

Collective Action in An Embedded Choice Model: A Study of Fishing Cooperatives in Calcutta

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Abstract: In recent years, collective action to reduce the impact of poverty has been attempted through membership based organisations, of which co-operatives are an important classical form. The participation of target groups in such organisations can be explained using the rational choice model in terms of opportunity costs of collective action. However, this approach ignores the context in which agents are situated. The rationality of agents is bounded, with actions depending upon perceived opportunity costs.

The roots of such perceptions are embedded in the history, politics, and the socio-cultural and economic background of agents. This implies that collective action should be analysed in an embedded choice model. In this paper, labour supply to the collective action arena is analysed using an optimisation model embedded in the historic and economic context of the communities. Studies of two fishermen's co-operative in Calcutta, India, provide the back drop of the study.

Key Words: India, South Asia, Common Property, Contextual Factors, Co-operative, Water body.

JEL Classification: Q23, J54

1 Introduction

Individual activities can be decomposed into two categories: those directed towards generating private benefits, and those generating collective benefits. Activities directed to generate benefits for the actor compose the greater proportion of activities. However, collective action is also an important class of actions. Instances of such activities include contribution of labour, capital and other resources towards the provisioning of public goods, managing natural resources through a common property regime, participation in a co-operative or social security system, etc.

Attempts to analyse the functioning and success/failure of such organisations (both formal and informal) has been based on the rational choice model. The main criticism levelled against this approach has been that it has minimised the empirical importance of socio-political forces and exogenous economic changes (Fields, 1979). This has led to an incomplete analysis of collective action, specially its dynamics (Steins et al, 2000). This paper argues that it is necessary to examine the functioning of membership based collective action forums by incorporating contextual factors into an embedded rational choice model.

The paper is arranged as follows. The rational choice literature on collective action is critically reviewed, followed by a description of the characteristics of the alternative embedded (or situated) choice model. This paper focuses on how the interplay of historical processes and the economic context determines the opportunity costs of actions and hence the success of collective action. Two case studies - Captain's Bheri Fishermen's Co-operative and Bon Hooghly Fishermen's Co-operative - have been presented to illustrate the arguments of this paper. After

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presenting a brief history of the co-operatives a simple theoretical model will be used to examine the role of contextual factors in explaining labour supply to the co-operative graphically.

2 Contextual Analysis and Collective Action

The rational choice model is based on a consideration of the costs-benefits of actions. Initial contributors to the literature on collective action argued that contribution of an individual generated costs on the person undertaking the action, while benefits of actions dissipated within the group (Olson, 1962). Hence, private costs would exceed private benefits, encouraging individuals to free ride. Collective action would occur only if some agents benefited so much from the collective action that they were prepared to contribute even if others free-rode on them. Olson's thesis stimulated research in various collective action arenas. In the literature on common pool resources, for instance, Hardin (1968) argued that natural resources jointly used by a group would inevitably be over-exploited and degraded. Popkin (1977) used Olson's frame of argument to refute Scott's (1973) writings on the importance of social security systems in Southeast Asia. Their argument was later stylised elegantly in terms of the Prisoner's Dilemma problem in game theoretic literature.

However, these writers failed to explain the numerous instances of collective action observed in empirical studies (Wade, 1988, Berkes, 1989, Chopra et al, 1990, Singh, 1994, Marothia, 1992, 1993). Subsequent writers attempted to explain why collective action was a viable action to individuals. Again, basing their theoretical framework on the rational choice model, these writers argued that repetitive interactions in a closed system characterised by interactions between agents in different arenas would tend to remove the constraints to co-operate and the incentives to free ride (Kimball, 1988, Coate and Ravallion, 1989, Ostrom, 1990, Fafchamps, 1992). This was supported by the developments in iterative game theory, showing that the 'prisoner's' with common interests could learn to co-operate (Axelrod, 1986, Balland and Platteau, 1996, Bowles and Gintis, 1998, Taylor, 1977).

2.1 A Close Look at the Rational Choice Model

However, these approaches rely on the rational choice model. This approach abstracts decision making from the context in which the agent is situated (Agrawal, 2002). Individual decisions are based, not on actual costs-benefits of collective actions, but on their perceived costs and benefits. Such perceptions are embedded in the history, politics, and the socio-cultural and economic background of the agents. This suggests that contextual factors should be incorporated into the framework of analysis. It is necessary to extend the traditional method of analysis to analyse collective action in an embedded choice model. This will allow a more exhaustive analysis of the rationality of collective action.

The reason for neglecting exogenous forces like socio-cultural processes, historical trends and the political economy of the community can be traced to the analytical framework adopted by researchers examining collective action. Researchers (Ostrom, 1990, Fafchamps, 1992, Singh, 1994) take individuals as their decision-making units (methodological individualism) and examine how rational individuals take decisions based on costs and benefits of their actions. Unfortunately, collective action literature has focussed on institutional aspects - how characteristics of institutions affect the incentive structure faced by individuals ensuring the success/failure of collective action.† Consequently, they have remained content to derive the conditions - in the form of 'design principles' (Ostrom, 1990) - that will ensure the sustainability of covenants.‡ At most they have attempted to relate costs-benefits of creating and adhering to rules to technology and characteristics of the good or service being provisioned - they have not attempted to examine how these (perceived) costs and benefits are determined by the context in which the actors are situated. This approach has several problems:

[a] McCay and Jentoft (1997) argue that such analysis is 'contextually thin' as they minimise considerations of

† As in Wade (1987), Pinkerton and Weinstein (1995), Hanna et al (1995), and Balland and Platteau (1996).

‡ For instance, Ostrom (1990) identifies certain features (referred to as design principles) that must be satisfied by the institutional arrangement under which collective action takes occur to ensure the success of such action.

history and processes outside the community.

