LITERATURE REVIEW ON THE ECONOMICS OF COMMON PROPERTY RESOURCES

Review of Common Pool Resource Management in Tanzania

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DRAFT

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1. INTRODUCTION

This review focuses on the economics of managing common pool resources in common property regimes, in particular the limitations imposed by transactions costs. The review discusses the relationship between poverty and property rights in natural resource management, and then more specifically considers the case of regimes where property rights have not been assigned (open access), and when common property rights are used. In conclusion, the influence of transactions costs on governance structure is considered and some empirical studies that have attempted to quantify transactions costs are briefly reviewed.

Ever since the publication of Garrett Hardin's influential article 'The Tragedy of Commons' (Hardin, 1968), there has been a great deal of research interest concerned with poverty, environment and natural resource degradation. The concept has been used to explain over-exploitation in fisheries, forests, overgrazing, air and water pollution, abuse of public lands, population problems, extinction of species, misallocation in oil and natural gas extraction, ground water depletion, and other problems of resource misallocation (Stevenson, 1991). When property rights over natural resources are absent and unenforced i.e. when there is open access, no individual bears the full cost of resource degradation. The result is 'free riding' and over exploitation, what Hardin termed the 'tragedy of commons' (Hardin, 1968). Hardin's arguments have been formalized in the form of a 'Prisoner's Dilemma Game' (Runge, 1981). The disturbing conclusion of prisoner's dilemma is that rational people cannot agree on collective outcomes. However, where the situation is an enduring or recurrent one (i.e. in repeated game), the logic changes (Axelrod, 1981). Free-riding remains a possibility but not, as in the Simple Prisoner's Dilemma, an imperative (Runge, 1984, Kimber, 1981, Sugden, 1984, Snidal, 1985). The critics argue that Hardin's tragedy of commons is applicable only to open access resources where no property rights are assigned, and not to commons i.e. common property resources (Ciriacy-Wantrup and Bishop, 1975, Runge, 1981, Bromley and Cernea, 1989). Even the common grazing lands in Hardin's classic 'Tragedy of the Commons' were well looked after for many centuries, before they declined for reasons unrelated to any inherent flaw in the commons system (Cox, 1985). Hardin's tragedy of the commons often results, not from any inherent failure of common property management, but from institutional failure to control access to resources, and to make and enforce internal decisions for collective use. Many common pool resources used by rural communities are not open access but are used under communal property rights arrangements. That is, more often than not, rules exist regarding access and joint use (McCay and Acheson, 1987, Berkes, 1989, Bromley, 1992).

Three broad schools of thought emerge from the literature of common property on the institutional arrangements to avert the tragedy of commons. According to the property rights school the problem of over exploitation and degradation of common property resources (CPRs) can be resolved only by creating and enforcing private property rights (Demsetz, 1967, Johnson, 1972, Smith, 1981; Cheung, 1970). The second school of thought advocates that only the allocation of full authority to regulate the commons to an external agency, in other words a State Property regime, can reduce over-exploitation of CPRs (Hardin, 1968). The third school believes in the 'assurance problem approach' based on voluntary compliance. In recent years, an increasing number of scholars advocate that decentralized collective management of CPRs by their users could be an appropriate system for avoiding the 'tragedy of commons' (Berkes, 1989, Wade, 1987, Jodha, 1986, Chopra et al. 1989). In practice every society has its own means and adaptations to deal with natural environment common pool resources, its own 'Cultural Capital' (Berkes and Folke, 1994) and local level systems of resource management, which are based on the knowledge and experience of the resource users themselves.

2. POVERTY, PROPERTY RIGHTS AND NATURAL RESOURCES

The relationship between poverty and property-rights over natural resources is complex. Poverty can lead to a high dependence upon, and consequent degradation, of natural resources. Exclusion from crucial resources following changes to property right regimes acts as the main catalyst for increasing deprivation and vulnerability of poorer households. Some authors argue that poor people extract more natural resources and cause greater environmental degradation following greater reliance on the natural resource base and the placing of high discount rates on future returns. In other words they consume for the present because the future holds no hope. The level of wealth of poorer users may be so low that the restraint required for sustainable use of CPR jeopardises their survival. The imposed constraint of poverty artificially reduces their time horizon since they are forced to attach considerable importance to their present incomes (Baland and Platteau, 1996). Some studies, on the other hand, have also pointed out that since poor people depend more heavily on a limited natural resource base, they attach greater value to its conservation and so have developed sustainable management strategies (Reddy, 1999). Environmental degradation substantially increases the survival risk of the poor. Dependence on common property resources is more crucial for poorer households (Jodha, 1986). The nature of property-rights regimes and distribution of access to natural resources not only affects levels of poverty in any specific region, but in the long-run it also affects the quantity and quality of the environmental resource-base (Dasgupta and Maler, 1991). It is therefore argued that appropriate property rights allocation is one of the major determinants of

a long term economic and ecological sustainability of the commons as well the social sustainability of people depending upon these resources.

The most efficient institutional arrangements for sustainable resource use and conservation are widely discussed in recent literature. In the case of open-access and unregulated common property, individuals do not get appropriate incentives to act in a socially efficient way. The property rights school of thought argues that private property is the most efficient way to internalise the externalities that arise when access is unregulated. It also makes the contention that private property rights will spontaneously emerge to increase efficiency (Demsetz, 1967). However, failures of market and state institutions as a cause of unsustainable natural resource management have also been discussed in recent literature. As an alternative to the market and state controlled institutional arrangements, local level collective action has been highlighted (Ostrom et al., 1988). Ostrom argues that collective action for CPR management will be long enduring and successful under conditions of well-defined boundaries, congruence between appropriation and provision rules, effective monitoring, graduated sanctions, efficient conflict-resolution mechanisms and minimal recognition of rights to organize (Ostrom, 1990). Many of these preconditions are effectively undermined when, as a result of state intervention and market penetration, resources are privatised and socio-economic differentiation take place.

