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Three conditions are largely responsible for the low and unstable crop production of the semi-arid tropics. These conditions are the inherent deficiencies of the natural resource base, the insufficient and sometimes ineffective investment in improvements of the natural resource base, and the inefficient use of existing or potential resources because of social and institutional structure and insufficient diffusion of knowledge among farmers. This paper describes the village level studies set up using a multidisciplinary approach as an organized way of gathering original microlevel data to satisfy many of the needs of different researchers in ICRISAT. The study is limited to three zones, the Sholapur, Akola and Mahbubnagar districts. The studies were to provide the data base for the following types of analyses: tests of new practices against the existing farming system via cost benefit analysis and other checks of how the new technologies could fit into or supercede existing practices; examination of proposed research projects for their likely contribution to alleviating existing constraints; search of existing practices of farmers for components which might be incorporated into new technologies or improved research; and identification of formal or informal institutional arrangements evolved in the past to facilitate agricultural production and identification of institutional changes required to make adoption of new knowledges or investment packages feasible. The payoff, investment cost and its spread, gestation period, extent of out-of-pocket costs, and so forth are basic considerations influencing farmers' response to new technology.

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CONDITIONS FOR GROUP ACTION AMONG FARMERS

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ABSTRACT

Many problems of agricultural development affect not only individual holdings but larger environmental units. This makes coordination, or group action, necessary to deal with such problems. It would be useful to have a set of cross-culturally valid criteria by which to measure the likelihood of willing group action among farmers presented with a plan for the solution of such problems. In order to formulate such a set of criteria, we compare cases from different areas of India.

Our primary conclusion is that in the absence of expensive, centralized administrative control, local group action can only be based on rules which establish a society of reciprocity rather than redistribution with respect to the resource or activity involved. Willing participation can only arise if the resource in question works in the same way for all its users, and if each has the right and opportunity to protect his interests vis-à-vis the other users. Economic and organizational requirements following on this conclusion are discussed.

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CONDITIONS FOR GROUP ACTION AMONG FARMERS*

Victor S. Doherty and N.S. Jodha†

INTRODUCTION : FARMERS AND THEIR ENVIRONMENT

The following pages contain a discussion, in anthropological and economic terms, of conditions for the promotion and maintenance of group action among farmers whose improved use of agricultural resources depends upon collective measures. Although our examples include such phenomena as credit and marketing cooperatives, our purpose throughout is to demonstrate principles of social organization which can help promote the increased welfare of agricultural communities by coordinating and improving use of the natural resources exploited by their members. Natural scientists increasingly phrase their solutions to agricultural problems in ecological terms. The validity of this approach is nowhere so apparent as in the world's semi-arid tropical (SAT) regions. Disregard of the long-term ecological consequences of traditional farming systems is a principal reason for instability and stagnation of agriculture in these areas. Yet despite environmental constraints, the productive potential of SAT agricultural areas is greater than actually realized by traditional farming systems. The key to improvement lies in treatment of environmental units, not individual holdings.

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† The authors are respectively Social Anthropologist and Economist in the Economics Program of ICRISAT. They thank Janet Benson, Hans P. Binswanger, Matthias von Oppen, James G. Ryan, and participants in Economics Program and Farming Systems Program seminars for their comments and suggestions. The authors alone are responsible for the final contents of the paper.

THE NEED FOR WATERSHED-BASED SYSTEMS OF FARMING

Resource use cannot be changed from a holding-based to an environment-based pattern unless the technology underlying this use is changed. This is the strategy behind development of resource-centered technologies at research institutes such as ICRISAT. In the ICRISAT Farming Systems Program, a watershed or catchment is considered to be the appropriate basic unit of resource management and utilization (Krantz, Kampen et al. 1976). To ensure conservation and effective utilization of water--the most scarce of the natural resources for agriculture in SAT areas--a variety of measures are pursued on ICRISAT experimental watersheds. These include land shaping; a "broad bed and furrow" plowing system, with its variants; grassed waterways for drainage; and other treatments. The goal is to facilitate maximum penetration of water where it falls. Runoff is guided into farm ponds for use in supplementary irrigation during mid-season droughts, or for raising a second crop in good years. These soil moisture management devices are complemented by other measures, such as micro-adjustment of cropping patterns to soil and moisture conditions, and the use of HYV cultivars capable of increased yields under improved soil-moisture conditions.

