Economics of Integrated Catchment Management

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Integrated Catchment Management (ICM) can be viewed as an institutional instrument designed to ameliorate losses of economic efficiency that have arisen due to incomplete specification of the privileges and restrictions attached to property rights. If applied appropriately ICM can facilitate the emergence of a market in which parties disadvantaged by incomplete specification attempt to bribe those advantaged, with the aim of obtaining the latter's agreement to more complete specification. The instrument provides potential for transactions costs of bargaining to be reduced substantially by reducing the number of parties eligible to participate in, and installing the state as broker and arbiter of, the bargaining process. Participation by sub-catchment committees and their constituents in the bargaining process can also, by fostering peer pressure, reduce the transactions costs of monitoring and obtaining compliance with any bargains successfully negotiated. However, the extent to which transactions costs are reduced in practice, and bargains are entered into and complied with as a result, depends on how successfully ICM principles are applied in practice.

1. Background

The Murray-Darling Basin (MDB) covers one-seventh of the area of Australia (Murray-Darling Basin Ministerial Council 1989). It is 1,450 kilometres long and 1,000 kilometres across at its widest point (Eastburn), with a population of about 1.6 million people (Read). It includes parts of Queensland, New South Wales, Victoria and South Australia and is subject to the power and responsibilities of the four State Governments as well as of the Commonwealth Government.

In 1985, Ministers representing the water, land and environmental portfolios of the Commonwealth, New South Wales, Victorian and South Australian Governments met to establish the Murray-Darling Basin Ministerial Council (MDBMC). It was agreed that there were important water and land degradation problems (including soil and water salinisation and pollution of rivers and wetlands with nutrients and biocide residues) that transcended the separate responsibilities of their governments and which therefore required an integrated approach. A need for improved community participation in developing strategies for addressing these problems was also recognised (Murray-Darling Basin Ministerial Council 1987).

The Natural Resources Management Strategy (NRMS) was developed by the MDBMC as a result. It "identifies the need for communities and Government to co-operate and coordinate their efforts (with respect to managing the MDB's natural resources)" and identifies responsibilities for action (Murray-Darling Basin Ministerial Council 1989, p.iii). Implementation of the NRMS is the responsibility of the Murray-Darling Basin Commission (MDBC) which is the executive arm of the MDBMC.

The NRMS can be viewed as an attempt to create a set of new institutional structures according to the philosophy of integrated catchment management (ICM). The New South Wales (NSW) Government's Total Catchment Management (TCM) philosophy represents application of ICM principles in the NSW context, being given legislative backing through the New South Wales Catchment Management Act 1989.

The ICM philosophy is again applied, at a yet lower level of aggregation, in the NSW Integrated Drainage Policy for Irrigated Areas (Department of Water Resources) which aims for communities of irrigated subcatchments to assume greater responsibility for addressing resource degradation problems to which individuals in their communities contribute and/or from which they incur damages. The proposed vehicles for implementing this policy are land and water management plans (L&WMPs) developed by community working groups comprised mostly of private stakeholders. Although government agency staff may be invited to become members of a community working group and/or of related sub-committees, their role is limited to that of providing information and advice.

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2. Objectives

In this article the aim is to analyse the implications for economic efficiency of the state adopting ICM as a method of resolving problems in natural resource management. The approach followed is to investigate how facilitating community involvement in natural resource management creates incentives whereby information requirements are more fully satisfied and individuals behave more in accordance with the interests of society.

Adoption of the ICM philosophy signifies an intention to change considerably the way natural resource management policies are developed. It requires governments lessening their adherence to a 'top-down' approach to problem-solving and relying to a greater extent on a formalised 'bottom-up' process of community involvement in identifying problems and proposing solutions.