Recent literature on common property resource management indicates that sustaining the environmental resource is not dependent on a particular structure of property rights regime. Rather it depends on a well-specified property rights regime and a congruence of that regime with its ecological and social context (Hanna and Munasinghe, 1995). Success of the property rights regime requires: congruence of ecosystem and governance boundaries, specification and representation of interests, matching of governance structure to ecosystem characteristics, containment of transaction costs, and establishment of monitoring, enforcement and adoption processes at the appropriate scale (Eggertsson, 1990; Ostrom, 1990; Bromley, 1991; Hanna, 1992; Hanna and Munasinghe, 1995). More importantly, equity and distributional aspects of a CPR regime is considered to be one of the major determinants of long-term sustainability of community-based resource management. Property rights, of course, by themselves, do not provide adequate incentives and conditions for sustainable management. Appropriate cost-benefit sharing arrangements, together with empowerment of resource users, technical assistance to develop and strengthen local organizational capacities, and support sustainable management and conservation efforts are examples of other essential elements. While aggregate gains from reducing common pool problems or promoting economic growth through the definition or redefinition of property rights are unlikely to be controversial, the distribution of wealth and political power inherent in the proposed rights structure will be a source of dispute (Libcap, 1989). Different property rights arrangements will not only have different production effects, but they will have different distributional implications. There is a need to further investigate the linkage between equity, distribution and poverty of existing traditional institutions for management of CPRs under conditions of increasing inequality on the distributions of assets and opportunities. Equally important is the need to analyse economic theory behind open access and common property resources and investigate the implications of transaction costs to resource management under different management regimes in various rural settings.

3. ECONOMICS OF OPEN ACCESS COMMON PROPERTY REGIMES

3.1 OPEN ACCESS REGIMES

Bromley (1991) considers the open access situation as a resource regime in which there are no property rights *(res nullius*). Because there are no property rights in an open access situation, it is logically inconsistent to assert – as many often do – "everybody's property is nobody's property" (Bromley, 1991). There is no defined group of user's or owners and benefit streams from the common pool resource are available to anyone. Individuals have both privileges and no rights with respect to use rates and maintenance of the asset. This is a situation of mutual privilege and no right; no user has the right to preclude use by any other party (Bromley, 1991). In this case there is a failure to deal with the obvious reality that, as the size of the community grows, and therefore the number of rights holders increases, the total demands on the resource will ultimately exceed its rate of regeneration. Open access results from the absence, or the breakdown, of management and authority systems whose very purpose was to introduce and enforce a set of norms of behaviour among resource users with respect to that particular natural resource. If property and management arrangements are not determined, and if investment is in the form of capital assets such as improved tree species or range revegetation, the institutional vacuum of open access insures that use rates will eventually deplete the asset (Bromley, 1991).

Some common pool resources are fugitive and can be depleted, so are characterised by rivalry in exploitation (Stevenson, 1991). Under an open access management regime, resources that fall into this category are subject to use by any person who has the capability and desire to harvest or extract the resource. Its exploitation will then

result in symmetric or asymmetric negative externalities. The rivalry in consumption of a common pool resource indicates that extraction by one user of the resource precludes another user's possession. For example, if one user cut a tree, another cannot use the same tree. However, for some ubiquitous common pool resources resources, such as the air, the relevance of rivalry might not be applicable until they are consumed (or polluted) at very high rate. Rivalry in extraction indicates that the common pool resource is not a pure public good at all potential use rates (Stevenson, 1991). Depletability of a common pool resource indicates that, along with rivalry in consumption, resource supply will reduce to zero at some use rate. This is true both of strictly exhaustible resources, such as oil and minerals, and of renewable resources, such as fish and trees (Stevenson, 1991). Simple physical or economic exhaustion can reduce the formers supply to zero, and sufficiently high use rate can extinguish the latter's capability to reproduce (Daspugta and Heal, 1979, Stevenson, 1991).

The fugitive nature of some common pool resources under open access management regimes means that they must be "reduced to ownership by capture" (Ciriacy-Wantrup, 1952: noted by Stevenson, 1991). There are no formal property rights over the resource in an *in situ* condition. This means that a physical unit of the resource in its *in situ* or fugitive state cannot be associated with a particular owner unlike in a private property regime where an *in situ* resource can be said to belong to a particular real or legal person. So in an open access condition anyone who possesses the social and physical capital to exploit the resource and the desire may enter into resource harvest. The meaning of symmetric or asymmetric negative externalities of open access regimes divides open access regimes into two different groups. The symmetric externality is present in an open access regime in which each entrant to resource use imparts a negative externality to all other producers. The new entrant, in turn, simultaneously has the negative externality imposed on them by the others. The externality is reciprocal or symmetric. Common examples include fisheries, wildlife, open grazing land, ground water, unregulated woodland and forests, and common oil and gas pools. One the other hand, the asymmetric externality occurs when production or consumption decisions of economic actors enter the production or utility function of others while the recipients of the externality do not cause any reciprocal effects (Stevenson, 1991). The typical example includes the classic case of a smoking factory dirtying a nearby laundry's clothes. Most of the literature on resources managed under open access regimes has concentrated on the symmetric externality situation; however, the concept of open access can be extended to both types of externality.

In his analysis of deforestation of open access forests in Nepal, Wallace (1981) reached several important conclusions. Firstly, resource users over-consume the resource in two different ways: they over use the resource relative to other goods, and they over use the resource this year relative to next year. Both kinds of over exploitation occur because of the costs of resource use to each individual is less than cost to society. For each user, the cost of a particular product from the commons next year depends mostly on this year's consumption by other users (the benefit from the resource next year is assumed to be independent of this year's consumption). Unable to influence this year's consumption by other harvesters, each user will consume the resources until this year's marginal benefit equals this year's marginal cost. Secondly, with two substitutable resources, resource users may consume too much of one and too little of another, even if total use is efficient. This unbalanced consumption mix also results from the divergence of private and social costs of resource consumption. For example, forest users may consume too much of one kind of wood and too little of another. Resource users in open access regimes tend to react to average rather than marginal costs and the unbalanced consumption mix is the result of different average and marginal costs (Wallace, 1981).

Thirdly, resource users may use inefficient methods to harvest a resource. In general, competing users overuse capital-intensive harvesting methods in their attempts to out-harvest each other. For example, most users freely graze cattle rather than rotating grazing areas or hand cutting fodder and stall-feeding their animals. When a fisherman harvesting in an open access regime buys and uses a bigger boat, he does not consider the decreased catch of other fisherman as a personal cost. As a result, every fisherman uses too much effort to harvest. Similarly, when a villager grazes his animals rather than hand cutting fodder for them, he does not consider the costs of trampled seedlings to other villagers. Fourthly, resource users under open access regimes are not likely to invest in the resource at all, even when investment in increasing the supply of the resource is possible. No-one has any incentive to invest unless there is an agreement binding others to invest as well. This situation is similar to under-investment in public goods such as clean air. Open access resource users invest in replenishing the forest only until the marginal costs equal a fraction of the marginal benefit. This under investment results from a divergence between those who invest in the improvements and those who reap the benefits. The divergence results from a mismatch of the scale of some investments and the amount of potential individual benefit, and from a lack of incentive to invest in the resource for future benefits because of a competitive rush for the resource in the present (Stevenson, 1991). People who may have strong incentives to invest in protecting trees for fodder or timber will have much less incentive to do so for public goods like clean air and soil conservation because they fear others will "free-ride" on their efforts or because they can free-ride themselves. Those who do not invest because they see little direct benefit are still able to gain from the investments by others (Varughese, 1998). This inefficiently low investment by the resource users imposes a welfare loss on the group of community members. Finally, users of common pool resources in open access regimes under-invest in information about the

resource since they have no incentive to acquire knowledge about planting methods, growth rates, or optimal cutting techniques. A person who had perfect information about a common pool resource under an open access regime would not change his behaviour regarding the resource, because other users would capture most of the benefits of any change. Thus no one has any incentive to gather information about a resources managed in open access regimes (Wallace, 1981).

