

10/2003 RE
WORKSHOP IN POLITICAL THEORY
AND POLICY ANALYSIS
613 HOWLE PARK
INDIANA UNIVERSITY
BLOOMINGTON, IN 47405-3000 USA

CPR INSTITUTIONS:

GAME THEORY CONSTRUCTS AND EMPIRICAL RELEVANCE¹

Nirmal Sengupta²

This paper is based on my experience of blending theoretical methods with field-based methods for understanding collective action on the commons. The workshop proposal includes (p. 2) as a point of inquiry, "... how theoretical methods and field-based methods can best be blended." Unlike anthropology, where field-based methods are systematized, the economists talk at the most of field experiences. There is a big difference between experience and method. What may be a field-based method for economists? Economists work with models. Not only realities in field are approximated by modifications of models but also models may be chosen to cater to the needs of the field, for policy or other purposes. I feel model making, fitting it better to the reality and choosing models to respond to field needs is what is field-based method for economics. Research on commons is one such area where facts from field have contributed to modification of economic theory and models. This provides an excellent scope for studying the field-based methods of economists. The present article is my understanding of the collective action theories in commons, which grew as a field-based method. In this paper I describe the development of game modeling of collective action in commons, suggesting why some matters were accepted, some rejected, and some others are still awaited. The first section is about the emergence of CPR game theories of commons as a field-based method. The second section lists a few questions raised in the field indicating the need for modifying game model in specific direction. The third and final section introduces certain recent efforts of theorizing in these directions.

¹ For Centre for South Asia Studies, UCB seminar, Goa, August 2003.

² Madras Institute of Development Studies, 79, Second Main Road, Gandhinagar, Chennai (Madras) - 600 020, INDIA; Email: nsengupt@mids.tn.nic.in

The Beginning

Theory of Collective Action

In the early nineteen seventies, while making a Perspective Plan for the State of Bihar, I had a chance to move a little away from input-output tables, matrix inversion and computer simulations. I was required also to assess the local resources that might be used for making a developmental Plan for the State. I went around the State talking to people, to know more about local resources. And this is the wonder; I did actually find some potential but neglected resources. The local people talked of many local resources. For the present study I mention only one of these, an irrigation system of Bihar. The people in this area would show me some rudimentary embankment structure and fondly mention the name *ahar*. I could not follow why were they important. But I started collecting information on their potential as resources. Gradually I learnt that there were about ten thousand *ahars* in that region. Together, they stored as much water as a major dam, and had made south Bihar (Magadh) *immune to both flood and famines*³. At the same time, these were not listed in irrigation statistics. The officials had not the slightest idea of their potentials⁴. Later, I studied other parts of India and found traditional irrigation and water management systems of comparable importance. For years I have argued that the *ahar-pyne*, and systems like these⁵ deserve to be developed and extended. But how? What exactly should we do? If government was so negligent that even the official data did not show *ahar-pyne* irrigation, then how were these surviving? How were these indigenous

³ As per government reports. I wrote about this system in Sengupta (1980). A detailed account is now available in my recent book Sengupta (2001).

⁴ This is not very surprising. Most CPR were 'discovered' after we became aware. In many areas two Census shows wide difference between village common land categories. Local genetic resources are being discovered though the local people knew those all along. Of course, property relations and knowledge are abstracts. Missing physical structures of irrigation systems is more surprising. Reasons however, are the same (viz. Sengupta, 2001).

⁵ I did a study of the so-called traditional irrigation systems all over South Asia, published as "Irrigation: Traditional vs. Modern" and later book (Sengupta, 1993). The IIMI (before it became IWMI) used to publish a bulletin of Farmer Managed Irrigation Systems all over the world, which too reported several locally important irrigation systems.

system being managed? The basic question that I had in the nineteen seventies was one of management.