Despite the significance of this change in policy-making method with respect to natural resource problems, the implications of this change with respect to economic efficiency have been paid scant attention. The focus of economists working on natural resource management issues has remained on the problem of choice among policy instruments (eg., standards, input restrictions, pollution-reduction subsidies, polluter-pays charges and transferable pollution entitlements), leaving the problem of choice among policy-making methods largely unattended. The relative merits of top-down and bottom-up approaches to solving problems with diffuse causes (such as are often found in natural resource management) has, however, received considerable attention in the literature of agricultural and rural planning for developing countries (Hunter; Belshaw; Livingstone), and in the Australian rural extension literature (Bawden *et al.*, and Martin).

After outlining the way in which ICM principles are being applied with respect to irrigated agriculture in NSW in Section 3, the rationale offered in the literature for adoption of ICM is reviewed in Section 4. The ways in which ICM may influence economic efficiency are explored in Section 5. These relate to costs of accessing information on, and implementing solutions to, resource degradation problems. Implications for rent-seeking behaviour are also examined.

3. Integrated Catchment Management in Irrigation Areas of NSW

In NSW, Total (ie., integrated) Catchment Management aims "to achieve better coordination between resource managers (government agencies) and users, and to achieve greater community participation in natural resource management" (Department of Water Resources, p.2). The legislation under which the program operates allows any individual or government agency anywhere in the State to initiate a catchment management committee (CMC). The majority of committee members must be land holders, and relevant local and state government agencies must be represented. The functions of CMCs include the preparation and implementation (after NSW Government approval) of catchment management strategies. A strategy can propose actions and how to implement them. CMCs have access to technical support from government agencies (Industry Commission).

CMCs are typically formed to represent communities of entire catchments. It was proposed in the New South Wales Integrated Drainage Policy for Irrigated Areas that community working groups (CWGs) be constituted as sub-committees of CMCs to address natural resource management issues relating to each irrigated area within a catchment.

The development of the integrated drainage policy can be viewed as a case in which the MDBMC, through controlling access to funds available under the Murray-Darling Basin Drainage Program, exerted financial leverage over the NSW Government and communities of irrigated areas in order to 'enforce' the practical application of the ICM philosophy embodied in the NRMS. NSW Government applications to the MDBC Drainage Program (a component of the NRMS) for matching funding of drainage-related capital works had previously involved only informal consultation among relevant government agencies. There had been only cursory attempts to integrate drainage works proposals with complementary on-farm actions so as to increase the cost-effectiveness of the works. By signalling that an ICM approach to drainage-related issues needed to be demonstrated in support of applications for funding capital works, the incentive for communities and government agencies to practice those principles was increased considerably.

The powers and responsibilities of CMCs and CWGs are currently limited to those necessary to advise the NSW Government. Read recommends as a priority that consideration should be given to assigning greater rights and responsibilities to community groups. The Industry Commission (p.184) recognised that if ICM is successful in its advisory role it could evolve into a mechanism for making decisions, but concluded:

"It is too early to gauge the quality of policy input emanating from catchment committees, its impact on policy makers, or the cost effectiveness of options. At this stage, ICM is perhaps best viewed as an important trial to be modified, as appropriate, as a better picture is gained of its precise role."

4. The Rationale for Integrated Catchment Management

Firstly, ICM is aligned with an emerging consensus within the rural extension profession that information requirements for solving environmental problems exceed the capabilities of agencies or groups of agencies, let alone individual extension officers, to satisfy. The diffusion model, which views extension officers as being a bridge between research (knowledge) and farmer implementation, is considered inadequate for addressing the information needs for solving these problems (Martin). ICM can be thought of as a way of obtaining increased collaboration within communities, among communities and between communities and the state in order to improve identification and implementation of solutions to environmental problems.

Secondly, Marston suggested that TCM improves the quality of natural resource management by increasing peer pressure on land owners to act in accordance with the collective interest of their community and by increasing agency commitment to co-operating with communities.