- [b] It overlooks the social nature of perception – the process through which individuals determine the nature and seriousness of the collective problem is strongly influenced by economic and socio-cultural factors (Klooster, 2000, McCay, 2002).
- [c] The fact that opportunity costs of collective action are affected by the alternatives available to the users not only related to the collective arena, but also outside the realm of the community (Edwards and Steins, 1999a).
- [d] Evolutionary processes shaping collective action are ignored (Steins et al, 2000). Dynamic changes in the external system can affect the parameters related to the collective arena. While some of these forces are disruptive, others can strengthen the basis of collective action (Richards, 1997).

2.2 Contextual Factors

The realisation of the analytical weaknesses of attempts to address collective action problems based on the rational choice models has led to attempts to incorporate the effect of exogenous changes into the framework. The development of ‘contextual analysis’ by researchers on common pool resources (Edwards and Steins, 1999b, McCay, 2002) marks an important conceptual breakthrough in this aspect.

Contextual factors are defined as “*dynamic forces constituted in the user groups’ social, cultural, economic, political, technological and institutional environment*” (Edwards & Steins, 1999a: 207). These forces can be divided into two categories: local and remote:

1. Local contextual factors are endogenous variables having an immediate impact on the choice set of the community. They may affect terms of access to the resource itself, or some suitable alternative, or the demand for the resource by consumers. Examples of such contextual factors include characteristics of the local ecological system, cultural characteristics of the community, extent of development of transport facilities linking the community to nearby markets, etc.
2. Remote factors, on the other hand, are exogenous variables beyond the control of the resource users. They affect the CPR system by influencing the ability of the resource system to produce benefits and by influencing demand for the benefits from the resource. Instances of remote contextual factors include changes in world market prices, government policy relating to resource use, developments in labour market outside the community, etc.

It should be noted that the distinction between local and remote contextual factors is made for the purpose of analytical convenience only. In reality we have what Edwards & Steins (1999b) calls a ‘contextual factors continuum’. This refers to the series of relationships linking remote with local contextual factors, and the entire set of contextual factors with the individual choice set. The conceptualisation of a continuum implies that remote and local contextual factors may mutually reinforce changes in the resource regime.

2.3 Situated Choice Model

The need to incorporate contextual factors calls for a shift in the conceptual foundations away from the rational choice model to a ‘situated’, or ‘embedded’ rational choice model (McCay, 2002). This model argues that the situation or context in which the choice has to be made determines the rationality of a choice. For instance, social psychologists (O’Riordan, 1976; Fishbein & Ajwen, 1977; Hill, 1981) have shown that response of resource users to an environmental resource problem will be conditioned by the interaction between information flows, experience, awareness, concern for others, norms, etc. Simultaneously socio-political forces both mould cognition and define the set of behavioural responses. O’Riordan (1976) suggests that a plausible behavioural model should conceptualise a transactional arrangement in which the individual negotiates with his environment in a symbiotic manner, each influencing the other. Responding to a collective action problem then becomes a game in which individuals test both the environmental response and the reaction of the socio-political system to which he belongs to realise the limits of

his abilities and the social and institutional constraints on his actions.

This paper incorporates contextual factors into an optimisation model of household behaviour to examine the decision to supply labour to the co-operative, or to free ride. It is shown that the structure of the problem - the nature of the objective function and the constraints faced by the member - is determined by the historical and economic context in which the members are situated. Although the member makes his choice rationally, it is bounded rationality as his decision is influenced by the context in which he is situated or embedded.

3 A Brief Look at the Co-operatives

Thus section presents a brief history of the two co-operatives. This is based on group discussions with co-operative members. In addition individual-based survey of 50 percent of the members using a questionnaire had also been undertaken. The financial performance and structure of the co-operatives was analysed using the audited reports.

3.1 Captain's Bheri Fishermen Co-operative

The Captain's Bheri Fishermen Co-operative Society is possibly West Bengal's oldest surviving co-operative. Triumphs and disasters, illustrating Kipling's lines "from heaven to hell, and back", chequer its history.

Captain's Bheri is located adjacent to the Eastern Metropolitan Bye Pass to the south of Chingrihata. Originally, it was part of the Sundarban forests and formed the banks of the Vidhyadhari River. A retired British Captain is said to have started pisciculture in the present site at the start of the 20th century. This has led to its present name. When the retired Captain started pisciculture, the local population decided to encroach on the water bodies to facilitate fishing. A period of insecure ownership followed – with the police driving away the local population at regular intervals, but who returned each time. Finally, a Muslim *sarkar* advised the locals to secure their access to the water body by forming a registered co-operative. This enabled the community to stabilise their access to the resource.

After 1971, the influx of refugees from East Pakistan into this area led to deforestation of the area to satisfy the demand for fuel wood. The clearing of the forestland opened up the surrounding areas for urban development and led to the development of wholesale markets in Chingrihata. It also led to better fish growth, as the shade was reduced (leading to greater fish mobility) and deposit of leafy debris in the water bodies decreased.

Around this time, the creation of a drainage system led to the release of sewage water into these water bodies. This sewage water contained nutrients that could be consumed by the fish. A new production process – sewage-based fishery – developed. The polluted water was a rich source of nutrients, which was a better substitute for the cheap natural fish food or the more expensive artificial variety. Simultaneously, fish culture reduced the pollution level of the water to acceptable levels, so that it could be subsequently used for irrigation. The process of production, therefore, converted the public 'bad' (the sewage water) to a public good' (the irrigation water).

These developments led to a change in the fish species cultivated by the co-operative. Faster growing species like *cyprinas*, *talapia*, *laylontika*, carp, *pona*, and *bata* replaced the earlier varieties of *singi*, *lata*, etc. The functioning of the co-operative also became less individualistic and more cohesive.

Over time, the co-operative flourished. In the late 1980s they decided to diversify their activities to providing paddleboat services. The banks were promoted as picnic sites. Licences were sold to food vendors. All these increased revenues to the co-operative. Earnings from pisciculture also increased and the co-operative won 4 National Productivity Awards between 1989 and 1992.[§] Round about this time, the increases in scale of operations of the co-operative led to the introduction of hired labour on a large scale.

