettiars only one caste is represented in the *Panchayat* unlike other villages where representation is given to all the castes. The panchayat members or karais are changed annually in the village meeting convened after the celebration of village festival. In the meeting, the village accounts are submitted by the panchayat and reviewed by the village people. Generally it is found that there is proper account maintained by the village panchayat on the utilisation of village fund.

Sources of Funds

As noted in the first survey, the village organisation continues to maintain funds. The main source for fund is the auctioning of fishing right in the tank. As the tank is under the control of PWD, villagers do not have the right over the fisheries. Hence the village organisation acquires the right every year from the government for cheaper rates and re-auction it for better prices. Generally the auction amount paid for the government is about Rs.1000 and reduction it for about Rs.20 to 30,000. The fund is utilised for maintenance of the tank and celebration of festivals. When the fund is inadequate, the organisation also levies taxes viz 'Thalaikattu Vari' a household tax. Depending upon the extent of the deficit in the fund, the rate per household is decided.

Role Of `Oor' Panchayat In Tank Irrigation Management

The `Oor' panchayat or Karai takes care of maintenance of irrigation structures and water allocation. Every year, before the start of the irrigation season, the inlet channel to the tank and leading channels from sluices of the tank are desilted. The village fund is utilised for the purpose. It is reported that about 10-15 persons work for 2 days, the total expenditure is about Rs.2000. As noted in the first survey, cash contribution instead of labour contribution is still prevalent.

Appointment of Water Men

Watermen are appointed every year after transplantation is over to take care of water allocation. Watermen are responsible for irrigating the field and farmers are not allowed to interfere in it. The watermen irrigate the field depending upon the water supply conditions in the field. It is noted that they are quite efficient in maintaining the equitable water supply without any bias. Watermen are appointed every year in the `Oor' meeting convened for the purpose immediately after transplantation. Their performance is evaluated in the next year meeting and they are changed if any problems found in their work. Watermen are all belonged to scheduled caste as existed earlier.

Remuneration

Water men are paid at the rate of two `marakkals' of paddy per acre per year by the ayacutdars. The remuneration was one marakkal per acre during the last survey and was hiked about five years back taking into account the inflation and also labour scarcity for agriculture due to availability of better urban employment.

Rules for Water Allocation

No specific rules are there for water allocation as irrigation is done entirely by watermen. However for raising of nursery, some allocation rules are followed : when the tank receives water supply from the monsoon (i.e. before opening of the canal), the decision regarding raising of nursery is taken. Depending upon the quantum of availability of water in the tank, the area to be sown for nursery is decided. The area is then allocated proportionately according to the land holding of the farmers. The decision is implemented strictly under the supervision of some panchayatdars appointed for the purpose. The above rule is framed to take care of nurseries. However farmers are free to grow additional areas under nurseries once the canal water is released. The rule is followed by the villagers traditionally. It is adopted basically to ensure nurseries for all farmers so that when the canal is opened, they can cultivate some minimum area of their lands.

Water Supply Conditions and Productivity

Farmers report that there is not much difference in the water supply conditions across reaches due to existence of the system of irrigation by watermen. Hence productivity is not affected by water supply condition but by the quality of the soil as discussed below. The same is noted in the earlier survey also.

Productivity

The average yield under tank irrigation is about 25-30 bags per acre. However, as noted earlier the yield varies according to the quality of the soil. In areas where soil is

alkaline the yield is reported to be about 15 bags only. The problem soil area in the tank has been increasing due to irrigation. It is reported that about one third area is affected by alkalinity problem. Farmers emphasise this as the major problem leave alone irrigation. This problem has been noted in our earlier survey also but the magnitude has increased. Farmers complain that the state is not taking adequate steps for reclamation of the soil and recommendation of suitable cropping pattern. Though a soil research centre is there in the district its role in solving the problem is reported to be negligible. As a result, farmers have incurred losses and reported to have sold a significant area under this tank as noted earlier. It is also seen that the ayacut area nearby the main road is being converted as plots for housing purposes.