The basic unit of study and development in this experimental framework is a watershed. However, for adoption and spread of any resulting technology, the individual farm holding will inevitably be involved. Fragmented and small holdings are characteristic of many SAT areas, where individual farm or parcel borders seldom coincide with watershed or sub-watershed borders. The real world situation is illustrated in Table 1, which presents

Table 1. Details of Land Holdings on Small Watersheds in India

Village	District	Details of watershed						
		Total area (ha)	Farms represented on watershed (No)	Average size of farm holding on given watershed (ha)	Range of holding size on watershed (ha)	Farm holdings smaller than average (%)	Soil types[a/] on watershed	Annual rainfall (mm)
1	2	3	4	5	6	7	8	9
1.Kanzara	Akola(Maharashtra)	19.9	13	1.5	0.4-4.5	69.2	MDV	819
2.Shirapur	Sholapur (")	16.9	13	1.3	0.2-3.9	76.9	DV	636
3.Darphal	Sholapur (")	70.5	30	2.4	N.A.	N.A.	MDV,SV	600
4.Khanderajani	Sangli (")	35.4	10	3.5	N.A.	N.A.	MDV,SV	425
5.Krishnapur and Takli	Dharwar (Karnataka)	43.4	29	1.5	0.3-4.0	N.A.	MDV	606
6.G.R.Halli	Chitradurga (Karnataka)	116.0	93	1.3	0.4-6.0+	47.3	DA,SA	612
7.Bayanapalle	Mahbubnagar (Andhra Pradesh)	20.0	30	0.7	N.A.	N.A.	DA,SA	792

Source : For 1 and 2 : P.N.Sharma and J.Kampen, *"A Feasibility Study of Improved Technology for Land and Water Management under On-Farm Conditions."* (Farming Systems Research Program) ICRISAT, Hyderabad (mimeo).

For 3-7 : Unpublished reports of the District Committees, prepared during Training Program for DPAP Officers, organized jointly by All-India Coordinated Research Program for Dryland Agriculture, Central Soils and Water Conservation Research and Training Institute and ICRISAT April 10-17, 1977.

a/ Soil Types :

MDV - Medium Deep Vertisols
DV - Deep Vertisols
DA - Deep Alfisols
SA - Shallow Alfisols
SV - Shallow Vertisols

details about farm holdings within typical watersheds surveyed in parts of SAT India.[1/] In different watersheds the number of farm households represented ranges from 10 to 93. Average size of landholding per farmer in a given watershed ranges from less than a hectare to 3.5 hectares. In three of these watersheds, from half to three-quarters of the holdings are smaller than average.

IMPLICATIONS OF THE FRAGMENTATION OF WATERSHEDS:

The data in Table 1 have clear implications for the adoption of any prospective watershed-based farm technology. Systems designed for an experimentally unified watershed cannot be adopted readily by most individuals, since property boundaries will seldom coincide with watershed boundaries.[2/] Thus watershed-based farming systems and individual farming systems seem to be opposed. It may be possible however to deal with such difficulties through social means. The required institutional mechanisms to coordinate decisions by individuals can be locally initiated and maintained, government patronized, or both. Effective institutional means which can assure a maximum of group action, or locally generated cooperation among farmers, are likely to be the cheapest means for the government involved and should therefore be of the greatest interest. It is on such means that we concentrate in this paper.

1/ The purpose of most of these surveys was to plan watershed development, on the basis of prospective watershed technology, by the Drought-Prone Area Program (DPAP) of the Government of India.

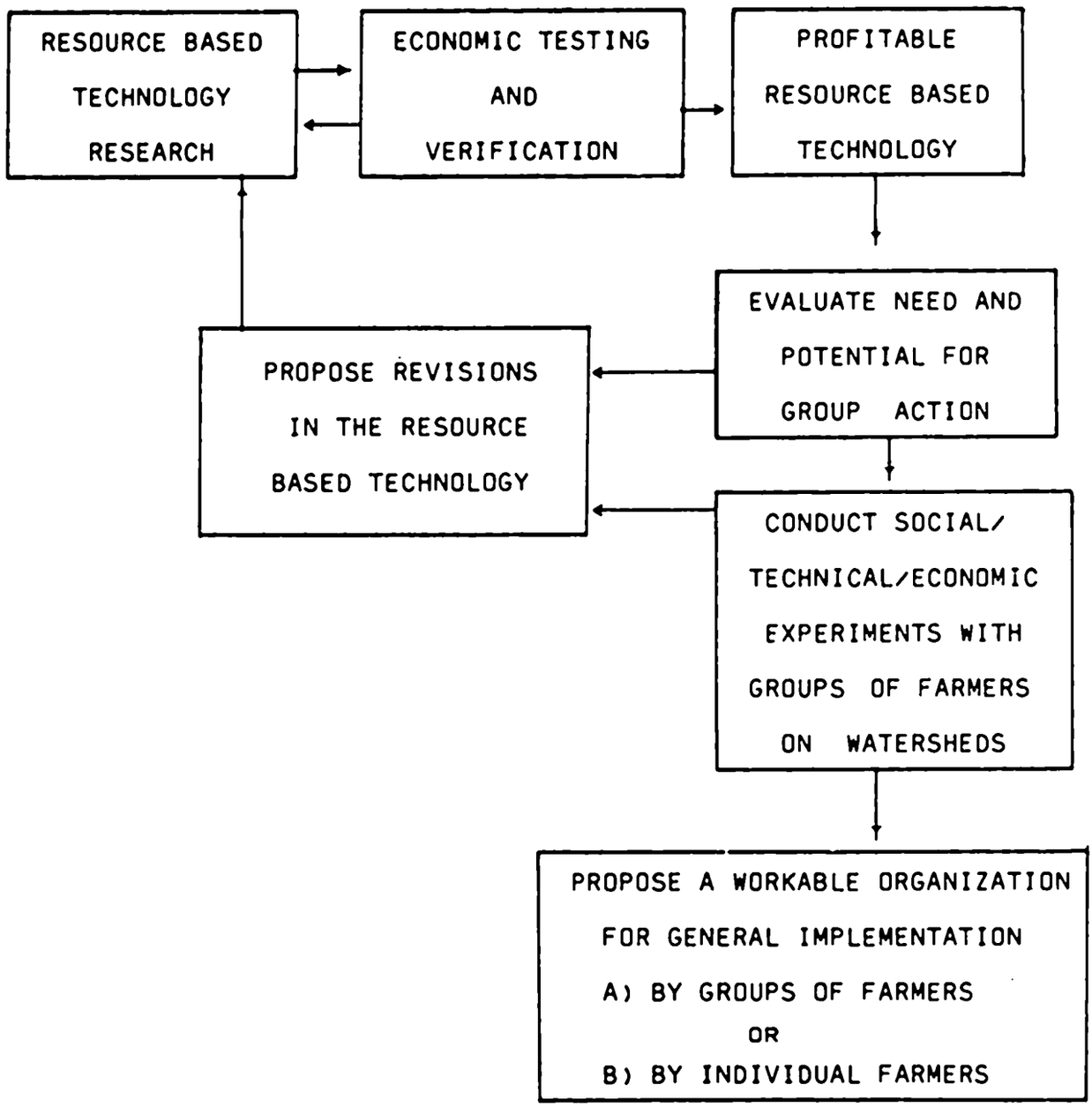
2/ Difficulties and unsatisfactory results in contour bunding programs in India in the past were largely due to farmers' resistance to any bunding which interferes with their property boundaries. Their resistance was not to bunding *per se*, on which many of them expend considerable investment.