This was followed by a dramatic decline in fortunes. Within 1994-95, the revenue from pisciculture fell sharply; losses replaced profits; debts mounted; and labour supply from co-operative members tapered off. Failure to pay

[§] First Award in 1989 and 1990, and Second Award in 1991 and 1992.

wages led to mass absenteeism; this further affected functioning of the co-operative. Simultaneously, vandalism and anti-social activities forced the Fisheries Directorate to close down boating and allied activities.

From 1999-2000, however, the co-operative is attempting a turn around. Although outbreak of an epidemic amongst the fish affected revenues in 1999-2000, in the following years a small profit was posted.

3.2 Bon Hooghly Fishermen's Co-operative

The co-operative was founded by migrants from East Pakistan (currently Bangladesh). The traditional occupation of the migrant individuals varied – but a dominant section (16 individuals) were fishermen by caste. Forced by political disturbances and riots, the fishermen migrated to India. Initially, they used to catch fish individually, or in small groups.

Around about 1972, Jamuna Bhowmick, wife of one of these fishermen, Gobinda Bhowmick, heard a radio program extolling the benefits from a fishermen's co-operative established at Mudiali, Calcutta. Deeply impressed, she informed her husband and Biren Sarkar, tutor of their children, about the program. Gobinda Bhaumik and Biren Sarkar talked the issue over with other refugees and decided to form a co-operative based on three water bodies in their locality.** One of the lakes was situated in Noahpara, where these refugees traditionally caught fish; the other two were adjacent lakes at Bon Hooghly, near the Indian Statistical Institute. All three had been degraded because of eutrophication and did not generate any significant benefit to the neighbourhood.

Initially the catch was low as the founding members lacked skill. Therefore, the members contacted some traditional fishermen who had settled in the suburbs in Calcutta and invited them to join them. A Co-operative was formally set up in 1974 under the name of Bon Hooghly Fishermen Co-operative Society. The total number of members increased to 78, of whom 6 members have since died. Heirs inherit membership; membership can also be transferred to persons nominated by the member. No new individual from outside the community can otherwise be inducted into the society.

Initially, the activity of the co-operative was confined to fishing. Later on, in the early 1990s, boating was introduced to supplement revenue. Gross revenue from fish sales have increased steadily, especially from the late 1980s. Though there was a decline in 1997-8 and 1998-9, revenue again picked up in 1999-2000. Boating has also been providing steadily increasing returns. The Co-operative has operated at a profit except for three years. From the early 1990s, net profit has been high. However, in 1998-9 and 1999-00, the level of profit has shown a steep decline.

3.3 Contextual Factors and Labour Supply

Members supply labour to the co-operative, the collective choice arena, to appropriate the flow of benefits generated by the common pool resource (the water bodies). An analysis of the rationality of such labour supply along the lines of the rational choice theorists would focus on costs-benefits determined by market and technological parameters, and the physical characteristics of the water bodies using the framework suggested by Oakerson (1986, 1990). However, it is also necessary to study how the socio-cultural characteristics of the community their historical formation and their economic context determines opportunity costs of collective action and perceptions of such costs, and how they change over time. This will explain the success, or failure, of membership based organisations.

Now what are the contextual factors that influence the supply of labour to undertake collective action? The objective of collective action and the socio-economic conditions of the community are important in this regard. The communities studied in this paper are characterised by poverty and vulnerability. Income levels are very low in both cases – in case of Captain's Bheri, for instance, per capita income is only Rs.509. In the case of the Bon Hooghly co-operative, members had been dispossessed of their homestead land and other physical assets by the political disturbances and riots. In such communities, survival motives have been found to be dominant concerns in

** This is a case of learning in the context of imperfect information.

explaining the direction of collective action (Husain and Bhattacharya, 2005). Contextual factors define, inter alia, the range of alternatives available to individuals to augment their income from outside the collective action arena. Commercial growth and residential expansion in the Baranagar and Chingrihata has led to the development of a labour market in these two areas. In Chingrihata, for instance, there are bulb and gloves manufacturing units. In both areas there is an informal sector where individuals can work as porters, transporters, tailors, petty traders, etc. At the same time, the simultaneous influx of migrants and population growth has led to excess supply of labour in this market. As a result wages have been depressed and uncertainties created. Nevertheless, the labour market provides an alternative means of livelihood. Hence it determines the opportunity costs of collective action, and ultimately determines whether such action will be undertaken.††

4 Labour Allocation in a Situated Choice Model

This paper examines the relation between contextual factors in the form of employment alternatives in a nearby labour market and collective action. Our starting proposition is that individuals seek to ensure a secure income flow with which they can consume a minimum level of goods and services (including leisure). The problem facing them is to determine how much labour to allocate to the collective action arena and how much to the labour market. The individual's choice has been situated in the context of its poverty and vulnerability, and the conditions prevailing in the labour market.

Now the problem of determining individual supply of labour to the co-operative has two perspectives:

1. *Collective perspective:* The individual supply of labour is to a collective choice arena. The returns to the individual will, therefore, depend upon the supply of labour from *all* individuals.
2. *Individualistic perspective:* This considers the effect of individual supply of labour on utility of the family. The supply of labour by other individuals is assumed by the individuals to be given (Cournot-Nash assumption).

Evidence from the survey indicates that community consists of homogenous individuals. This implies that individual choice functions, constraints and expectations will tend to converge. Thus, the analysis can be undertaken in terms of a typical individual. Our argument is that the collective dimension of the problem will determine the rewards associated with the set of feasible labour supply decisions by the individual. Using a diagrammatic approach, we have then examined how an individual chooses between these alternatives based on their associated pay-offs.

4.1 The Collective Dimension

Since the labour supplied is directed towards attaining a collective outcome, it is expected that the pay-off associated with a particular level of labour supply by the individual is not unique, but depends upon the supply of labour by other individuals. This implies that we can represent the situation using a game theoretic matrix. If there are M possible levels of labour supply by the household to the co-operative, the relation between each choice and the pay-off can be represented below.