How were these traditional irrigation systems managed? The colonial government had a simple answer for all such questions – zamindars manage anything and everything in their domains. My early work published in 1980 was based on reading of government documents as they were, not between the lines. I wrote naively that zamindars constructed and maintained⁶ *ahars* and *pynes*. This fitted nicely with the reigning theory of that period, that of Asiatic mode of production further vulgarised by Oriental despotism thesis of Wittfogel. In essence, these theories postulated that authorities like zamindars were essential for construction and management of irrigation systems. My field experiences however, stood in sharp contrast. The zamindars were there no more after zamindari abolition. The present authority, the government, did not even know of their existence. There simply was no effective authority to lend support to the Wittfogelian thesis. By then, in research world too, doubts about the role of despotic (even benevolent) authority had started creeping in. Several empirical studies of water management in various parts of the world, some excellent anthropological studies had brought out the role played by user communities in management. Citing those in 1980 was eclectic and I had to force them to a footnote in my first article (Sengupta, 1980). In another five years the CPR institutional theory appeared in full vigour and lent support to a possibility of management without despotic authority. My field experiences made me an instant supporter.

Gordon or Hardin were writing about management of CPR predicting that systems like *ahars* and *pynes* were merely awaiting their tragedies. Their Hobbesian recommendation parallels that of Asiatic mode and Wittfogel. The simple argument of the new theory of commons was that the continuing existence of those systems which must not last as per Hardin, are pointers to alternative systems of management. Many of us had immediately noticed the great potential of the implicit argument in favour of field-

⁶ This article is now frequently cited in environment history studies, unfortunately missing the later corrections that I did later.

based method. The introduction of the intellectual milieu of that period remains incomplete without the mention of Wade's famous study. Wade essentially lent support to the theory of authority requirement. I was not very impressed from the beginning. I knew of several other empirical studies of India that recorded collective actions for irrigation without the help of an authority. Even Oscar Lewis, whose writings on feuds in Indian villages had blown the myth of harmonious community had noted that irrigation works were some of the few works for which rival feuds came together. This however, was only a footnote to his famous study.

Game Theory

In spite of the doomsday prediction Hardin had laid down the foundation for a rigorous game theory formulation of the commons studies. I feel, without their initial stress this highly empirical branch would have shown the same lethargy that other empirical branches show about theory. However, game theory is not the only theoretical school for the study of collective action in commons. In a recent book Mosse (2003: 16-18) identifies two schools of collective action theories that have influenced the policy debates. One emphasizes the 'moral economy' approach of small community's need to cope with risk and its collective dependence on local resources, often institutionalised in religion, folklore, and tradition. The other uses formal models consisting of costs and benefits to individual actors, incentives and penalties, to demonstrate the economic rationality of co-operation. Intellectual legacy of the first school, Mosse argues, is Durkheim among others, and of the second Hobbes and Adam Smith. However, scholars did not align to these two schools according to their basic disciplines. Sociologists and anthropologists have analysed rationality of cooperation in terms of individual incentives, while famous economists like Balland and Platteau (1996) or Bardhan used sociological approach. The practical implications of these two streams of theorizing are different. The 'moral economy' approach is directed towards identification of potential areas/villages/systems. The rationality-based approaches on the other hand, try to find suitable conditions – or 'principles' following Ostrom (1990) - that can be replicated. This approach therefore, has some suggestions for all situations. The moral economy

approach cannot suggest how to proceed if the congenial conditions are not met. No wonder therefore, that the rationality based approach can be identified as made for participatory programmes and the likes (viz. Mosse, 2003: 16). I was a great enthusiast of the notion of participatory management.

Some Questions

In the next few years the game theory models of commons were further developed (e.g. Ostrom, Gardner and Walker, 1994; Balland and Plateau, Seabright), largely out of efforts to modify models to field realities. These were not merely modifications of pay off structures or time period. The developments linked to the two branches of equilibrium formulation: the evolutionary model relying on spontaneity and the incentive designs bringing in designers. The success of a model is the explanations it provides through its implications. The next stage in the inquiry was for answers to some of these questions as implications of the theory. In this section I will only introduce these questions. In the final section I will introduce whatever answer is now available, what are promising areas and the gaps demanding attention.