The search for such institutional mechanisms is an important part of the technology generation process. We have diagrammed this process in Figure 1, indicating the position of theoretical and field research on institutional mechanisms. The search is for means to bring people to act in common; to engage in group action for a collective good. If this search ends unsuccessfully the technology itself may have to be modified to depend less on farmers' collective action. Alternatively, the technology may be made divisible and adoptable in stages, including elements which at each stage can induce group action on the part of the farmers. Finally, the technology itself may decide whether group action, if necessary, will be temporary or permanent, short- or long-term.

In this paper we discuss conditions derived from examination of cases in India, which we feel should be tested for their use in evaluating technologies which may require group action. We feel that these conditions, or a revised set which may result from later testing, will be useful in determining whether group action is necessary for the adoption of a proposed technology, and in showing what degrees of institutionalization and outside help may be necessary to maintain the group action itself. Watershed-based farming systems such as those under development at ICRISAT constitute a new technology for the semi-arid tropics. Thus there are no full, field applications in existence from which one can draw conclusions respecting this technology alone. There are enough successful and unsuccessful cases of group action by farmers in other areas, however, to suggest necessities of human organization which this technology will have to take into account.

FIGURE 1

DEVELOPMENT OF TECHNOLOGY FOR INTEGRATED TREATMENT OF WATERSHEDS



CONDITIONS FOR GROUP ACTION

Logically the term group action can refer to a wide variety of more or less coordinated events involving a number of people. In this paper we are concerned with a particular kind of group action : measures adopted by a group to provide its members with common benefits. In agreement with Olson (1971) we assume that individual use of the common good, or individual benefits derived from its existence, provide the motivation to engage in group action. On the basis of the cases to be considered below, we hypothesize that group action can be elicited if a number of conditions are met in the nature of the benefits, and in the circumstances of their provision. These conditions are:

Collective good

Organizational good

Individual profit

Compensatory profit

Functional identity

Appropriate group size

Structural guarantees

Before considering the cases from which they were derived, the conditions themselves are discussed briefly in the next section. In general we wish to note that these conditions describe a society based on reciprocity rather than on redistribution; the common benefit derived from group action works in the same way for all, and each has the right and opportunity to protect his interests vis-à-vis the other members of the group. It should also be noted here that the final condition providing for structural guarantees is

quite important. No society today--even(or perhaps especially) a society of small-scale farmers--is independent of outside pressures. Nor is any farmer equal to his fellows in all economic respects. In order that these imbalances not destroy the conditions for group action some arrangement to guarantee the working structure of the group must be available. Such an arrangement will probably be sanctioned ultimately by government; its actual operation could be administrative, financial, or through managerial devices adopted by the group. We specify passive guarantees, however--not active coercion. Coercion of course is more expensive, and thus to be avoided on economic grounds alone. It will not be necessary in any case, and development will be much smoother, if the conditions set out here are met.