Alternative	Alternative Strategies for Other Individuals			
	1	2	M

†† It is not possible to make any general statement regarding the nature of causality between poverty, vulnerability, contextual factors, and collective action. For instance, in Bankura collective action to deepen a pond supplying drinking water was inhibited by the presence of opportunities in the external labour market. In Purulia, on the other hand, it was found that the absence of such opportunities forced villagers to intensify their rate of exploitation of local forest resources – even at the cost of denudation of the forest cover (Husain and Bhattacharya, 2004). The precise nature of these alternatives and the extent to which external opportunities are supplementary or complementary to local collective action in achieving the primary objective of the community members is important.

	A_{11}						
		A_{22}					
			A_{33}				
				A_{44}			
					A_{55}		
						...	
							A_{mm}

Figure 1. Collective Supply of Labour and Pay-offs

Individual x assumes that the other individuals supply the same amount of labour. Now, when $l_c = M$, supply of labour to the co-operative is highest; when $l_c = 1$, supply of labour to the co-operative is lowest. Suppose, individual x supplies 3 units of labour. Then it will prefer, that other individuals supply *at least* 3 units of labour, or more. If other individuals supply 3 units of labour, then the burden of work is distributed evenly. If they supply more labour (say 4), then x is able to free ride to some extent on others. But, if other individuals supply less labour (say 2), then the greater burden of work falls on x ; it is now the other individuals who are free riding on him. Generalising, it can be said that if individual x supplies i units of labour then it will want the others to supply j units of labour, when $j \geq i$. Alternately, it can be argued that, given supply of labour by other individuals = j , individual x will chose i such that $i \leq j$.

Since this is true for all individuals, we are confronted with the classical Prisoner's Dilemma situation. In the absence of communication and simultaneous play, a sub-optimal equilibrium will result with all players choosing 1. However, there are certain reasons why this process will not occur in reality.

The supply of labour to the co-operative occurs in a specific context. This context has several features that prevent the game from being a facsimile of the standard PDG. These features are:

1. The production process requires supply of labour not in isolation but in close proximity to each other. As a result there is no possibility of 'hidden action' by any single individual – since all labour has to be supplied publicly (in front of other members) the other members will notice any shirking.
2. There is constant interaction over time between the individuals in the collective arena. The labour allocation decision has to be repeated every day; this allows scope to teach deviators to co-operate. In game theoretic terms, the strategy need not be invariant; we can introduce the possibility of learning the optimal strategy through a trial and error process.
3. Interaction between the players occurs not only within the collective arena, but in other spheres also. This enables the creation of reputations – anticipations of what the other players will do in given circumstances. It also provides further avenues for teaching through sanctioning and rewarding in other spheres. For instance, a habitual defector may find him self cut-off from the social network relations existing between individuals. This denies him help during a crisis. Individuals who normally co-operate, on the other hand, have good reputations; easy availability of help during in any crisis acts as a reinforcement to further co-operation.
4. The lack of alternatives outside the co-operative creates a closed system on which the individuals become totally dependent. By removing the possibility of leaving the co-operative, the adoption of hit-and-run strategies is eliminated. An effect similar to parochialism is created.

In such a situation, the veil of anonymity enabling a player to get away with defection is absent; all actions are public. Further, both sanctioning and the credibility of the threat are serious enough to keep potential defectors in line. However, this does not rule out defection in the resultant equilibrium. Both theoretical and empirical studies

have shown that a certain amount of defection can be ‘tolerated’ by co-operating players in equilibrium (Taylor, 1977; Baland & Platteau, 1996; Steins, 1998; Husain and Bhattacharya, 2002).

Thus, in equilibrium of each sub-game, the players are partitioned into two groups – a group of players who defect, and another group who co-operate. This implies that all members of the second group chose to contribute the same level of labour (say i), while members of the first group chose j – such that $i < j$. The equilibrium is repeated in the successive sub-games until the number of players defecting crosses a certain threshold level. In that case co-operation unravels to a stable equilibrium characterised by universal defection. In terms of the matrix, the community moves up the diagonal towards a_{11} .

Thus most of the co-operative members will supply the same labour hours. The minority can continue to free ride. For instance, It has been observed that those members who are in distress are permitted to defect without reprisals in each sub-game (Husain and Bhattacharya, 2004). Therefore, the composition of the defecting group changes in each sub-game.

4.2 Framework of Embedded Choice

Having decided to co-operate (i.e. supply the same amount of labour to the co-operative) individuals have to decide on this level. It has been seen that the member can supply l_1, l_2, \dots, l_M labour units to the collective action arena; the associated pay-offs from the co-operative to these alternatives are $a_{11}, a_{22}, \dots, a_{MM}$. The members will now rank these alternatives and choose the alternative yielding highest benefits. However, the choice is not made in a vacuum but in a specific historic and economic situation. This context shapes constraints and determines the parameters of the optimisation problem.

It had been pointed out earlier that members also supply labour to the nearby labour markets. So their choice consists of allocating work hours between three alternative uses – enjoying leisure (l), working in the co-operative (l_c), and working in the labour market in his neighbourhood (l_s). For convenience it is assumed that the member has already decided how much leisure he will enjoy. This reduces the problem to allocating total labour hours in a day, less leisure hours, between the labour market and the co-operative: $24 - l = L$ (say) $= l_c + l_s$.

The returns to the alternative uses of labour are as follows. In the labour market, the worker gets an income of w , but this has to be discounted by the uncertainty of getting work. Suppose the probability of getting work is q . His expected income from the secondary job is qwl_s . In addition he also gets a wage from the co-operative. This is w_c , so that his returns from supplying labour to the co-operative should be $w_c l_c$. In reality he is paid a fixed daily amount, irrespective of the work done. Let this amount be W . Thus, total income to any member is: $W + qwl_s$. This income is used to purchase subsistence goods (X) at a price p .

This, however, is not a complete description of the expenditure constraint. Consider the labour-consumption space. We start from a position where the entire labour time (L) is supplied to the co-operative. This means that the individuals are supplying $L = m$ units of labour to the co-operative. The individual income will be W , represented by point A in the diagram. Now, households can increase their income, and hence expenditure, by reducing labour supply to the co-operative and diverting it to the labour market. This is denoted by a movement up the budget line AB.