Encroachment

Another important problem is the increasing area under encroachment especially along the inlet channel. As a result the breadth of the inlet channel is reduced affecting the canal water supply to the tank especially during scarcity. The encroachers are mostly from nearby villages. As they are socio-politically powerful, eviction seems to be difficult inspite of continuous efforts by the irrigation organisation of the village. Mostly they petition the collector for eviction of the encroachers. Some times they conduct agitations with the support of political parties for eviction of the encroachment. Urbanisation and pressure on lands have led to increased encroachment which has become an important reason for inter-village dispute.

Irrigation Institutions in Other Villages - A Comparative Perspective

The existence of village organisations to take care of irrigation problems is also noted in other villages like Theneripatti and Asur. However their role in the water management is found to be weaker than that of Aravakurichipatti.

In both Theneripatti, and Asur, the village organisation viz 'Oor' Panchayat exist. In the former, the village Panchayatdars are changed annually after the village meeting whereas in Asur it is not. In Theneripatti the village organisation is involved in both the appointment of water men and desilting of inlet channels. However rationing of area under cultivation during scarcity time (as found in Aravakurichipatti) is not in vogue here. In Asur, the involvement of village organisation in the water management like appointment of water men and desilting is not regular. Also misappropriation of village fund is reported in the village. The main reason noted for such less involvement in irrigation activities is factionalism in the village. As the village is multicaste village (unlike Aravakurichipatti which is single caste) collective action is noted to be less. Also the village belonged to 'Kallar' a dominant caste of the region, hence cooperation from other castes is seen to be less. In addition, the Asur tank is dominated by the few powerful big land owners who get more access to tank water by virtue of their socio-economic positions. This also retard collective action in the village. However in Theneripatti majority farmers are Udayars and Muthurajas, minority castes of the region. Also the Aravakurichipatti belonged to another minority caste viz. Chettiars. Hence village organisations in these villages are stronger than Asur. Due to fear of subordination by Kallars, they force cooperation among themselves. However as noted earlier collective action is relatively more in Aravakurichipatti which is a single caste village compared to Theneripatti a double caste village.

Role of Supra Village Organisations in Water Management

Another important finding of the re-survey is involvement of farmers organisations led by political party viz CPI(M) in the irrigation related issues. This is especially in villages (like Aravakurichipatti and Theneripatti) formed by minority castes. These villagers faced problems of encroachment of tank foreshore land by dominant Kallar caste people which retarded water supply to the tank. In addition there used to be obstruction of canal supplies to the inlet channel of the tank by upper reach tank ayacutdars who also belonged to dominant caste. This retarded filling up of Aravakurichi tank during each spell of canal supply by PWD. On these issues, the farmers organisations led by CPI(M) conducted agitations and also taken up these matters with the district collector. As a result these villagers could get water supplies uninterrupted during some spells. Thus we could see the emergence of supra-village organisations other than traditional ones. These organisations have taken up issues which could not be handled by village level institutions. They have taken up not only irrigation related problems but also social issues like against oppressions by dominant caste people. One such issue is intercaste marriage between Chettiar boy from Aravakurichipatti and Kallar girl of nearby village which was opposed by the Kallar people. The boy was kidnapped, kept in a secluded place and tortured. The intervention by CPI(M) led farmers organization at the district level helped to release the boy. The organization also helped the villagers belonged to minority caste to take up other issues like drinking water, road facilities etc.

Farmers in these villages are also reported to be paying annual kind contribution of 3-6 marakkals of paddy per acre for farmers' organization.

Summary

The above analysis brings out the following points regarding irrigation institution and agricultural changes over a period in the study area.