DISCUSSION OF CONDITIONS FOR GROUP ACTION

A collective good, following Olson (1971), is identified by the impossibility of excluding any member of a group from its consumption, if one member consumes it. Examples of pure collective good would include national defense and malaria eradication programs. In this paper, however, we consider only those goods which can be divided among the members and individually disposed of; we are looking, for example, at improved productivity on individuals' holdings and not at the macro-climatological effects of widespread watershed based management in a region.[1/] Collective goods are defined with respect to specific groups, and to initiate group action

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1/ Such macro-effects are sought, of course, but probably cannot be realized without providing individually divisible benefits.

it is important to identify a group for which the provision of a true collective good is possible. If some farmers on a watershed dig wells for irrigation, thus providing themselves with private goods, they will perhaps have no need of the collective benefits from watershed development. If their land occupies key positions, group action may be impossible unless by government fiat. If watershed development will substantially improve the water table adjacent to the watershed, it may be necessary to include the farmers there in some way. In cases where such problems of group composition arise, it is often best to reconsider things from a technological point of view.

Potential for a collective good is not in itself a sufficient reason for group action. The collective good must also be, in another term of Olson's, an organizational good : it is not available unless the potential beneficiaries organize themselves to procure it. We must add further points concerning the level of payoff which will be necessary. As a rule of thumb, one could suppose that the required level of individual profit to a member of the group is about equal to the percentage return on investment required to motivate the establishment of an individual business in the same area (economic environment) where group action is proposed. Further increment in payoff is necessary, as compensatory profit, for the transaction costs and loss of individual discretion involved in joining and cooperating with the group. Even if membership is coerced, such coercion is unlikely to be successful in its purpose unless profits and costs are covered in this way.

These points concerning collective good, organizational good and payoffs comprise the basic economic points in our argument. In addition it is necessary to consider anthropological requirements--principles of social organization which describe the types and sizes of groups in which human beings combine successfully for different types of activity. These points are brought out in Marshall Sahlins' (1965) discussion of reciprocal vs. redistributive economic societies; and by a comparison of the size, purpose, and longevity of human groups under different techno-environmental conditions. They emphasize a need for functional identity of the collective good, and for appropriate group size, if group action is to succeed.

Redistributive and reciprocal societies both provide collective and organizational goods. They operate in very different ways, however, with very different implications for group action. In a traditional society based on reciprocity, participation in economic exchange is enforced upon all members of the group, but the enforcing agency is community pressure alone--there is no central authority involved. People exchange items among themselves according to need, and with the implicit agreement that a roughly equal return will be forthcoming, sooner or later, in reciprocity for any particular prestation. All participate because they must, in order to occupy an economic niche or territory which can only be used by a group and which can only be used in the same way by all. The textbook examples of societies based on reciprocity are hunting-gathering societies; the reward for participation is continued privilege to exploit the commonly occupied hunting-gathering territory. It is very important to realize that this type of economic society (or sub-society)

is of universal occurrence, and is not limited to association with one type of techno-environmental system. The key points are: first, existence of a common resource which cannot be exploited efficiently (defended) without the participation of the group; and second, the equal power of all concerned to participate and to preserve their individual interests. Reciprocity among members is a direct outcome of this kind of economic base. For modern examples, observed at the highest levels of techno-environmental complexity, one may look to successful industrialist subcastes in modern India, professional associations worldwide, and oligopolistic business combinations in the United States and Japan.

Redistributive systems, in contrast, are based on inequality of power and diversity of individual interest. In a redistributive situation the society's product is centrally pooled and redistributed to individual members under the direction of some coercing person(s). This is the basis of organization of chiefdoms, state societies, and all subsystems based on differential power. Redistributive systems are not necessarily inegalitarian--complete and strictly equal redistribution of the common product is the rule in some such societies (Oliver 1955). It is more common however that the person, group, or class in control manages to retain a greater amount of this product relative to the non-coercing members, and to introduce differences among the other members as well. Most importantly, the coercing members gain, in addition to the subsistence (for example) in which all participate, additional benefits of enhanced power and prestige which can be used to support their further differentiation from the other members. The crucial difference there-

fore lies in the functional identity of reciprocal systems for their members, and the lack of such identity for participants in a redistributive system. Most redistributive systems must be based ultimately on force, since although the good--a harvest of grain, for example--may be both collective and organizational, it has entirely different meanings for different members of the society. In a hunting-gathering environment the territory occupied functions identically for all members of the group : it provides subsistence. A landlord with his attached laborers in southern India (Epstein 1967) constitute an economic society also, but the grain produced on the landlord's field is handled in a redistributive manner and as such means very different things for landlord and for laborer. For the landlord it is a basis of power, a source of prestige, and a basis for (limited) luxury consumption. For the laborer it represents only assured subsistence at the same minimal level in both good and bad years. Redistributive systems are unstable ultimately, and are difficult to institute unless based on considerable differences in power available to their members. Lack of functional identity prevents common interest in maintenance of the system, encouraging individuals and sub-groups to attempt to change places or to subvert its working.