Process Theory

To pure CPR theorists the only importance of cases of collective action in traditional commons was as counter examples to Hardin's thesis of the 'tragedy of commons'. To me, there were questions of practical significance. What should I do about the case of still working traditional commons of the *ahars* and *pynes*? Should I leave alone the good management? Is there a reason to intervene even though performance is good? And if so, how do we intervene? How to form a new level of collective action? What should be the criteria for assessing which one is better CPR management?

Game theory or any other economic theory had only explanations about the occurrence of collective action, but no lead regarding necessary and desirable actions. The Participatory Programmes therefore, were designed by sociologists. Community organizers, with sociology or social work backgrounds, were engaged for months to build water-users associations. Economists were not invited for the task, and rightly so. They had little to contribute. Economists direct their energy to finding equilibrium. They have little to say about the way to the equilibrium. In the past, growth models had given a try but ended up depicting economies bogged down in equilibrium. I feel, game theory has some potential to develop as a process theory. Under certain assumptions evolutionary games describe paths. Let me share an effort of mine. In 1994, the International Irrigation Management Institute organized a seminar to celebrate its 10th anniversary. In my paper to this seminar I introduced a game-based model for organizing WUA (Sengupta, 1994). In this seminar, and later in local level seminars and training programmes this model generated some interest. The approach that I had adopted was of repeated game model of cooperation depicting ultimate existence of equilibrium when enforcement is not necessary. My analysis was about the path to equilibrium under different kinds behaviours of the users. The conclusion was about the stringency of enforcement needed at different stages of management transfer or association formation, programming of tasks at different stages and the duration of close monitoring. It was an analysis of stabilisation process, emanating from equilibrium view of economic understanding and had a very different scope from that of the sociological programme of IMT. It was not a great theoretical analysis. I mention it as an early attempt to use theory to answer empirical questions. On the positive side, when I presented the path in simpler language in a couple of places, farmer leaders and farmer organizers confirmed that in field they actually faced the kind of situation that I had modelled. More and more I began to feel that the theory has not found wide empirical relevance because important empirical questions were not asked.

Transition

In promoting traditional irrigation systems another serious question had to be answered. Whether techniques can be separated from their social basis? Whether one can be promoted neglecting the other? In indigenous knowledge research this is now a hotly debated question. Brouwer drew a distinction between indigenous knowledge system (IKS) and indigenous technological knowledge (ITK) arguing that IKS delineates a cognitive structure in which theories and perceptions of Nature and Culture are conceptualised. It includes definitions, classifications and concepts of the physical, natural, social, economical and ideational environments. Is it possible to conserve and promote the ITK like that of *ahar-pyne* irrigation, without extending support⁷ to IKS? Here, the question of ideology has always retained some prominence. Colonial onslaught is a popular explanation of degradation of traditional knowledge. The champions regarded traditional social setting as glorious. They would argue in favour of promoting IKS. Even from developmental interest it is difficult to conceive why a working system may still need intervention. But a different perspective may demand intervention. Even if performance of a traditional commons of the *ahars* and *pynes* is good it may be supporting highly inequitable distribution. Also, in a rapidly changing modern world it is less likely that traditional/indigenous institutions will survive long. Participatory programmes were directed to form WUA where they did not exist, or at least assumed not to exist. They did not ask the question whether to change an existing association. In JFM new associations were established. They often came into conflict with the existing ones. The conflicts have been studied, not how the conflicts could have been avoided by transforming old associations.

This is a very simple problem. But economics has never bothered about such questions because questions like these would not arise in conventional economic analysis. Anthropologists went to distinct societies, first to study their economy and culture and

⁷ Current IK researchers are divided over this issue. But ideologies are not so lenient. World Indigenous peoples' movements insist, not without ground, that conservation of indigenous genetic knowledge is closely linked with land rights of the communities. In the past, when CBD and interest in traditional knowledge was not so wide, survival of old societies and livelihood form was in the forefront.

then also to understand the transition process from old to new institutions⁸. As globalisation proceeded, and local communities were rapidly transformed in last few decades, anthropology and sociology has moved more into studying the transition process and its various implications. For Arun Aggarwal these are issues on which one can talk for hours. But economics did not address this question. Economics, with rare exceptions, had no institution and no problem involving structural change. They were not interested in primitive societies and their institutions. Those were regions for market extension. Only recently, the issue of market transition of former Soviet countries has become a topic of interest. This however, is not the first set of transitional studies in economics. Economic studied of collective action on Commons may also qualify for being economic study involving institutional transition in developing countries. The question is whether economics has a suitable theoretical framework for this. My answer is 'no'. In game theory model a well-performing traditional institution is in equilibrium. It can change in just one way – by deteriorating.