Reflecting on the West Australian experience with Soil Conservation Districts (SCD) and associated community committees, Robertson found the following outcomes of community involvement to be important in explaining the overall success of the SCD program:

- the concerns of individuals were widened from their private cause-and-effect relationships to community-wide cause-and-effect relationships;
- government research and extension was focussed to a greater extent on addressing causes of resource degradation rather than addressing the outcomes of degradation for individuals on a piecemeal basis;
- community committees integrated information from farmers and government agencies;
- community committees acted as peer groups in fostering individuals' attitudes to resource management; and
- changes in individuals' attitudes often led to changes in on-farm practices.

The approach taken in analysing the implications of ICM for economic efficiency was to investigate how facilitation of community involvement in natural resource management creates incentives leading to the types of benefits identified above, viz. greater accumulation of relevant information and greater consistency of individual behaviour with the interests of society. Understanding the attributes of community involvement which help to create these incentives will enable ICM processes to be better designed, thus increasing the degree to which intended benefits are realised.

5. Integrated Catchment Management and Economic Efficiency

5.1 Property Rights, Transactions Costs and Economic Efficiency

The economic approach to natural resource management focuses on how institutions create incentives with respect to use of resources. Institutions have been defined as "the 'going concerns' which order the relationships among individuals within a society." They include laws, constitutions, traditions, moral and ethical structures as well as "customary and accepted ways of doing things" (Randall, p.151).

Property rights, which "specify the proper relationships among people with respect to the use of things, and the penalties for violation of those proper relationships", are one aspect of the overall institutional framework (Randall, p.148). "An owner of property rights possesses the consent of fellow men to allow him to act in particular ways. An owner expects the commu-

nity to prevent others from interfering with his actions, providing that these actions are not prohibited in the specifications of his rights" (Demsetz, p.347). Economists, and policy-makers more generally, are interested in identifying how property rights systems can most efficiently be structured so that, as much as possible, private interests line up to serve the public interest and losses of economic efficiency are avoided (Sturgess).

In an economy that is otherwise conducive to economic efficiency, non attenuation of the complete set of property rights will ensure this efficiency as long as the process of specifying, transferring and enforcing these rights is costless. A set of non attenuated property rights is completely specified, exclusive, transferable, enforceable and completely enforced (Randall, p.148). These costs of specification, transfer and enforcement, known as transactions costs, can in fact be considerable. The efficient level of investment in each attribute of non attenuation is therefore that at which the marginal benefit from proceeding further toward 'perfection' equals the marginal transactions cost (Randall, p.149).

A major reason for unresolved conflict over natural resource use is incomplete specification of property rights. A property right is completely specified if it fully defines the rights that accompany ownership, the restrictions on those rights and the penalties for their violation (Randall, p.148). Unless completely specified, the incentive to trade property rights as a way of resolving a conflict is reduced and the likelihood of continuing conflict correspondingly increased.

The property rights system in existence at any time is an artefact of previous resource scarcities and distributions of political influence (Bromley and Hodge). Given previous resource scarcities, the cost of complete specification may have been perceived to exceed the benefit. Johnson notes, for instance, how the Torrens system of land titles evolved in Australia at a time when the present magnitude and diversity of off-site costs imposed by land use externalities was not envisaged.

Over time, however, new technology can reduce the cost of specifying rights more completely. Furthermore, the benefits of more complete specification increase when the loss of social welfare associated with the existing level of specification has increased. Losses of social welfare occur because individuals have insufficient incentive to account for 'bads' they are not restricted from imposing on others (ie., causing external costs) or for the 'goods' they are unable to capture for themselves (ie., causing external benefits). These losses of social welfare increase over time if the magnitude of these unaccounted for goods and bads grows and/or if the value society places on these effects appreciates.

Attempts by the state to respond to changed circumstances by making specification of property rights more comprehensive have been discouraged (a) due to entrenched opposition from polluters who are the prospective losers and, increasingly, (b) by the state's own recognition that many of its efforts to increase economic efficiency have in fact had the opposite effect due to inadequate information on which to base its decisions. Losses incurred by any party due to an administered change in a property rights system indicate that the outcome is not a Pareto-improvement. The outcome may represent a potential Pareto-improvement, however, if those who gain from the alteration of property rights could fully compensate the losers and still make a net gain (Randall, p.133).