In conclusion, open access regimes result from the absence of well-defined property rights. Access to the resource is unregulated and is free and open to everyone (Feeny et al, 1998). Rent is completely dissipated at open access equilibrium. Theory indicates the undeniable conclusions of superfluous input levels and resource over use under open access (Stevenson, 1991). There is over-use resulting from resource users ignoring the effects of their consumption on the costs faced by other users, and there is over-use resulting from users ignoring the effect of their consumption this year on the costs they will face next year. On the supply side, common pool resources managed under open-access regimes are like public goods. Individuals cannot capture the benefits of their investments in these resources, and as a result investment is inefficiently low, resources are misallocated, and there is under-investment in information (Wallace, 1981). Governance of natural resources can thus be conceptualised as a collective endeavour of individuals organising for provision of, and appropriation from, resources that have public good characteristics. Since individual interests are unlikely to lead to sustainable management of public good in open access regimes, the design of governance for resource management has to include some elements of support from government to modify incentives for individuals (Varughese, 1998).

3.2. COMMON PROPERTY REGIMES

Common pool resources managed under common-property resources management regimes, share two important characteristics. First, exclusion of resource users to these resources is difficult. Secondly, the use of resources by one person subtracts from the welfare of other users. Natural products like trees, water, wildlife, are subtractable, and in most cases, exclusion will be problematic and costly. If one individual uses more, less remains for another. These resources are therefore potentially subject to depletion or degradation. i.e. use which is pushed beyond the limits of sustainable yields (Varughese, 1998). Berkes and Farer (1988) define common-property resources as ‘a class of resources for which exclusion is difficult and joint use involves substractability. Hence, they share the first attribute with pure public goods; the second attribute, with pure private goods. Feeny et al. (1998) defines common property resource as the resource held by an identifiable community of interdependent users in which these users exclude outsiders while regulating use by members of the local community. Within the community, rights to the resources are unlikely to be either exclusive or transferable; they are often rights of equal access and use (Feeny et al, 1998). The rights of the group may be legally recognised or in some cases it may be *de facto* rights. Evidence suggests that successful exclusion under communal property is the rule rather than the exception. Many misunderstandings found in the literature may be traced to the assumption that common property is the same as open access. Hardin’s prediction of the inevitality of over-exploitation follows from this assumption (Feeny et al., 1998).

Bromley (1991) argues that a common property regime (*res communes*) represents private property for the group of co-owners (since all others are excluded from use and decision making) and individuals have rights (and duties) with respect to the resource in question. Common property is said to be similar to private property in a sense that there is exclusion of non-owners. The property-owning group may vary in nature, size, and internal structure across a broad spectrum, but it is a social unit with definite membership and boundaries, with certain common interests, with at least some interaction among members, with some common cultural norms, and often their own endogenous authority system (Bromley 1991). The management group (the “owners”) have the right to exclude non-members, and non-members have a duty to abide by exclusion. Individual members of the management group (the “co-owners”) have both rights and duties with respect to use rates and maintenance of the property owned (Bromley 1991). The fundamental difference between open access and common property is that in an open access situation, every potential user has a privilege with respect to use of the resource since no-one else has the legal ability to keep the person out. Therefore an open access situation is one of mutual privilege and no rights. In contrast, a common property regime is one in which there are rules defining who is in the resource management group and who is not (Bromley 1991).

For almost two decades after Hardin’s article, common pool resources managed under communal property and open access regimes were frequently viewed as synonymous. It was thought that common property was inherently unstable and pressures from free riders were inevitable, leading natural resources to be degraded in the ‘tragedy of the commons’. However, in many cases this is not true. More careful analysis of the foundation of common property regimes, combined with closer investigation of the management of collective goods in the developing world, suggests that common property regimes are not only viable, but in some circumstances are essential (Gibbs and Bromley, 1989). Even the common grazing lands in Hardin’s classic 'Tragedies of the Commons' were well looked after for many centuries, before they declined for reasons unrelated to any inherent flaw in the commons system (Cox, 1985). The tragedy tends to be related to the breakdown of existing commons

systems due to disruptions that have originated externally to the community (Berkes, 1989). Hardin's tragedy of the commons often results, not from any inherent failure of common property, but from institutional failure to control access to resources, and to make and enforce internal decisions for collective use. Institutional failure could be due to internal reasons, such as the inability of the users to manage themselves, or it could be due to external reasons, for example an incursion of outsiders (Dove, 1993; Berkes and Folke, 1998). Pressure on the resource because of human population growth, technological change, or economic change, including new market opportunities, may contribute to the breakdown of communal-property mechanisms for exclusion (Feeny et al., 1998). The social and political characteristics of the users of the resource and how they relate to the larger political system affects the ability of local groups to organize and manage communal property (Ostrom, 1987).

Stevenson (1991) noted seven different characteristics of common property resources, which he regards as a set of necessary and sufficient conditions for a successfully managed common property. The conditions are individually necessary because a resource managed under common property must meet all seven of them and the conditions are jointly sufficient for common property because all other resource use regimes (in particular, various forms of open access and private property) fail to meet at least one of the conditions (Stevenson, 1991). Based on the analysis of Ciriacy-Wantrup (1971) and Ciriacy-Wantrup and Bishop (1975) on the distinction between open access and common property resources, Stevenson (1991) described the following characteristics of resource ownership for common property regimes.

1. The resource unit has bounds that are well defined by physical, biological, and social parameters.
2. There is a well-delineated group of users, who are distinct from persons excluded from resource use.
3. Multiple included users participate in resource extraction
4. Explicit or implicit well-understood rules exist among users regarding their rights and their duties to one another about resource extraction
5. Users share joint, nonexclusive entitlement to the *in situ* or fugitive resource prior to its capture or use.
6. Users compete for the resource, and thereby impose negative externalities on one another.
7. A well-delineated group of rights holders exists, which may or may not coincide with the group of users.