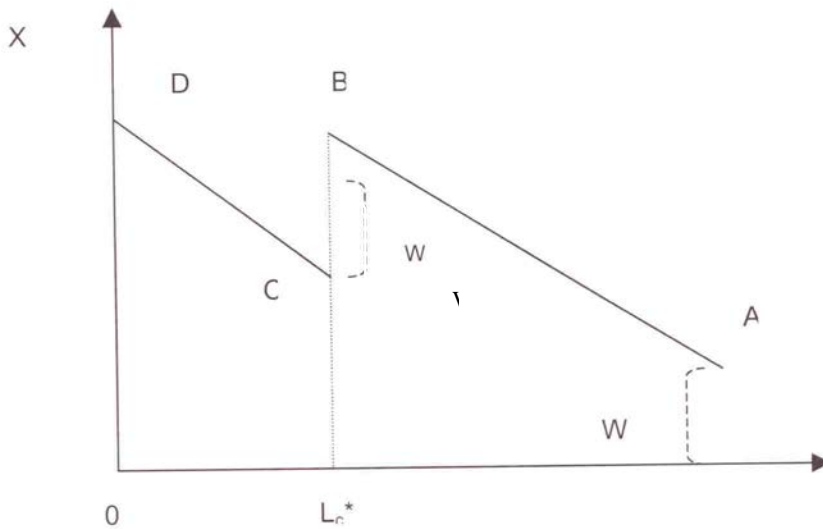


Figure 2. Budget Line of the Individual

Now, whether the co-operative is able to pay the wages W to the members depends upon the revenue obtained by the co-operative. If the supply of labour falls below a critical level, say L_c^* , then the co-operative will be unable to generate sufficient revenue to pay its members. For simplification, we assume that the co-operative stops payments to its members. So any reduction in the labour supplied to the co-operative below L_c^* will be accompanied by a drop in the income level by W . This is shown in terms of a downwards shift in the budget line of the individuals.‡‡

Mathematically the budget line can be represented as follows:

$$\begin{aligned}
 p \cdot X &= W && \text{for } l_c = L \\
 &= W + qw(L - l_c), && \text{for } L > l_c \geq L_c^* \\
 &= qw(L - l_c), && \text{for } l_c < L_c^*
 \end{aligned}
 \tag{1}$$

‡‡ In reality there will be a series of L_c^* . As l_c is reduced below each L_c^* , the co-operative enforces a wage cut, lowering the budget line parallel to the earlier budget line.

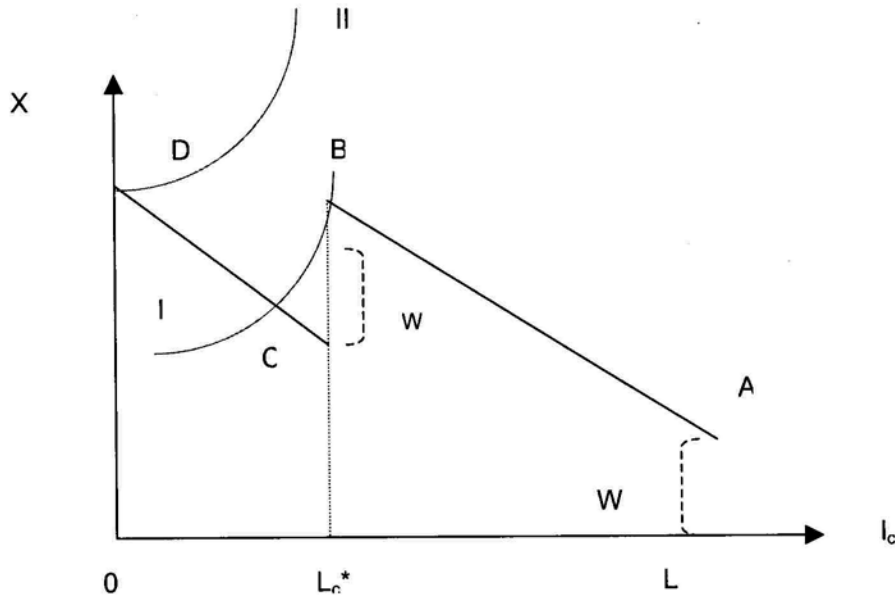


Figure 3 [a]: Equilibrium of the Individual

The objective of the individual is to maximise utility. We assume,

$$U = U(l_c, X) \text{ with } U_l < 0, U_x > 0, U_{ll} > 0, U_{xx} < 0 \text{ [2]}$$

The indifference curves will be positively sloped. Further, as we move upwards, utility levels will increase. Convexity of the indifference curves to the horizontal axis is also assumed. Given the objective function and constraints, we now attempt to determine the optimal labour supply by a representative individual based on a graphical exposition. §§

In Figure 3 [a], we have a corner solution, with the individuals diverting their entire labour to their secondary occupations. In terms of the matrix (Figure 1), individuals will simultaneously defect and choose not to supply any labour to the co-operative. Collective action is not a viable proposition to the individuals and the co-operatives will die out. Note that all individuals have decided to reduce labour supply together. This behaviour is different from the individual attempts to free ride discussed in Section 4.1. In the earlier case, it was a decision taken by all members *individually*; in the present case, however, it is the *group that takes the decision* to reduce labour supply to the collective arena. To distinguish these two types of decisions, we refer to them as *individual defection* and *group defection*, respectively.

Alternately, we can have a situation represented by Figure 3[b]. Here the highest indifference curve is tangent to the budget line at the kink. This again leads to a corner solution – this time at the kink, with the individuals supplying l_c labour to the co-operative, and $(L - l_c)$ labour to the secondary market.

§§ Since the constraints are non-linear, classical optimisation techniques will not apply. Kuhn-Tucker conditions will have to be used. The results of the optimisation and specially the comparative static exercises will be both cumbersome and will fail to provide results that can be interpreted conveniently. So we have relied on a graphical exposition, and avoided a mathematical approach.