- The traditional irrigation organisation existed earlier during the first survey is still intact and its role in maintenance and management of water allocation continues to be significant. However their role differs depending upon the caste composition of the village. The institutions are stronger in the single caste village like Aravakurichipatti than multicaste villages.
- Farmers organisations led by political party have emerged to take up inter village conflicts. These organizations are involved in not only irrigation but also other socio-economic issues. They are found mainly in minority caste villages
- There has been a significant change in the land transfer in Aravakurichipatti village mainly due to losses in agriculture because of deterioration in the quality of the soil and consequent reduction in the productivity of lands.
- In spite of absentee land ownership to a significant extent, the Aravakurichipatti villagers show much interest in collective action as their livelihood continues to depend upon agriculture for which tank irrigation is the sole source of supply. Threat from upper reach ayacutdars (Who belongs to dominant caste) by way of

encroachment and obstruction of canal supplies also a reason for continued collective action in the village. Absence of factionalism and presence of single caste contributed for better collective efforts by farmers in the village.

- Conversion of agriculture land for housing purpose is slowly taking place especially along the main road.
- Encroachment and extension of area under tank ayacut has increased significantly reducing the reliability of tank irrigation.
- Continued State inaction in the matter of eviction of encroachers and undertaking repairs of main irrigation structures is an important problem as regards tank irrigation. Coupled with these, absence of concerned efforts by the state for dealing with alkalinity of soil, threaten the very basis of the agriculture of the region.
- Increased employment opportunities in nearby industrial town and expansion of transport facilities offered scope for absorption of displaced families from agriculture by sale of lands. The existence of better industrial labour market has also created labour scarcity in agriculture, which would give fillip to the diminishing of agriculture in the region.

Conclusions and Theoretical Implications of the Study

The study is concerned with irrigation institutions, its role in water management and changes in them over a period since the first survey was conducted in 1985. It rests on the premise that these institutions and their role in management are significantly conditioned by the agricultural and socio-economic environment (especially caste and class) of the region.

Maintenance of irrigation structures and regulation of water supply to tanks is fully the responsibility of the state. The state is not able to undertake these tasks efficiently. However the village level irrigation organisations undertake cleaning and desilting of channels which bring water to their tanks. Emergence of supra village organizations led by political party to take care inter-village irrigation issues. These organizations are involved not only irrigation but also other village affairs.

Though the bureaucracy is not able to regulate water to the tanks properly, local institutions themselves undertake such tasks. Collective action both in the appropriation of water from canal and allocation of water at the tank level is very significant. These organisation have well defined structures, rules and functionaries. The members of the panchayats are generally farmers with relatively larger land holdings and community influence in the village. They are assisted by professional watermen and watchmen, appointed during every irrigation season and paid through the ayacutdars contribution. Thus collective action as regards functions of water management is quite significant and brought substantial benefits to farmers in terms of access to water and productivity gains from irrigation. Had there not been such institutional arrangements there would have been substantial losses because of overall reduction in water in the system due to Cauvery water dispute and the increased problems due to encroachment and alkalinity of soils.

Caste plays an important role in the working of institutions and management of village affairs including water. The institutions are stronger in the single caste village like Aravakurichipatti than multicasite villages.

The continued presence of irrigation institutions and their role in water management and other village affairs point to the fact that pessimism expressed on collective action by theorists of 'tragedy of commons' like Hardin, and Gordon is exaggerated. The study also brings into focus that potential benefit from collective action is an important determinant as noted by collective action theorists like Wade and Ostrom. Though there has been a significant change in the land control, the villagers continue to show interest in collective action as majority of their livelihood depends upon agriculture for which irrigation is the basis. Not only irrigation but also the very life of villagers depend upon cooperation among themselves for the fear of subordination by the dominant castes. Thus as noted by Olson coercion is an important aspect of the logic of collective action. Also homogeneity of the group in terms of caste and kinship is another important factor for strong institution as noted by Tang.

The resurvey shows that irrigation systems are not existing as blue prints but continue to undergo changes in which institutions are important as noted by Chambers. Though there are many changes in irrigation and agriculture, caste (as a part of institution) continues to play an important role in irrigation and other village affairs.

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