The first point indicates that resources under common property regimes must be defined biologically, physically, or by social convention or a combination of these. Common property refers to a social institution, which differs from physical objects. The resource is the physical or intangible asset that a group can own and manage as common property. Demarcation of the resource, however, must be included in the definition of the social institution of common property since the institution cannot exist without the resource it controls (Stevenson, 1991). The second point specifies that there are two groups associated with the resource: included users and excluded persons. The first group consists of an identifiable, countable number of users the second of a set of persons who do not have the right to use (Stevenson, 1991). This is in contrast to open access where every one is a potential user. Third, common property resources are utilized by more than two people unlike in private property where a single person is considered to be the legitimate user. Fourth, the existence of rules regarding resource extraction to guide the groups of resource users is the main characteristic, which helps distinguish common property from an open access situation. This includes how rights are transferred, what financial obligation a user has to the group, what contribution he or she has, and how the rules themselves are changed. The rules may be formal and explicit or they may be informal and implicitly accepted (Stevenson, 1991).

The fifth point provides an essential difference between common and private property and the relationship of common property to a public good. Unlike common property, in private property the *in situ* resource belongs to a particular owner. Under a common property regime, the user may have a secure expectation of getting particular units of physical product, but not about possessing particular physical units. The joint, non-exclusive entitlement condition means that participants in common property arrangements have simultaneous, *ex ante* claims on any particular unit of the resource (Stevenson, 1991). It can be argued that an essential step in the use of common property resources (except for resources which have pure public good character) is that they be "reduced" to sole ownership by capture. Point five also provides some basis to distinguish between common property and public goods. First, some common property resources have public good characteristics like national parks, reserves, and so on which do not exhibit rivalry at a low and moderate level of use. Reducing the resource to sole ownership through capture does not apply to these resources as it does to resources that exhibit rivalry in extraction. Second, these resources exhibit joint, nonexclusive entitlement, because all participants who use the resource have an *ex ante* claim to benefits from the resource. For these reasons, reduction to sole ownership through capture is not a necessary condition for common property, but joint, nonexclusive entitlement is (Stevenson, 1991).

Point six indicates that, under common property multiple users compete for the resource in such a way as to make mutual capital investments assist each other in resource management and utilization. As in open access conditions, extraction by one user of the resource in a common property regime may generate negative externalities for other users. However, the difference lies in the extent to which externalities are generated. Point

7 recognizes that the resource users and resource owners are not always coincident in a common property regime. A common property rights holder may rent their resource use rights to the actual users subject to the condition that the right holders be a group of people who fulfill the institutional criteria of common property (Stevenson, 1991). This is not meant to preclude the situation in which a government entity coordinates or imposes rules regarding resource extraction on users and rights holders.

In conclusion, common property is a form of resource management in which a well-delineated group of competing users participates in extraction or use of a jointly held, fugitive resource according to explicitly or implicitly understood rules about who may take how much of the resource (Stevenson, 1991). Indeed, the confusion in the conventional literature over the tragedy of the commons arises from a failure to understand the concept of property, and therefore to fail to understand common property regimes (Bromley, 1991).

3.3. TRANSACTION COSTS

3.3.1 DEFINITION

Transaction costs have been a subject of discussion in the literature of externalities over the past few decades. Despite variation in the concept of transaction costs, a number of useful definitions are available in the literature such as Cheung (1969), Williamson (1973, 1981), Brazel (1989) and North (1990). Transaction costs are the costs of arranging, monitoring, or enforcing agreements; the cost associated with all the exchanges that take place within an economy (Eggertsson, 1990; North, 1990). Randall (1972) considers transaction costs as "the costs of obtaining information, establishing one's bargaining position, bargaining and arriving at a group decision, and enforcing the decision made". Coase (1960) observed that identifying relevant parties, collecting pertinent information, conducting negotiations, enforcing agreements, and so on, could be sufficiently costly to prevent many transactions from being achieved. Transaction costs are "the costs of resolving situations where involved parties have conflicting interests…. including the costs to each party of gathering information, determining their position and strategy; the costs of the bargaining, negotiation, arbitration, judicial or any other process by which an agreement is reached….. and the costs of enforcing the agreement is made" (Randall (1975: noted by Colby, 1995).

Dahlman (1979) separates transaction costs into (a) search and information costs, (b) bargaining and decision costs, and (c) policing and enforcement costs and then states that all of these costs "represent resource losses due to lack of information". Transaction costs are a real and unavoidable aspect of any economic system. It is not even possible to eliminate transactions costs by prohibiting all transactions because such a decree would have to be deliberated and enforced and other institutions would emerge to replace banned markets. Williamson (1979) argues that "if transaction costs are negligible, the organization of economic activity is irrelevant, since any advantages of one mode of organization appears to hold over another will simply be eliminated by costless transaction". However, Libcap (1991) points out that having lower transaction costs is a necessary rather than a sufficient condition for adoption. The inevitability of transactions costs means that any notion of Pareto optimality is incomplete until transaction costs are incorporated (Griffin, 1991). It is therefore appropriate to examine transactions costs when evaluating the potential of new institutions as alternatives to existing institutions (Kuperan et al., 1998).

3.3.2 TRANSACTION COSTS AND COMMON PROPERTY RESOURCE MANAGEMENT

Resource users enter into various kinds of explicit and implicit agreements in order to initiate collective action or agree to exchange or transfer goods or services, which requires immediate and costly contributions. These contributions will be incurred in the form of negotiation, monitoring and enforcement costs, which can be a significant part of the resource use. The process of contracting involves two parties agreeing to *ex ante* and *ex post* situations where a substantial amount of management costs are incurred at different stages of resource management. *Ex ante* costs involve search costs of finding partners, setting up the agreement, and the cost incurred negotiating with partners. *Ex post* costs are needed to ensure that the exchange is carried out, or monitored, and if necessary enforcing its performance. Hanna (1995) describes four different resource management stages in which variable transactions costs are incurred. These four different stages are the description of the resource context, regulatory design, implementation, and enforcement of agreed upon rules. Description of the resource context includes a description of resource users, processors, markets, and the analysis of social and economic characteristics of all resource interests. Designing the regulation requires information describing the resource context and is dependent on the quality of contextual information provided. Implementation of a regulation is a critical test of a regulation's fit to its contexts. Monitoring and enforcement of a regulation is a final area of transaction costs and monitoring compliance with regulations will be excessively costly if monitoring systems are not designed to be consistent with resource dynamics or users operation (Hanna, 1995).