The historical strength of disincentive (a) can be explained by non-prohibition of pollution in the past having become " . . . translated through the political process into presumptive entitlements in the policy area" (Johnson, p.177). This has meant that the state has often felt morally obliged to compensate those who would lose from legislated changes to a property rights system and, consequently, that its enthusiasm for intervening has been dampened by fiscal considerations.

With respect to disincentive (b), governments in the past have used a range of policy instruments to rectify problems arising from possible resource degradation. Instruments commonly used have been 'polluters are liable' regulations, and schemes making subsidies and/or tax concessions available to those who reduce their discharge of pollutants. Other options less frequently used include 'polluter pays' levies and allocation of 'pollution entitlements' (possibly tradeable). Repetto explores the relative merits of these types of instruments under various circumstances.

The choice among these instruments and among the possible levels of parameters for those chosen requires accurate information regarding preferences of, and biophysical interrelationships between, individuals. Wills suggests that government failure in choosing and setting instruments has often occurred because of inadequate availability of this information due to the

high transactions costs of obtaining it. Read (p.3) argues similarly that management of natural resources in the Murray-Darling Basin is constrained by "thoroughly inadequate" information about the nature of the problems and the treatments for them.

Inaction by the state with respect to deficiencies in a property rights system does not, however, preclude individuals from seeking to bargain among themselves to respecify the system to their mutual advantage. For example, a downstream user of river water affected deleteriously by upstream polluters has the possibility of offering a 'bribe' so that the polluters agree to respecify their property rights such that their behaviour is curtailed to some degree. Ignoring any third party effects, such a process will lead to a Pareto-improvement if a change in property rights actually results from the bargaining, since only trades that are mutually advantageous will occur.

In practice, however, the transactions costs involved for individuals are often large enough to outweigh the benefits they would individually gain from bargaining. Transactions costs of bargaining include those of identifying the parties to the transaction, measuring the effects of each party's actions on each of the others and excluding non-bargaining parties (ie., 'free riders') from the benefits of bargaining (Wills). They can escalate as the number of parties to be included in the process increases and increase further when off-site effects from individual land users are difficult to measure because of their non-point origin. Transactions costs are larger again when there is a wide geographical spread in the parties involved.

ICM can be viewed as an 'institutional instrument' introduced by the state to reduce the transactions costs of bargaining among parties within a catchment. The broad features of this institutional instrument are: (i) the state recognises a series of committees representing the communities of the various sub-catchments with an interest in the overall environmental outcomes to be negotiated; (ii) each committee is expected to submit a plan detailing how the natural resource management problems of its community can be solved; (iii) widespread support for each plan by the relevant community needs to be demonstrated; (iv) the state makes it understood that any requests to fund projects addressing environmental problems need to be integrated within a plan that satisfies (ii) and (iii) and that is consistent with an equitable, efficient and environmentally sustainable set of outcomes for the overall catchment. The ways in which ICM might be expected to reduce transactions costs are discussed in Sections 5.2 and 5.3.

Thus the state effectively provides for the establishment of a market in which negotiation among 'institutionalised' community representatives can occur and in which the state acts as a broker among the parties. Due to its capacity to offer financial and regulatory support to any bargains reached, the state is also a negotiator in its own right. The state performs its role as broker by providing ongoing feedback to each sub-catchment committee regarding the intentions of the other committees as well as the state's own priorities, thereby allowing each committee to tailor its plan to maximise likelihood of final acceptability to the state. In the end, however, the state has the responsibility of determining the final shape of the negotiated package and convincing all sub-catchment committees that the package deserves support from the communities they represent. Political manoeuvring by sub-catchment committees at this stage can of course be expected to be intense.