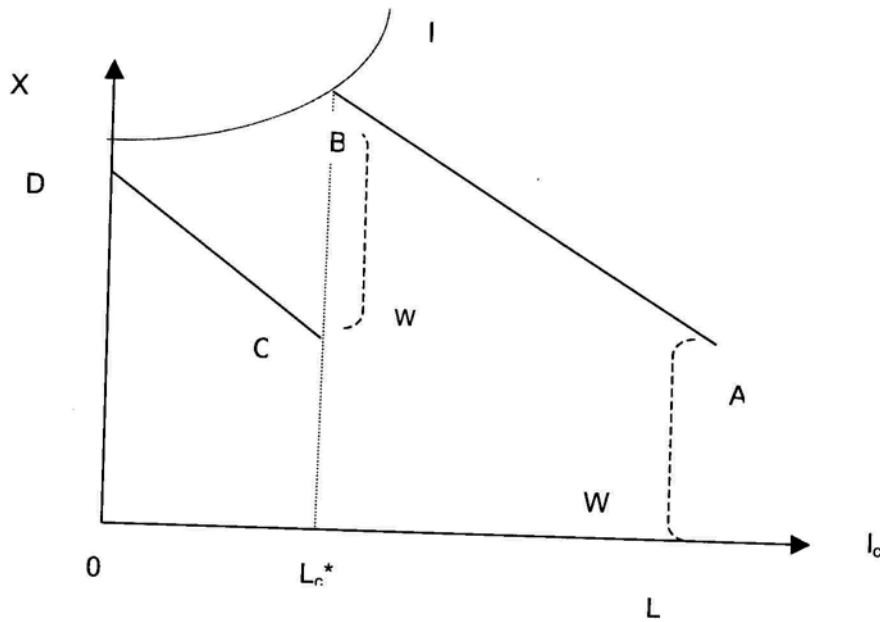


Figure 3 [b]: Equilibrium of the Individual

4.3 Context and Equilibrium

The survey indicates that the co-operatives are in the equilibrium described by Figure 3[b]. But what are the reasons for this choice? To answer this question it is necessary to consider how the historic and economic context shapes mature of the collective identity and preferences of the members.

Although the co-operative is a formal organisation consisting of a limited number of individuals, forces stronger than the legal structure imparts the collective identity of the members. Specifically, it is the presence of a collective consciousness that gives the community its collective identity. Community exists among individuals who share "common *interests, common identification... growing out of shared characteristic*" (Ascher, 1995: 83). The belief in shared identities and common experiences reduce individuality of community members - they become more willing to co-operate over formal decisions to manage and conserve resources.

The members of Captain's Bheri are long time residents in the Chingrihata area. Their shared past has created common interests and shared characteristics. Further, the common problems faced by them in their daily struggle for existence means that they have a common future. This has engendered what Ostrom (1990) calls mutually recurrent expectations.

Similarly, the members of the Bon Hooghly co-operative had gone through a similar experience and were facing a common problem. They had all been dislocated and re-settled in a culturally new locality. All of them were facing the desperate problem of earning a secure income flow. Although some of them had obtained work, the income earned by them was low and had to be supplemented by other means.

Louderdale et al (1984) have shown in a game theoretic framework that the perception of a common threat may increase group solidarity. The creation of a group identity encourages co-operation because members of a social group tend to regard other members favourably and believe them to be trustworthy, honest and co-operative. Other members of the same group are expected, therefore, to reciprocate co-operative behaviour. In addition, inclusion within a social group reduces social distances between members so that they make less distinction between their

own and other's welfare.

In addition to this historical context, the economic opportunities outside the domain of the resource were another important variable affecting behaviour of individuals. The labour market was extremely 'tight' – in the sense that unemployment was high, and employment and income insecure. The uncertainty and risk of loss of livelihood created a situation where transaction costs in the form of search costs and insecurity of job reduces the efficacy of the labour market as an allocative mechanism. Individuals were no longer guided by market principles (in the form of seeking sectors with highest returns) in allocating labour; instead members incorporate security considerations into their objective functions. Thus the economic context in which the choice of the members was embedded strengthened the historical base for collective action by determining the target of the co-operative.

Specifically, both forces acted to depress the Marginal Rate of Substitution of labour supply (to the co-operative) for consumption. This can be defined as the ratio of Marginal Utility (MU) of labour supply to the Marginal Disutility (MDU) of consumption (i.e. $-MU_{lc}/MDU_x$). Since MU of consumption will be high for households close to the subsistence level, while the sense of community and uncertainties in the external labour market implies a low absolute value of MDU of labour supply to the co-operative, MRS will be low. This implies that the indifference map will consist of relatively flat indifference curves. Consequently, equilibrium will occur at the kink rather than at the corner. While respondents were unwilling to state the extent of their dependence on the labour market, this study found that about 50% of their income was obtained by working in part-time jobs.

5 Comparative Statics in Embedded Choice Model

Now, over time, there may be parametric changes in the appropriation methods, in wage levels, etc. These changes can both increase or decrease net benefits of collective action. Once again, however, the effect of such changes will depend upon the context in which the actors are embedded. In fact, as we shall see subsequently, the interaction of parametric changes with contextual variables may cause unexpected changes in the collective arena.