Bromley (1991) discusses three types of transaction costs – information costs, contracting costs, and enforcement costs. Any transaction requires knowledge about the opportunity for exchange, the nature of the items to be exchanged, and the willingness of the participants to engage in bargaining processes (Bromley, 1991). The information required for various co-operative arrangements is not costless and the lack of this information can prevent the possibility of collective action. Once willing bargainers locate one another, considerable effort is required to reach a common agreement, which is also a costly process, for example in terms of the time involved. Finally, there are certain enforcement costs that the individual participants need to bear although some part of the resource management costs can be covered by the state (Bromley, 1991). It is often argued that the costs of privatization of communal resources (fences, measurement, title insurance, record-keeping) are greater than those of the collectively managed public domain village. However, when the various hidden costs of resource management are incorporated into an economic analysis of common property, a somewhat modified picture appears. A common property regime would not have the need for extensive records on boundaries and sales, but will instead require meetings and discussions where the co-owners decided their strategies for the coming period (Bromley, 1991). These meetings constitute a significant portion of costs of resource use.

In many field settings, efficient management of common property resources is often challenged by various sources of uncertainty that result in high transactions costs of resource management. For individual resource users, the transactions costs of resource management are related to participation, opportunity cost of time involved in meetings, time required to acquire information and communication, direct monetary expenses for travel, communication and information. These costs are directly related to management effectiveness and efficiency of a collection action, and at the community level they are borne by poor community members. It may easily happen that benefits from collective action are exceeded by transaction costs (Hanna, 1995). It is argued that the transaction costs disincentives may be counteracted if larger proportions of poorer users see environment management, particularly conservation of local natural resources, as an important part of their way of life, rather than simply an economic enterprise. However, poor users with little outside opportunity and a shorter time horizon tend to be concerned about the extent of transaction costs of resource management and disregard the longer term considerations of resource conservation which might be significant constraints on participation. The possibility of cooperation in such games depends on the future not being discounted too heavily, and on the availability of retaliatory strategies that are credible in the sense that once a person has defected, it must be in the interests of others to put the retaliation into effect (Aggrawal, 2000). Ignoring transactions costs in policy design and evaluation risks producing sub-optimal policy recommendations. A starting point lies in an examination of what transactions occur, and what interactions are needed as the bare minimum for effective policy operation (Falconer, 2000).

Room (1980) argues that economic studies of participatory forest management have been biased towards measuring benefits as opposed to costs, especially the likely major transaction costs of management for local forest users. In most of the community-based resource management systems with an initially degraded resource base, the costs associated with management are reported to be higher than the expected benefits. Nonetheless, in many economic models, physical input and property rights are taken as variables and transaction costs of resource management are seldom incorporated in the 'price' of resource consumption, though they can be a significant component of resource use. These costs vary with attributes of the resource, nature of use rights and socio-economic circumstances of the local communities. An adequate theory of forest resource use should incorporate the role of institutional structures associated with different forest management regimes and their associated transaction costs (Kant, 2000).

High transaction costs, whether perceived or actual, related to entry into collective action may pose significant constraints on participation. The private transactions costs of participation may be so high that it might form potentially important constraints on collective action. The existence of transaction costs may also have important distributional aspects. For example, sizeable fixed transaction costs related to participation (i.e. mandatory start-up costs to be contributed by each participating community member at the initial stage of collective action) may discourage poor community members from entering into community-based management, as their use of natural products from the CPR is relatively small. To date, however, there has been very little attention paid to the socio-economic significance of such costs. Transactions costs are largely invisible and there has been little attempt to quantify them (Falconer, 2000). Aggrawal (2000) argues that there is a need to direct research efforts towards understanding how these groups form and evolve over time, how and to what extent are they able to control for the tendency to free ride (a problem that arises in larger groups) and for what kind of activities it is desirable to have such groups. While there has been a recent growth in theoretical research in this area, systematic empirical research is still lagging behind (Aggrawal, 2000).

Despite their importance, transaction costs incurred in community-based natural resource management are often not incorporated into economic analyses. Few measurements of transaction costs in natural resource management have been reported. Transaction costs in the public sector can be estimated on the basis of

information acquired from public agencies, which are typically part of the organization's budget. However, measuring the transaction costs of resource users is often difficult (Birner and Wittmer, 2000) since most of these costs are incurred indirectly i.e. time spent for meetings, carrying out protection work and other daily activities. It is argued that the higher the transaction costs of negotiating, monitoring and enforcing collective agreements, the lower the likelihood that collective action would be observed. Theoretical review suggests that the probability of collective action is likely to be higher in groups that: (a) are relatively small in size (b) where members are family related (c) where members interact in other activities rather than single action (d) where members have few other options besides sharing a common resource and (e) where there has been a history of cooperation (Aggrawal, 2000). Within a given group, the probability of cooperation is likely to be higher in activities that: (i) are repeated very often as opposed to one-time activities, (ii) where there is a commonly accepted set of norms (iii) where there is a common information base about the benefits and costs of the collective activity and (iv) where short-term benefits from defection are low relative to the long-term benefits from cooperation (Aggrawal, 2000). Despite this understanding of collective action, empirical research on transactions costs is scarce, and surveys among resource users have to be conducted to obtain information on these costs (Birner and Wittmer, 2000).

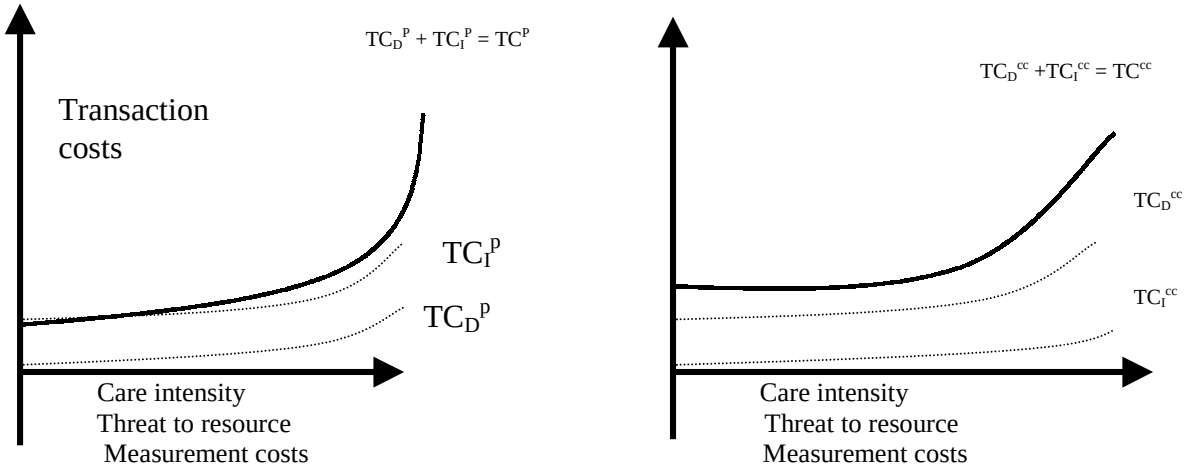
3.3.3 TRANSACTION COSTS OF DIFFERENT GOVERNANCE STRUCTURES IN NATURAL RESOURCE MANAGEMENT