Finally we note that different sizes of human group have different rates of longevity, and are typically organized for different purposes. To draw a simple example, we note that in hunting-gathering societies it is the regional ethno-linguistic group that has long term coherence and which occupies (in at least a de facto way) the common

territory. It is within the regional group as a whole that ceremonial unity and systems of marriage alliance are maintained and that any individual's complete set of reciprocal relationships is spread. The living group or local band on the other hand is a quite temporary thing, changing in size as individuals and families move in and out from week to week and season to season. There are seeming "equilibrium sizes" associated with such hunting-gathering groups--perhaps 500 persons for the regional group, and from 25 or 35 up to as many as 75 for the living group (Birdsell 1968, Williams 1968). These numbers as such almost certainly depend upon subsistence/technological and marriage network requirements. Nevertheless if we assume that a married pair with their dependents (children or aged parents or both) constitute a basic unit of economic interest and production averaging five persons, we have the round numbers of 5 to 15 units for a small group and around 100 units for a large group, based on observations of hunter-gatherers. It is worth considering and testing in later studies whether these represent approximate optimum sizes for short- and long-term group action in other types of society, and whether they are applicable to the organization of farmers for resource development and control.

We may conclude in any case, however, that the gross size of a group is closely connected with its purpose, and in turn with its duration. All members have a common interest, for the moment, in the maintenance of a living group--but it is difficult to maintain this for very long. Small size intensifies interpersonal contact, thus increasing chances for disagreement, and at the same time increases the leverage that can be exerted against the group as a whole by one

or a few members. We may make the general conclusion, useful to our purposes here, that small groups are task groups, while large groups are suited to long-term maintenance. Technology and economic/political environment will help determine how large a large group must be to avoid factional takeover, and what minimum size is necessary for a small group to accomplish a one-time task. Benefit-cost analyses will have to take into account that transaction costs are larger for a large group, but these costs will have to be borne nevertheless if the nature of the benefit requires a large group for long-term action.

The conditions for successful group action summarized again are collective good, organizational good, individual profit, compensatory profit, functional identity, appropriate group size, and structural guarantees. We now proceed to examine how these conditions are met, in actual practice, in group action undertaken by farmers. Our examples will be drawn from the areas of credit and marketing cooperative societies, projects involving land-shaping and the provision of access to lift irrigation, and surface runoff reservoirs (tanks) for gravity irrigation.

GROUP ACTION FOR CREDIT AND MARKETING

Financial cooperation is a means often recommended to farmers; it has been of great benefit in some circumstances, to some farmers, in some areas. In India after independence there was a concerted government drive to establish credit cooperatives throughout the country. Marketing was also considered a possible avenue for cooperative action; but it was

regarded as second priority, suitable for addition to credit cooperatives' functions after the primary business of making cooperative loans was established. In practice, the situation proved to be exactly the reverse. Marketing societies, where tried in Gujarat and Maharashtra states, were much more successful than credit societies. One of the present authors, in a study of the situation in Gujarat, concluded that "the cotton societies show that the most effective way of linking credit with marketing was to start from the marketing side rather than the credit side" (Jodha 1974:80). The same situation is observed in Maharashtra, where sugar processing and marketing cooperatives were quite successful. The Amul Dairy and those dairies established after its pattern in Gujarat are well known as successful ventures in the collection, central processing, and cooperative marketing of milk and milk products.

Credit cooperatives, on the other hand, for the most part failed. Even when successful they were often prevented by factionalism from serving local populations on the whole-village scale originally envisaged by planners. Jodha (1974:82) notes the importance of factionalism in impeding development of credit cooperatives and in limiting their membership. Orenstein (1965) provides illuminating case analyses from a Maharashtra village, noting that membership in a given credit society tended to consist of a single faction's members, along with their clients and a few neutrals.

Several of the conditions for stable group action discussed above seem to have been missing from the credit cooperatives as these were first established. The most important seems to have been a lack of functional identity of the credit resources offered. Cheap guaranteed credit offered by the government to both large and small farmers meant different things

to these groups. For both it was more than a simple resource for agricultural production. For large farmers it also represented patronage, and for small farmers it represented independence. Local political/economic leaders sought through faction-based societies to deny credit to their adversaries or to those persons whom they wished to see continue as tenants and agricultural laborers. Failure of the cooperatives to realize functional identity was implicitly recognized in the Report of the Reserve Bank of India (1969) which recommended establishment of the Small Farmer Development Agency.

Since there was no functional identity in the case of credit, in most instances it was difficult or impossible to provide a collective good which would maintain the interest of all members. The condition of organizational good was also missing, since the government was flexible in its application of rules and many bogus societies were recognized. For something as necessarily long term as a financial institution, inappropriately small size also seems to have been a common problem. All these deficiencies made it difficult to provide structural guarantees. Access to subsidized credit by all classes of farmer finally improved after the government, for reasons of administrative economy, decided to amalgamate the local societies in several-village areas into single larger institutions controlled by the government. Credit societies seem to have foundered in many cases simply because the nature of the resource was inappropriate for group action under conditions then commonly prevailing in Indian agricultural society.