The contribution that bargaining might make to reducing losses of economic efficiency with regard to use of a natural resource can be analysed using a partial equilibrium framework as illustrated in Figure 1. The figure refers to a simplified catchment comprising only two communities, both located along the same river, with land use in the downstream community involving irrigation. Due to incomplete specification of property rights, the upstream community presumes a right to discharge pollutants to the river. Land use in the upstream community thus generates external costs by causing pollution that reduces irrigation water quality for downstream users.

The marginal profit schedule for the upstream community is denoted by MP. Marginal profit, equal to marginal private revenue less marginal private cost, declines as production increases due to increasing marginal costs. A profit-maximising upstream community (which would ignore external costs imposed on downstream irrigators) would produce up to Q_1 where marginal profit is zero.

The marginal external cost schedule is denoted by MEC. Note that, in the situation assumed, the MEC schedule for the upstream community coincides with the marginal damage schedule for the downstream community. Social efficiency of upstream production is maximised where the MP and MEC schedules intersect, corresponding with upstream production level

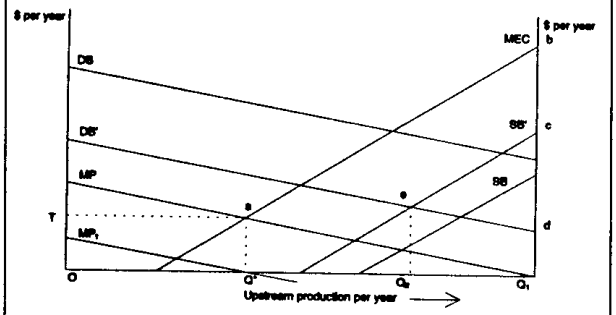
Q^*. The upstream production volume Q^*Q_1 by which the equilibrium outcome exceeds the efficient outcome is associated with a loss of economic surplus given by the area abQ_1.

In the absence of any transactions costs and assuming zero income effects,[1] the MEC schedule indicates the maximum bribe the downstream community would pay at the margin to have upstream production reduced. Similarly the MP schedule indicates the minimum bribe the upstream community would accept at the margin as compensation to reduce its production. Assuming that the downstream community is perfectly informed regarding the upstream community's MP schedule, bargaining would result in a total bribe of aQ_1Q^* being paid to the upstream community to reduce its production from Q_1 to Q^*. This is the efficient outcome identified above.

This partial equilibrium outcome of bargaining in the absence of transactions costs and income effects is identical to that which would result from imposing an optimal Pigovian tax of \$T per unit of upstream production, equal to the marginal external cost at the optimal level of externality (Pearce and Turner). Imposition of this tax would result in a shift of the marginal profit schedule from MP to MP_t (MP - T) and thus a reduction of upstream profit-maximising production from Q_1 to Q^*. However, with zero transactions costs the bargaining solution has the advantage over the Pigovian tax solution because parties to a bargain are aware of their own preferences whereas a third party (eg., government) setting a Pigovian tax is beset by the very difficult practical problem of acquiring enough information about the preferences of all parties to set the tax at the optimal level (Graham). Possible differences between bargaining and a Pigovian tax with respect to general equilibrium effects are of course not accounted for in a partial equilibrium analysis.

Where bargaining involves transactions costs, (i) the maximum bribe that would be paid at the margin by the downstream community is given by the marginal external cost of upstream production less the downstream community's marginal transactions cost,[2] and (ii) the minimum bribe that the upstream community would accept at the margin is given by the marginal profit of upstream production plus the upstream community's marginal transactions cost. The resulting 'supply' and 'demand' schedules for bribes are denoted in Figure 1 by SB and DB respectively. Note that these schedules relate to levels of upstream production only up to Q_1, the existing equilibrium level.[3] The equilibrium level of bribe to reduce upstream production is given by the intersection of these two schedules. It is seen that under these particular circumstances the schedules do not intersect, since the magnitudes of transactions costs for both communities mean that the marginal bribe the upstream community

Figure 1: A Model of Bargaining Between Upsteam and Downstream Communities



[1] The effect of non-zero income effects in combination with zero transactions costs is analysed in Randall (Figure 8.4). The analysis shows that positive income effects result in the outcome of bargaining being a Pareto-improvement rather than Pareto-efficient and, in our simple catchment, a lower reduction in upstream production and a lower increase in economic surplus than without income effects.