Birner and Wittmer (2000) divided transaction costs of natural resource management into two parts i.e. transaction costs of decision-making (TC_D) and transaction costs to implement those decisions (TC_I). The decision costs (TC_D) are incurred during the process of acquiring various information prerequisite to making appropriate decisions and costs of coordinating the activities like resources spent for meetings, settling conflicts, and costs arising due to delayed decisions. Transaction costs of implementation (TC_I) influence the incentives of those carrying out implementation activities to comply with the management decisions made, the presence of asymmetrical information and the measurability of the outcome, the possibilities to use social control for monitoring, and the damage caused in the case of non-compliance (Birner and Wittmer, 2000). Economic literature suggests that the incentive for compliance depends on the direct benefits from the compliance as compared to defection. Moreover, the incentive for compliance is also influenced by the value which resource users put on the management decision and degree of members' compliance with these obligations. The extent of group obligation depends positively upon (a) the cost of producing the joint good and (b) the degree dependency among members. The degree of members' compliance with these obligations depends positively on the monitoring and sanctioning capabilities of the group. Since costs of monitoring and sanctioning can be high, the degree of cooperative success will depend on the mechanisms the group adopts to economize on such costs (Hetcher, 1990 noted by Molians, 1998). A way to reduce monitoring costs is to increase user participation in decision-making processes, which possibly creates the legitimacy required for compliance. User participation in common property regimes is considered to be essential in developing countries, because resource dependency is very high, number of users is comparatively large, spatial extension and poor infrastructure make monitoring costly, conservation measures are care-intensive and irreversible damage may occur (Birner and Wittmer, 2000).

Transaction costs of public sector governance (TC^p) and co-management (TC^{cc}) are presented in Figure 1a and 1b respectively. Transaction costs of decision and implementation change in relation to cost of resource management. Variable costs described here represent the care-intensity of the implementation activities, the costs of measuring the outcomes and/or intensity of the threats to the natural resource in question. It is clear that the decision costs of state governance (TC_D^p) are lower than those of co-management (TC_D^{cc}) with lower values of the variable costs (little care-intensity, little threat to resources and measurement of outcome is possible). This reveals that transaction costs are higher for co-management governance indicating a higher degree of effort required for joint decision-making and coordination. When more than one person/group is required to make any given decision, time and effort are involved, and the time and effort required appear to be rapidly increasing functions of the size of the group. When the consent of every party participating in collective action is required for agreement, these costs may be very high indeed (Baden, 1998). Nonetheless, with increasing value of variable cost, the decision costs under public sector governance are assumed to increase more rapidly than those under co-management, because the probability of making wrong decisions is assumed to be higher due to lack of idiosyncratic knowledge that further increases the decision costs (Birner and Wittmer, 2000). In contrast, transaction costs of implementation seem to be higher for public sector governance than those of co-management. Community-based management systems have the potential of solving the commons dilemma by internalizing the high information and transaction costs. The community has a built-in incentive of social capital that can be used to overcome the problem caused by asymmetrical information and lower opportunity costs of their time than that of state machinery. The community also has at its disposal the requisite social coercive mechanisms to force compliance with expected harvest (Grima and Berkes, 1989). Though the figure does not specify how the transaction costs are distributed between state government and community in joint management, co-management seems to be crucial to shift transaction costs from state agencies to local users (Birner and Wittmer, 2000).

Figure 1: Decision and implementation costs of public sector governance and co-management

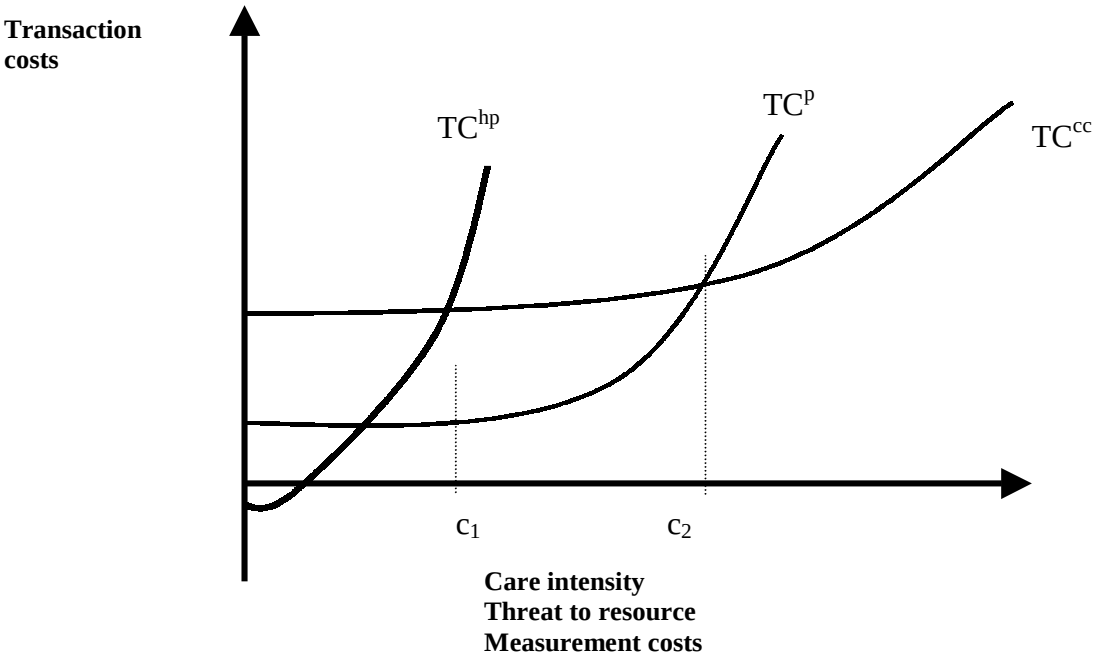
a) Public sector government b) co-management (state/community)



Source: Birner and Wittmer (2000)