Marketing cooperatives, where they have been tried in India, have on the whole been much more successful than credit cooperatives. Table 2 summarizes the experience for both kinds of institution in each of two Gujarat villages. Major factors in the success of marketing cooperatives

Table 2. Details (average per society) of Credit Cooperatives and Milk Cooperatives in two villages of Vijapur Taluka of Mehsana district (Gujarat) 1969-70.

Particulars	Credit Cooperatives	Milk Cooperatives
Period of operation (years)	18	7
Working Capital (Rs '000)	22	36
Proportion owned resources (%)[a/]	35	93
Total members	239	372
Beneficiary members (%)[b/]	13	100
Average landholding of beneficiaries (ha)	17.8	5.3
Services received per beneficiary (no)	<2	6
Per-beneficiary value of transactions with/ through the society (Rs) c/	632	2218

Data collected during a study of cooperative credit societies in selected areas of Gujarat (Jodha 1974).

a/ Proportion of owned resources to total working capital.

b/ Members who had at least one transaction--borrowing, buying, input, selling product, etc.--with the society during the reference year.

c/ In the case of credit cooperatives transactions are mainly borrowing, at interest rates 5 to 10 percent lower than charged by private lenders. In the case of milk cooperatives, transactions are sale of milk at prices nearly 25 percent higher than market price, free or subsidized veterinary services, supply of processed feed and nutritious fodder seeds at subsidized prices, bonus on milk sold, etc.

seem to be that for such groups it is relatively much easier to provide the conditions of functional identity, collective good, and organizational good. The famous milk processing and marketing cooperative enterprises in Gujarat (Chothani et al. 1976; NDDB 1976; Patel and Desai 1976) provide a good example. These organizations are by now highly centralized and experienced, which makes the initial establishment of village-level milk producers' cooperatives much easier. Nevertheless, if farmers are to have access to the assured markets and concessionary inputs of Amul, Sumul, and the other dairies, a certain number of these farmers in any given local area must agree not to sell their milk elsewhere despite temporary inducements or seasonal difficulties; they must form a managing committee at the village level; and they must arrange to look after routine business on a day-to-day, long-term basis. The provision of market power, available equally to all members but only to members, and at the same rate per unit of milk provided [1/] constitutes a truly collective and organizational good, which functions identically for all to build up their profits in a specific area of production.

Cotton marketing societies in Gujarat tell the same story (Catanach 1970). These grew from small beginnings initially motivated by worsening malpractice on the part of dealers (see Choksey 1968), and by the self-reliance themes of the Indian independence movement which was gathering force in the 1920's. The number of local societies of the South Gujarat Cooperative Cotton Marketing Union (SGCCMU 1977) grew from 11 in 1931 and

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1/ Depending on conformation to different standards of non-fat solid (SNF) and fat content.

51 in 1951 to 124 in 1976. In these years the percentage of all Surat District Cotton sold through the Union was 5, 24, and 60 percent respectively. As the parent organizations grow in experience and size payoff also becomes more assured and local societies are able to reduce transaction costs to their members. As a factor enabling such development, we emphasize the functional identity of the good provided by marketing societies. Before the crop-loan system was instituted against abuses, credit from government-sponsored societies could be used for any (or no) crop; and, as we have seen, credit *per se* may not have been a member's main object in joining. One joins a cotton cooperative, however, only in order to sell cotton, and can obtain member's credit for planting the next season's crop only on the surety of returning cotton to the society. Finally, it soon becomes apparent to members that their individual share of market power is increased if more rather than fewer persons join. This improvement in the collective good as the organization grows is probably the main reason behind the relatively quick acceptance into the societies of lowcaste persons by highcaste members, a development commented upon throughout the literature on the Gujarat milk cooperatives.

GROUP ACTION FOR LOCAL IRRIGATION CONTROL

So-called tanks (rainfed irrigation reservoirs) are a common feature in India where climatic and soil/subsoil conditions are appropriate.[1/] Historically, tanks have been an alternative to canal irri-

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1/ One is likely to find tanks in areas where there is a long dry season; where rainfall is uneven and intense during the wet season; where soil is quickly permeable and relatively unretentive of water; where evaporation is relatively low during the main periods of collection and use; and where impermeable subsurface rock formations minimize percolation losses (von Oppen 1977).

gation. Local rulers with relatively few resources at their command found that it was still within their means to raise agricultural production, and thereby their revenue, by commanding the construction of tanks. There is a very common cropping pattern which occurs with traditionally run tanks, which may be determined in important part by sociological pressures.[1/] To understand cropping patterns under tanks, they should be seen in perspective. The clearest contrast is with well irrigation--from seepage wells, which are common in the same semi-arid areas.