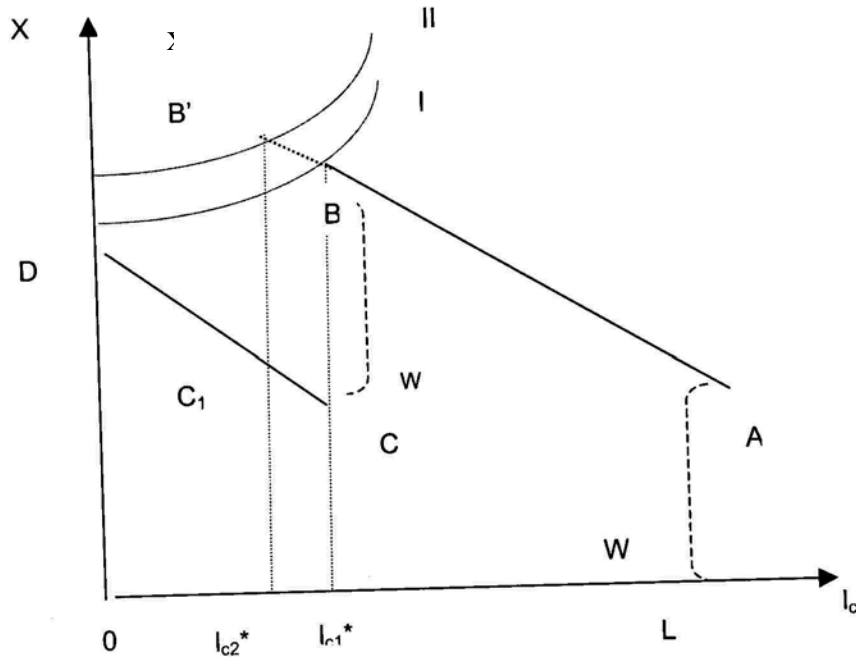
5.1 Changes in Wages

While analysing comparative statics, it should be kept in mind that the objective of the members is to maximise income (subject to security considerations). This is possible if there is an increase in wage rate in the labour market. Such a development may follow expansion of this market due to urbanisation, industrialisation or even simply demographic expansion in the surrounding regions. This is an exogenous change. The effect of a change in the co-operative wage rate is an upward shift in the budget line. Another possibility is that the co-operative increases the wages paid to members. This will cause the budget line to *rotate* upwards.

In both cases, however, the comparative static results will be similar. Equilibrium will occur at a higher indifference curve. The nature of equilibrium remains unchanged if the utility function is assumed to be homothetic. In such cases if the original equilibrium was at the kink, the new equilibrium will again be at the kink. Alternately, if the original equilibrium was on the vertical axis, the new equilibrium too will be on the vertical axis. If, however, the utility function is not homothetic then the indifference curves will no longer be parallel. In that case, the above analysis will no longer hold true – we *may* have a change in the equilibrium from a corner point to the kink of the budget line, or vice versa. Alternately, equilibrium may again occur at the same point. What type of change will actually occur cannot be predicted without precise knowledge of the utility functions and other parameters.

5.b Change in the Production Technology

Another possibility before the co-operative members is to modify the production system. This is possible by adopting a labour saving production process. In that case, each unit of labour supplied by the members will fetch a higher return to the co-operative. This will increase the cash reserves of the co-operative and allow the management to pay a higher wages to their members.



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Figure 4: Impact of Change in Technology

In terms of our framework, the threshold level of labour (l_c) - the minimum labour supply that allows the co-operative to meet wage dues of its members - will fall. In Figure 4 we can see that the budget line will be extended beyond B to B'. The remaining portion of the budget line will contract from DC to DC₁. It is easy to see that such a change must lead to equilibrium at the (new) kink of the budget line – at B'. This implies that the individuals will be able to reduce their labour supply to the co-operative and divert it to the labour market to increase their income and hence utility.

5.3 An Illustration: Effect of Introducing Boating Facilities

How can such changes be achieved? One possibility is a shift to a labour-saving and capital intensive technology of catching fish. However, the financial resources of the co-operatives and the physical characteristics of the resources^{***} are such that this course is difficult to implement.

What the co-operatives did do was to diversify their activities and introduce boating as a sideline. The capital expenditure on the boats is comparatively less than purchasing sophisticated machinery to catch fish. The operating costs of boating are negligible. Day guards usually double up as ticket collectors; other operating costs include painting and minor repairs, which do not sum to any large amount. On the other hand, boating generates additional revenue to the co-operative. It also generates positive externalities in the form of better fish growth due to circulation of dissolved oxygen in the water and movement of fish owing to the waves created during paddling. Introduction of boating facilities, thereby, increases the net benefits from the co-operative. All these can be expected to strengthen the base for co-operation. However, the actual effect was quite different.

The introduction of paddling facilities in the Bon Hooghly Co-operative increased profit. But if we deducted revenue from paddling from the total profit (to examine the co-operative simply as a fishing unit) the positive profit is reduced to losses (Table 3 later). The change was even more dramatic in the case of Captain's Bhery Co-operative. Although, there was no decline in the revenue from fish sales, there was a sharp decrease in the level of profits

^{***} The shallow depth and the small surface of the water bodies are important constraints.

(Table 4).

To understand the reasons underlying this unanticipated change it is necessary to refer back to Figure 4. It had been pointed out that any labour saving way to generate revenue would extend the budget line, and reduce labour supply to the collective action arena. This is because the benefits from collective action are the same even at a lower level of labour supply as the resultant fall in revenue from fish sales was compensated by an increase in revenue from boating facilities. As a result members defect collectively and the labour thus released is diverted to the labour market to increase private benefits. Thus, the provisioning of paddling facilities in both co-operatives increased the benefits per unit of labour supply and hence, paradoxically, *weakened* the basis for co-operation.

In this context, a relevant question is why do not the members maintain their labour supply to the co-operative and improve its financial position. This will enable the co-operative to increase wages – which will benefit the members. The reason why this effect does not operate is that wages are linked to productivity increases with a very long lag.††† Typically, co-operative wages are sticky and are hiked after 10-12 years. Wages may increase following the technological change – but only in the long run. Increased profits of the co-operative following the introduction of paddling will be diverted to reserves in the short run. Immediate benefits – which are more important for individuals close to the survival level and having a preference biased in favour of present income flows - can be obtained only if the members divert part of l_c to the secondary job market.

Such a diversification affects the nature of the co-operative. Fishing may become less important, as the co-operative becomes increasingly dependent on boating and allied activities. But the viability of the co-operative as a vehicle to attain some collective target (in this case, ensuring a secure income flow) remains as it continues to provide a means to generate income. A serious problem will occur if the member reduce labour supply below the threshold labour supply level (l_c^*).

In the case of diversification, if the members over-estimate the revenue expected from boating, the labour supply may fall below l_c^* . This may again reduce l_c to 0. Now the revenue from boating compensates the fall in revenue from fishing partially. This reduces the profits of the co-operative. Initially, reserves will be used to meet wage bills; but after a time, delays in wage payments will occur.