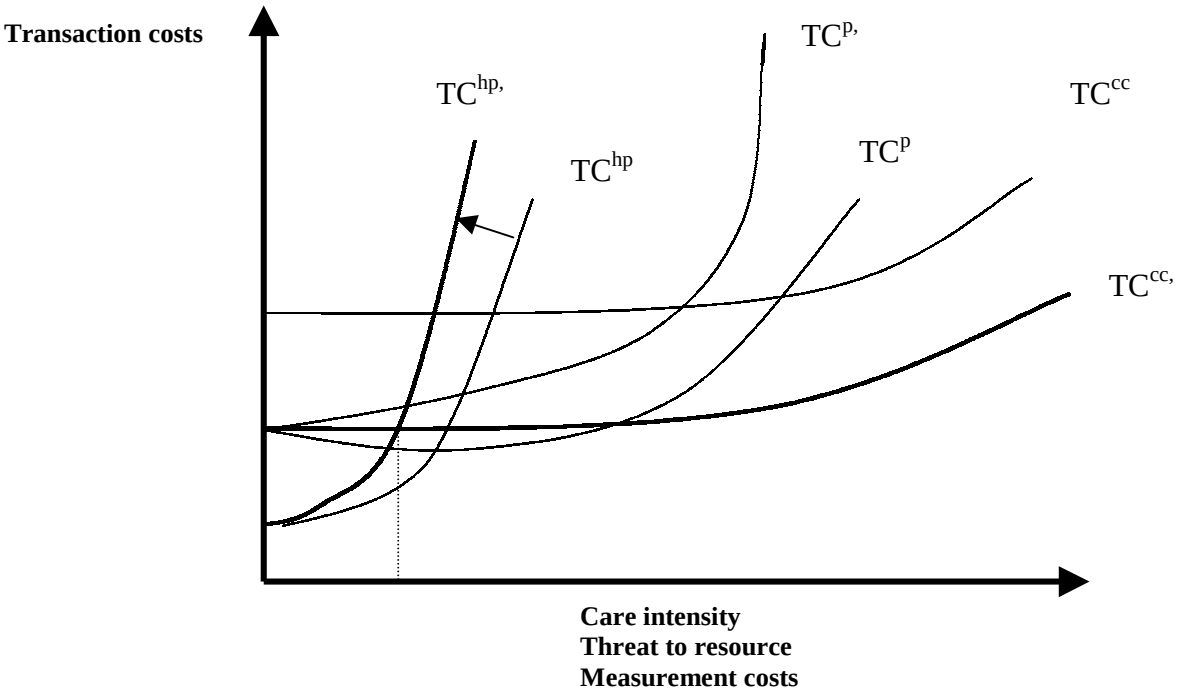
Transaction costs of public sector governance and co-management are compared with those of hybrid private sector governance (TC^{hp}) in Figure 2. The State government's involvement in common property resource management seems to be essential for various types of conservation initiatives, such as biodiversity conservation. The graph tries to deal with "transaction of public relevance", as mentioned in the previous discussion, and representation of the resulting efficient governance structure in relation to the variable costs. Hybrid private sector governance is assumed to have the lowest transaction for low values of variable costs because (a) decision costs are low (b) there is no need to overcome collective action and co-ordination problems, and (c) private enterprises can typically use stronger incentives than the state (Birner and Wittmer, 2000). Hart et al. (1997) argue that incentives are too great in the private sector for cost reduction and so the adverse effects on noncontractible quality are neglected. The figure demonstrates that contracted or regulated private sector governance is comparatively efficient if c is smaller than c_1, pure state governance is comparatively efficient for $c_1 < c < c_2$, and co-management (public and collective action sector) is comparatively efficient if $c > c_2$ (Birner and Wittmer, 2000).

Figure : 2 Comparative efficiency of different governance structure



Source: Birner and Wittmer (2000)

Figure : 3 Impact of state capability and social capital on governance structure



Source: Birner and Wittmer (2000)

Efficient governance structure is also influenced by reduced state capability and social capital of the community engaging in collective action, which is represented in Figure 3. Social capital consists of features of social organization such as networks, norms and social trust that can improve the efficiency of the community by facilitating cooperation and coordination (Molians, 1998). Social capital is also productive since it makes possible the achievement of certain outcomes that would not be attainable otherwise (Molians, 1998) and it also reduces the transaction costs of collective action. Peer monitoring can considerably reduce the cost of monitoring and this is one reason why local informal institutions of resource management are able to perform better than centralised government mandated institutions (Aggrawal, 2000). If state capability is low, the transaction costs of hybrid private governance and of state governance increase more rapidly with increasing values of variable cost, because the state is less able to protect endangered natural resources without community participation. For example, losses of biodiversity may increase more rapidly due to difficulties of state governance preventing over exploitation of biological resources. As discussed earlier, increased social capital reduces the transaction costs of collective action since coordination costs in cooperative arrangements are lowered by the implementation of an instrument of social control. Figure 3 shows that hybrid private governance is comparatively efficient for $c > c'$ and co-management is the optimal choice for $c > c'$ (Birner and Wittmer, 2000). Table 1 provides a summary of the institutional choice for common property resource management under different state capability and social capital.

Table 1: Role of social capital and state capability in selecting appropriate institution for commons management

State Capability	**Social Capital**	
	Low	**High**
Low	(Hybrid: private sector management under contract or regulation)	Community-based management
High	Public sector management	Hybrid: co-management involving collective action sector and state

Source: After Birner and Wittmer (2000)

If both state capability and social capital are low, private sector management with state regulation is superior over community-based management in order to reduce the transaction costs of collective action. Participatory

management is especially suited to cases where community involvement in decision-making processes enhances compliance with resource use regulation and where equity issues need to be taken into account. Co-management may be an optimal choice where the governance structure places less demands on social capital (state assistance in maintaining governance structure) and state capability (transparency may help to reduce corruption in the public sector) (Birner and Wittmer, 2000).

Birner and Wittmer (2000) summarize the following attributes of the most important governance structure for the common property resource management (Table 2).

Table 2: Important attributes of different property rights structure in natural resource management

Governance Structure **Attributes**	Centralized / Concentrated public agency	Community Management	Private sector management	Regulated community management	Regulated private sector management	Co-management (State/ communities
Instruments						
Incentive intensity	-	+	++	+	+	+
Administrative control	++	-	-	+	+	-/+*
Participation, social control	-	++	-	+	-	+
Demand on Frame Conditions						
State capability	++	-	-	+	+	+
Social capital	-	++	-	+	-	+
Accommodation of public interests						
Local	-	++	-	+	-	++
Higher level / Sovereign	++	-	-	++	++	+

++ = Strong, + = semi-strong, - = weak, * depending on the type of co-management arrangements

Source: After (Birner and Wittmer, 2000; based on Williamson, 1999)