With tanks, the usual cropping pattern up to now has been simple--paddy rice. If the impounded water is sufficient for two crops, rice will be raised on a relatively large area during the rainy season and a second crop of rice will be taken on a reduced area during the post-monsoon season.[2/] In parts of Andhra Pradesh now, tanks have been built for which a local board or the Irrigation Department is to work out a coordinated but diverse cropping pattern and irrigation timetable, taking into account the applications of various users for water to grow "irrigated dry" crops such as sorghum or groundnuts. It is notable, however, that so far this has required considerable government investment in field channels, etc.,

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1/ This entire area (of tank irrigation) is a vexed one, requiring special study on its own to separate sociological and economic factors. Such a study, to be carried out in India and based on data collected from tanks under both traditional and newly-developed systems of management, is proposed for the near future.

2/ Without sophisticated staffing and technology, large-scale canal irrigation often produces the same single-species cropping pattern (Wade 1976). Depending on the amount of water available, this may be rice, sugar cane, or another crop. When, under such conditions, farmers utilizing the same subdivision of a canal do not grow the same crop at the same time, there can be considerable friction (Tantigate 1975).

and continued government control. The system is still experimental (and is unstudied). Tanks which run on local momentum except for upkeep subsidies tend to show the unified pattern. Group action is minimal in the case of traditionally run tanks, but it seems to be important. Rulers or landlords ordered them built and district governments provide for their upkeep. Local officials, by and large, decide when the sluices will be opened and for how long. None of these administrative mechanisms could act, however, unless they represented a consensus among the farmers. Even with state sanctions based ultimately on force, it is necessary that a user's consensus exist or be induced for the system to be stable. In the case of traditional tanks, minimum outside administrative effort and force are applied, and the consensus seems to emerge in favor of functional unity. There are many agronomic, climatic and consumer-preference reasons why the crop chosen is rice rather than any other grain; but the facts remain that there is a unified rather than diverse cropping pattern, based on a usually uniform distribution of water in the primary area served.[1/]

By contrast, well irrigation in the areas where one finds traditionally-run tanks is often quite complex. With wells one finds a great variety of crops, depending on the local market and transportation situation and on the farmer's subsistence needs. Bananas, rice, sugar cane, groundnuts, wheat, finger millet, and papayas are a few of the crops grown under well irrigation in semi-arid India. Moreover, several of these are

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1/ Edmund Leach (1968) provides a detailed account of the very precise tenurial and mechanical means used to assure access of all users to the same amount of water per unit area served by a traditional Sri Lankan tank for paddy rice irrigation.

grown in combination, on different plots at the same time with water from the same well. In principle this seems perplexing, since it constitutes differential response to identical market conditions. One main reason for this differential response may be the need for functional identity of a common resource. A well owner is independent. But since different crops use different amounts of water at different times, and consume different quantities of water over their span of days to maturity, there can be no functional identity for the users of a traditional tank unless each one grows the same crop at the same time. Logically enough, this crop is paddy. It has the advantage of being a staple foodgrain, welcome to both large and small landholders; its growing season is short enough not to overstrain tank capacity; and of all grains it uses the greatest amount of water per unit of cropped area. When all use the maximum, all are equal proportionately. Finally, even if all do not plant at exactly the same time, continuous flooding of all fields is practical with rice, and one can get around the irrigation timing problem in this way.

It has been suggested that tank water is too precious to use for rice in the semi-arid areas; that comparative advantage could act to increase overall agricultural production if tank water in such regions were used more extensively; and that the more humid regions should be left to concentrate on paddy. It is possible that for the reasons discussed above this cannot come about without considerable increases in the administrative effort and/or engineering investment applied to tanks. The question of cropping pattern needs close study in any particular case, from the combined viewpoints of hydrology, agronomy, economics, and social analysis.

GROUP ACTION FOR IRRIGATION DEVELOPMENT AND FOR LAND SHAPING

In the closest approximations to actual watershed development we have examined, it is possible to see the conditions respecting collective good and group size in action. These examples comprise the so-called joint farming groups in Rajasthan and Gujarat (Choudhary 1972), and the water users' cooperatives (lift irrigation schemes) in Maharashtra.

Joint farming groups are the practical remnant of a government-sponsored program for cooperative farming which began in the 1950's. This underwent many changes and vicissitudes, being widely used as a cover for landholdings in excess of ceilings, and for concealment of tenancy. As successive laws have eliminated the grosser possibilities for tenurial abuse, joint farming has become in effect a government-sponsored loan program widely used for land-improvement projects. There is much badly eroded land in Rajasthan and Gujarat--land potentially of good quality but needing extensive reclamation. Several farmers whose holdings of such land adjoin each other (often these persons are relatives as well) seem to have little difficulty in jointly applying for a loan, hiring machines to have the work done, and supervising the work. Each cultivates his own plot individually; Choudhary says that such societies always dissolve after a few years when the improvement work is complete. Often only four or five farmers are involved. Recalling our suggestions above, the small-sized task group seems to be most efficient in terms of transaction costs since only relatively short-term cooperation is required. Initial formation seems to be facilitated by the functional identity of the benefits involved, as well as by the previously existing close relations one commonly finds here.