The Scale of CPR

Another serious problem that has arrested growth of empirically meaningful theory is artificial scaling of CPR. It is true that CPR is more important for the poor, the traditional societies, and the weaker section of population. It is one thing to admit their importance in certain spheres, and another to restrict the analytical subject to that section. One major bias was to conceive CPR exclusively as technologically primitive, pre-modern, small-scale phenomena, supporting the poor. Even this Workshop proposal shows this kind of orientation. Baland and Platteau's influential work relegated CPR to small groups alone. Even if I leave aside the 'commons' in Burndtald's "Our Common Future", there are rich materials which shows impropriety of binding CPR to small scale. In irrigation, participatory management of modern irrigation systems have been seen as this type. Global commons have been discussed (Ostrom et. al.): Atlantic fishery,

⁸ Maurice Bloch for example

geostatic orbit, climate etc. Is there a real difference? True, this Workshop is meant for studying 'local CPR'. But that should not be done with a localised framework. No doubt village-level CPRs often assume critical importance for the livelihood of the rural poor in developing countries for reasons ranging from employment opportunity to risk minimisation. No doubt, due attention to these will help the poor. But does it mean that one has to take a static view? Should the commons be preserved or developed? Should they remain as local as in the past? Or should they extend and increase in scale?

In some distant past the region around Tamiraparani river in deep south had only a few small tanks. As technology developed the tanks were connected to rivers by construction of dams (anicut) on rivers, which enriched their water supply. In the nineteenth century modern technology was used to construct anicuts in more difficult sections of the river and connecting more tanks. In the twentieth century massive reservoirs were constructed to stabilize the supply. Finally, a few decades back, two hydropower stations have been added making it a multipurpose project. The Tamiraparni irrigation system now irrigates 35 thousand hectares not only through its channel systems but also by use of 179 tanks in its command area. Three reservoirs have been constructed at its upper reaches; two of them are for power generation. It has some excellent examples of collective action in commons. When I visited the system one of its irrigation associations was celebrating its hundred years in style. Though this is the development potential of 'rainwater harvesting' many of my friends popularised the technology as small-scale traditional wisdom. The poverty of imagination robbed the CPR development of technological possibilities of gaining from modern period.

For anything larger Baland and Platteau brought in something called 'co-management' mostly because game theory shows cooperation is possible in small units. But small units need not be small scale. Large-scale cooperation may be achieved by groups, villages, even nations. Ostrom has developed the interconnections in several ways: multiple level, nested organizations etc. She even initiated systematic research on global commons. The notion Baland and Platteau called 'co-management' has been

discussed always under participatory management. I used (Sengupta, 1991) what was also current⁹ at that time: 'joint management'. The narrow view CPR has actually restricted development of useful theory, and meaningful development policies in certain areas.

Commons and Market

Another problem is the market compatibility issue. Starting from Jodha's seminal work CPR is regarded as incompatible with markets. While grazing and fuel wood collection suffered from market expansion, traditional irrigation often gained by modernisation and market advance. It is accepted that participatory management is possible in modern irrigation. Chopra and Kadekodi did indeed, estimate the market value of Sukhomajori forest consequent upon the participatory programme. Still later, the catechu plantations on CPR at Sukhomajori have become more valuable. McKean (2000) listed Chiclé latex extracted from the Maya biosphere reserve and used for chewing gum, birds' nests in Kalimantan for use in Chinese cooking, and gum acacia in Senegal, as items whose value as resource come almost entirely from the commercial demand for those abroad. But that alone has created the incentive for devising communal management institutions. If so, the development policies of traditional CPR should look for compatible modernization and market expansion. The narrow view has misdirected development policies in CPR.