3.3.4 EMPERICAL STUDIES ON TRANSACTION COST ECONOMICS IN NATURAL RESOURCE MANAGEMENT

Cheung (1975) addresses transactions costs in the context of agricultural land markets and emphasizes the influence of differing legal arrangements on transaction costs and thus on negotiations and contractual behavior. Crocker (1971) conducted an empirical analysis on the role of transaction costs in natural resource transfer (the impact of air pollution on agriculture land use). He concluded that transaction costs for affected farmland owners to bargain with polluters were very high. Leffler and Rucker (1990) applied transaction costs analysis to the structure of timber harvesting contracts and established empirical evidence for the influence of specific types of transactions costs on contractual provisions. Kumm and Drake (1998) estimated the private transactions costs incurred in relation to participation in the Swedish agri-environmental programme, using data from a survey of 90 randomly selected farmers. Transaction costs were defined to include expenditure for assistance from agriculture or conservation consultants, mapping, communication costs related to participation, and time inputs (individuals working hours). On average, consultants' costs accounted for approximately one-third of the total

costs and the individual's labour accounted for approximately two-thirds. Transaction costs, as a share of actual compensation received, are typically around 12 % and private transaction costs have risen over recent years.

(Drake et al., 1999) carried out a pan-European survey to determine the cause of participation and non-participation of farmers in agri-environmental programs in eight EU members' states. They outlined a theoretical econometric participation function related to parameters like the direct resource costs of conservation (in terms of reduced production levels), the direct utility of the farmer derived from conservation activities, and the transactions costs borne by farmers in relation to participation. They found that transaction costs borne by farmers in relation to schemes might pose constraints on participation. Information-gathering, for example, on the economics of organic conversion and how to change management practices, can be a key component of the transactions costs incurred by farmers wishing to participate in conservation schemes (Drake et al., 1999).

Aggarwal (2000) undertook a case study of group-owned wells in Southern India in an attempt to understand the possibilities and limitations of cooperation in small groups by looking at the transaction costs associated with these activities. He observed that start-up costs of well construction in these villages included the costs associated with digging, pump installation, construction of waterways and electricity connection. The major operating expenses were the costs of electricity used in pumping, the cost of pump repair and maintenance, and costs associated with periodic removal of silt from the well. The community also invests substantial amount of money periodically for the expansion of the wells. He observed that costs of negotiating are likely to be higher in the case of expansion activities, particularly in groups where heterogeneity among members in terms of their endowments and needs is high. Because of the higher stakes involved in the case of expansion activities, a higher peer pressure is required to enforce collective arrangements (Aggrawal, 2000). Moreover, he also observed that instead of a community-owned well, most villagers prefer to have their own private well. Their reluctance for joint investment can be understood in terms of the high transactions costs of negotiating and enforcing a complete contract which outlines the obligations of each member under the different possible contingencies that can arise (Aggrawal, 2000).

Richards et al. (1999) undertook a participatory economic analysis of community forestry in Nepal in an attempt to improve donor and project understanding of the economic incentives faced by different stakeholders, and in particular local forest users. The case study particularly seeks to contribute to efforts to improve equity in the forest user groups and to understand the role of recurrent annual transaction costs faced by community members at the local level. Transaction costs were simply measured in terms of the opportunity costs of time spent in obligatory forest activities (planting, protection, weeding etc.) and in various community meetings. They found that transaction costs of resource management as a percentage of total costs were significantly higher for the less forest dependent community than that for more dependent forest user groups. This finding can be explained by economies of scale. In the case of groups more dependent on forests, people devoted much of their time to forestry-related activities; therefore the transaction costs were relatively low as a proportion of total costs, usually less than 5 %. However, in a situation in which forestry is just one of many livelihood activities, transaction costs as a proportion of total costs can be significant- up to and sometimes above 20 % of the cost. The study included that it is very important to include transaction costs in any economic study of community-based resource management (Richards et al., 1999).

Kuperan et al. (1998) attempt to analyze transaction costs of a fisheries co-management system in San Salvador Island in Philippines. The transaction costs of fisheries management was categorized into three major cost items: (a) information costs (b) collective fisheries decision-making costs and (c) collective operational costs. They found that whether or not the difference in the total costs of fisheries management between centralized government management and co-management is significant, there is significant difference in the costs at the different stages of management. For the first two stages, which are the stages of initiating a new management regime and community education, the costs are higher for the co-management approach compared to the centralized approach. Nonetheless, transaction costs are lower in the later stage for a co-management approach when monitoring and enforcement and conflict resolution become important. This is because the costs of monitoring and enforcement are likely to be lower as resource users are more likely to comply with community devised rules and regulations as opposed to regulation imposed by centralized government authority. Since monitoring costs are the major transaction costs, and monitoring is undertaken by the community, there is an opportunity for these costs to decline over time as community acceptance of the rules and regulations for managing the common property increases with a greater moral obligation to obey those rules and regulations (Kuperan et al., 1998), i.e. the costs are internalized. They further argue that monitoring activities emerge as the activity accounting for more than fifty percent of the total costs of all the activities involved in co-management. It takes up the bulk of time as it is a continuous day-to-day activity and it is crucial for the maintenance of the institution (Kuperan et al., 1998).

Though the management of CPRs and its implication for environment and poverty has been well-studied, very few empirical studies have been undertaken that analyse the transaction costs of resource management under

common property regimes. Much of the existing literature on these issues touches upon the theoretical aspect of transaction costs in resource management (Hanna, 1995, Birner and Wittmer, 2000; Drennan, 2000) without a great deal of quantification. Davies and Richards (1999) extensively reviewed the literature on economic analysis of community-based forest management to understand the incentives to different stakeholders and found that these studies tend to biased towards i) reviews of valuation studies as opposed to providing clear methodological guidance; ii) non-market valuation for global and national stakeholders as opposed to how to add marketable value for local stakeholders; iii) benefits in general as opposed to costs like transaction costs; iv) sophisticated high-cost methods as opposed to more accessible low-cost methods; v) *ex-ante* studies for project preparation as opposed to *ex-post* monitoring and impact analysis; vi) treating forestry as a separate enterprise as opposed to a more holistic livelihood focus; vii) efficiency and profitability as opposed to equity, gender and institutional issues and; viii) returns to land and capital as opposed to returns to labour. Hobley and Wollengerg (1996) pointed out that 'chief amongst the questions still to be answered is how great are the real costs and benefits of participation, and how they are distributed amongst the various actors. Grimble and Wellard (1997) stress the need to evaluate distributional and social effects as a part of an holistic approach or procedure for gaining an understanding of a system, and assessing the impact to that system, by means of identifying the key actors or stakeholders and assessing their respective economic interest in the system. The findings of such research will be instrumental in better informing policymakers about institutional support structures that would facilitate efficient and equitable resource management regimes at the local level (Gibson et al., 2000).

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