If the co-operative pays only a part of the wages due to each worker, this will be equivalent to a wage cut. This is represented by a downward parallel shift in the budget line from AB to A'B'; the CD segment, however, remains unaffected. If there is a sufficiently large amount of wage withheld by the co-operative – so that the new budget line (A'B') falls to below II (Figure 5) - optimal level of labour supply to the co-operative may fall from l_c^* to 0. The survival of the co-operative is now threatened.

Group discussions with members and the management of the two co-operatives revealed that a sharp reduction in labour supply to the co-operative occurred after the introduction of boating facilities. The management tried to compensate this by hiring daily workers and paying overtime allowance to the members. As a result revenue from fish sales was maintained; but, the increased wage bill led to a decline in the profits from fishing. In the case of the Bon Hooghly Co-operative, while pisciculture has become a losing line of activity, the net profit has remained positive (Table 3).

††† This is because the co-operative management is generally more risk averse than members are, and tend to view increases in co-operative revenue as temporary deviations. Such increases are interpreted as a permanent increase only if revenues are maintained at the new level for several years at a stretch.

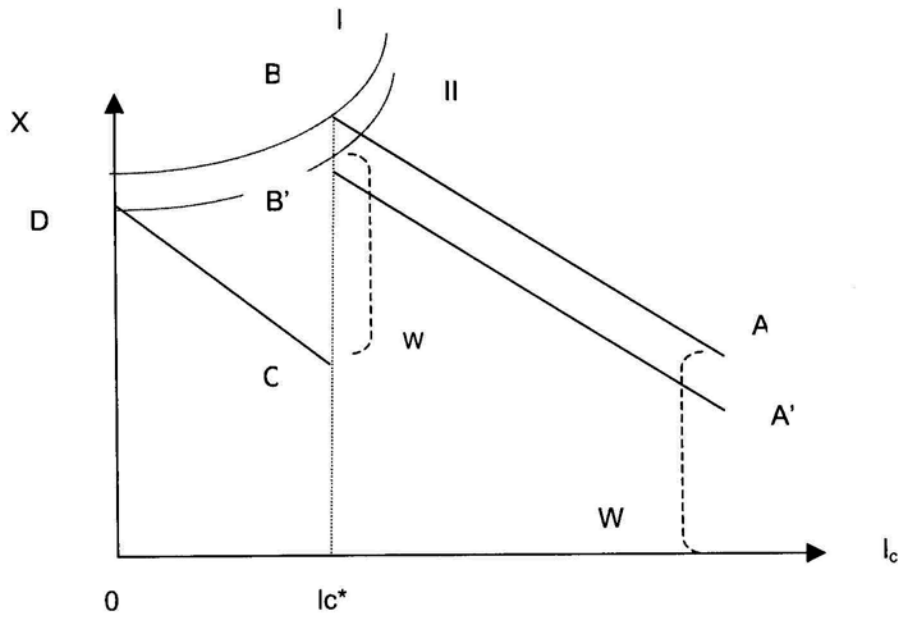


Figure 5: Effect of a Fall in Wages

Table 3: Impact on Boating on Net Profit and Pisciculture (in Rupees) – Bon Hooghly Co-operative

Year	Net Profit	Revenue from Fish Sales	Revenue from Boating	Wages to Hired Workers	Profit to Pisciculture
1993-94	58011	1507050	20348	41775	37663
1994-95	64730	2117682	30247	40500	34483
1995-96	25310	1831720	98325	38775	- 73015
1996-97	54841	1989203	89050	752585	- 34209
1997-98	46298	1951512	63720	738878	- 17422
1998-99	4421	1667995	72155	682532	- 67734
1999-00	2196	2288275	82910	898414	- 80714

In the case of Captain's Bhery, however, the decline in labour supply was even more marked, and led to a fall in profits.^{***} This affected the ability of the co-operative to pay wages (arrears in salary exceeded actual wage disbursements in 1991-2 and 1992-3) and led to a further fall in labour supply. Some workers even stopped coming to the co-operative for months on end – i.e. $l_c = 0$.

^{***} The difficulties of monitoring hired labour and managerial inefficiencies that crept in at about this time also contributed to the decline in profits.

Table 4: Trends in Revenue from Fish Sales and Profit – Captain’s Bheri

Year	Revenue from Fish Sales	Co-operative Profit	Casual workers		Overtime to Members
			Wages	No. of mandays	
1991-2	985777	-73806	36136	602	-
1992-3	1428972	55991	48263	804	-
1993-4	1707799	-204341	57535	959	19240
1994-5	1405333	-23305	73920	1232	27215
1995-6	n.a.	n.a.	n.a.	n.a.	n.a.
1996-7	2298711	-25838	72920	1215	9500
1997-8	1350314	-183032	83740	1396	12175
1998-9	1282424	-133555	51517	859	1100
1999-00	1480410	-100960	61075	1018	125
2000-1	1753626	-172054	101767	1696	-

It was only later on in the 1990s that the declining fortunes of the co-operative could be arrested with a banning of boating in the water bodies and sanctioning of absenteeism.

6 Conclusions

Equilibrium of a membership based organisation of poor households is thus delicately poised. The pressures of survival force the members to constantly search for avenues to increase their income. This may affect the evolution of the co-operative society in various ways – it may change the form of the society (Bon Hooghly), or it may even threaten the survival of the society (Captain’s Bheri). This discussion indicates that inducing policy changes to increase the benefits from the collective arena, or seeking to analyse parametric changes solely in terms of costs-benefits from collective action overlooks the complex nature of the interaction of the collective arena with the historic, economic and socio-cultural context in which actors are located.

The interplay of contextual factors and variables internal to the community affect perceptions of cost-benefit calculations of individual agents in complex ways. While agents have to learn to cope up with these complexities, policy makers must take into account such interactions while introducing policy changes. Simultaneously, researchers have to appreciate how such changes affect the rates of exploitation and the nature of the property regimes.

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