How does commercial demand for resources taken from community-managed systems affect the dynamics of internal cooperation? McKean (2000) says that the evidence here is quite mixed. Many communally managed resources are managed for commercial extraction and are not worth extracting at all except for peculiar customers who pay cash. Yet at the same time, it appears that commercial demand in the company of rapidly rising prices for the resources in question can exacerbate the temptation to harvest more now, to capture high prices, and solve problems of overexploitation of resources later. I studied (Sengupta, 1995) the market compatibility issue from economic theory. The New Institutional Economic

⁹ E.g. joint forest management.

(NIE) literature, that admits hierarchies and organizations along with markets, had something to offer.

Choosing A Model

What kind of theory of CPR management do we require? It should be a model that may allow collective action, and at the same time can develop from small scale to large scale and be market compatible. In my recent study (Sengupta, 2001) I have made an effort to make this kind of a model. Essentially, it is a process analysis. The disequilibrium and process analysis for institutions is already a rising trend in institutional economics. Aoki and Young used the biological concept of punctuated equilibrium towards this end. I used the theory of self-organization, now known also as a part of complex system analysis, which suggests that phase transition in non-linear dynamic systems may generate systemic (equilibrium) evolution in a punctuated form. Here the scope of study is the state away from equilibrium (i.e. disequilibrium). Under some conditions a system far away from the equilibrium may develop a different evolutionary process leading to a different equilibrium. This may be explained as that the same ITK may exist under different IKS (equilibrium) and under some conditions the collective action may move away from one IKS to another. In other words, new forms of participatory organization is able to support old technology. The conditions, that regulate movement from one interpretation mode to the other, should be the scope for economic analysis of participatory management. I also tried if a subjective force can be introduced in evolutionary games, to account for leaders, community organizers and other designers. Spontaneity may describe evolution of species in biology. Human evolutions must not be modelled without its intelligent mechanism designers.

References (incomplete)

- Agrawal, A, 1995: 'Dismantling the divide between indigenous and scientific knowledge', *Development and Change* 26:413-439.
- Bardhan, Pranab, 1993: "Symposium on management of local commons", *The Journal of Economic Perspectives*, 7(4).

- 2000: "Irrigation and Cooperation: An Empirical Analysis of 48 Irrigation Communities in South India"; *Economic Development and Cultural Change*, pp. 847-865.
- Chopra, K., Gopal K. Kadekodi and M. N. Murty, 1990: *Participatory Development: People and common property resources*, Sage Publications, New Delhi.
- Keohane, Robert O. and Elinor Ostrom, *Local Commons and Global Interdependence*, Sage Publications (forthcoming).
- McKean, Margaret A. 2000: "Governance and Civil Society," paper presented at the Fifth Annual Colloquium on Environmental Law and Institutions, "Sustainable Governance," 27-28 April, Durham, North Carolina (unpublished).
- Mosse, David, 2003: *The Rule of Water*, OUP, New Delhi.
- Ostrom, Elinor. 1990: *Governing The Commons - The Evolution of Institutions for Collective Action*, Cambridge University Press.
- Ostrom, Elinor, Roy Gardner, James Walker, 1994: *Rules, Games, and Common-Pool Resources*,
- Seabright, P. (1993): "Managing local commons: theoretical issues in incentive design", *Journal of Economic Perspectives*, 7(4): 113-134.
- Sengupta, Nirmal, 1980: "Indigenous Irrigation Organisation of South Bihar", *Indian Economic and Social History Review*, April.
- , 1991: *Managing Common Property: Irrigation in India and Philippines*, Sage publishers, New Delhi.
 - , 1993: *User-Friendly Irrigation Designs*, Sage publishers, New Delhi
 - , 1995: "Common Property Institutions and Markets", *Indian Economic Review*. 30(2), July-December.
 - , 2001: *A New Institutional Theory Of Production – An Application*, Sage Publications, New Delhi.