Larger group size goes along with longer-term benefits in the case of water users' cooperatives. But these coordinated lift-irrigation schemes, based on a river or a government canal, have a history of difficulties encountered in their formation, and of increasing outside involvement in the program. This outside involvement seems to be due in large part to problems of group definition. Where these problems were not solved, the provision of structural guarantees proved difficult. Lift irrigation cooperatives, sponsored by the government as a part of the "Grow More Food" campaign, began in Maharashtra in 1949. By 1970 the state had nearly 290 cooperative lift irrigation schemes, with a total irrigable area of 74 thousand hectares. Scheme command areas varied from 25 to more than 400 hectares (Mohite 1970). The payoff to irrigated agriculture is so high that potential members respond readily. The demonstration effect of successful groups is strong; and help is taken from those already running such groups. However, despite the clear economic payoff, the formation of these cooperatives is not as smooth as the benefits from them would indicate. The following problems have proven important. First, coverage of one's land area by water from the scheme is greatly influenced by the location of water distribution points and the arrangement of channels, pipelines, etc., in relation to individual plots. Influential members of the cooperative can manipulate these matters. Some farmers whose land falls within the command area of lift irrigation schemes have refused to join, claiming that their share in the irrigation benefits was reduced through irregularities at the formative stages of the scheme. Secondly, some farmers with strategically located plots refused to join, evidently hoping for increased groundwater to be tapped by their private wells at no charge. Finally, in some cases, established cooperatives ran into trou-

ble when members refused to take water; official specifications were for (relatively) low-value, low water-consuming foodgrain crops on lift-irrigated land, which greatly reduced potential profits (these and other problems are discussed in Mohite 1970).

In 1962 a state commission proposed remedies. One of the most important changes was an increase in attention to purely techno-economic (rather than political) factors in the location of field channels and overall design of a particular scheme. Structural guarantees on these points were provided by increasing involvement of the state land development bank and of the nationalized banks. In the case of holdouts, persuasion was tried. Both holdout and non-user problems seem finally to have been reduced by the very groundwater recharge which initially prompted holdouts. Crop restrictions do not apply to land irrigated by wells. With both well and lift irrigation water available, one can raise very long-term crops like sugar cane, for example. It seems that on balance the activities of these organizations have been successful in increasing agricultural production. It also seems clear, however, that group action according to our definition proved difficult and required a number of adjustments before it was achieved. The problem of "last holders" (Olson 1971) or "free riders" was difficult at the beginning; it was finally solved when the technical possibilities of groundwater plus lift water gave holdouts a positive inducement to join the larger group. Large size also made for high transaction costs; managerial work was detailed, technical, and continuous. These difficulties seem to have been overcome in part by employment of managers or promoting agencies to assume the burdens. Such adaptations seem to be called for in the case of large groups, when coordinated activity is needed over the long-term.

SUMMARY AND CONCLUSIONS :

In recapitulating the conditions for group action which have been set out here, the conditions of collective good and functional identity stand out especially clearly. All of the conditions are of coordinate importance--none of them can be neglected if group action is to be successful. These two conditions, however, are of the most importance in determining whether or not there is actual scope for group action in any given case. If a collective good and functional identity are present, then whether or not the benefit sought is an organizational good determines whether the farmers' active participation or simple acquiescence to an administered plan will be necessary. Touching profit, it is of course assumed that any new technology must be profitable to be accepted. We make the further conditions here however that in order to generate group action the profits must be divisible among individuals, and that these individuals must be compensated by some further increment for the loss of discretion experienced in adhering to the rules of the group. Small groups of five to fifteen farmers are task groups, while only larger groups in the neighborhood of perhaps 100 farmers can maintain the momentum and enforce the rules necessary to keep up group action on their own over the long term. The necessity to identify the appropriate group size for the result or activity desired is thus quite important. Finally we note again that as <u>ultimate</u> guarantor the government or some similarly impersonal institution must stand behind group action. The technological and social complexity of today's world make it too easy, otherwise, to subvert even the bestplanned arrangements. If such a

passive but effective guarantee is available and our other conditions are met, local action will be forthcoming and can support day-to-day work and decision making.

It is important to know what use to make of this knowledge, and how to improve it. We believe that the list of conditions for group action among farmers, presented above, constitutes a useful framework for evaluation of the likelihood of successful cooperation by farmers in common tasks to promote agricultural development. The lessons of the cases examined--in credit, marketing, land-shaping and irrigation--seem clear. Further work on this topic is necessary and study of additional cases of this sort will prove useful. The highest payoff at this point however is likely to come from controlled experiments in group action with farmers themselves--experiments in social action designed as diagnostic tools and considered as part of the process of technology development. From such experiments we can learn to what extent group action is or is not necessary for the widespread adoption of a new technology. On the basis of this knowledge and with the increased practical understanding of group action gained through such diagnostic experiments, effective strategies and organizational plans can be developed for the introduction of profitable agricultural innovations.

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