[2] Since the MP and MEC schedules are defined here on an annual basis, the same is required of transactions costs. Since capital and recurrent classes of transactions cost can be distinguished, the former incurred in negotiating a bargain and the latter in having it honoured, annual transactions costs are obtained by annualising the capital transactions costs using an appropriate discount rate and adding the result to the recurrent transactions costs. Marginal transactions cost is the addition to transactions cost arising from increasing the size of the transaction by an additional unit of the relevant output. In the situation illustrated in Figure 1 the relevant output is annual upstream production and marginal transactions cost is assumed to be constant regardless of the size of the transaction (hence the parallel shifts from MP to DB and from MEC to SB).

[3] To enable increases in upstream production beyond this level, the direction of bribes would be reversed and another set of demand and supply schedules would apply.

is willing to accept exceeds that which the downstream community is willing to offer. Hence no bargaining occurs and equilibrium upstream production remains at Q_1.

Assuming bargaining involves positive transactions costs and has zero income effects, the economic effect of ICM in our simplified catchment can be illustrated by referring again to Figure 1.[4] Assuming that ICM results in reductions in marginal transactions cost for the upstream and downstream communities which are unaffected by the size of a transaction, the effects of ICM are represented as parallel shifts in the demand and supply schedules for bribes (to DB' and SB' respectively). Bargaining would result in a bribe of edQ_1Q_2 being paid to the upstream community to reduce its production from Q_1 to Q_2. Although upstream production remains above Q*, the economically efficient level that could be achieved under an optimal Pigovian tax or by bargaining if transactions costs were zero, annual economic surplus is nevertheless increased due to ICM by an amount given by the area cde minus the relevant portion of the annual overhead cost of maintaining ICM. Whereas formerly the magnitude of transactions costs precluded attainment of a Pareto-improvement through bargaining over rights to pollute, inclusion of ICM within the institutional framework in this case leads to such an improvement by reducing transactions costs sufficiently that bargaining occurs.

It is important to note that ICM does not preclude application of policy instruments by the state. First, before the process commences, it is incumbent on the state to define settings of those 'generic' policy instruments particularly relevant to overall catchment management (eg. with respect to irrigation water pricing or transferability of water rights), at least roughly. This allows bargains to be predicated realistically and avoids a situation in which transactions costs continually escalate as bargains require renegotiation after each unforeseen change in policy settings. Otherwise this form of government failure will mean that the potential for ICM to reduce transactions costs substantially is not realised.

Secondly, policy instruments such as regulation, subsidies or Pigovian taxes specific to the problems being dealt with by bargaining may still be applied in many cases, the difference being that they will only be applied as a result of negotiation (for example where the transactions costs of enforcing a bargain will be significantly reduced due to regulation by the state) rather than imposed 'from the top' by the state. However, the need to apply specific policy instruments will be reduced to the extent that ICM contributes to resolution of externality problems by effecting trades in property rights among concerned parties. If specific policy instruments are applied, ICM may also lower the transactions costs of monitoring and enforcing their application (this is discussed further in Section 5.3).

The question of whether the gain in economic efficiency achieved through the 'bottom-up' process of ICM is superior to that which could be achieved by the historically prevalent top-down process, whereby the state relies on setting policy instruments "accompanied by extensive political negotiations" (Johnson, p.177), can only be answered empirically. The Industry Commission concluded the jury is still out. An answer to this question will not only require comparison of the costs and benefits resulting from the decisions emanating from these alternative approaches (including transactions costs of designing and enforcing policy instruments and the costs and benefits of works and management changes that occur). The transactions costs (public and private) incurred in reaching those decisions will also need to be accounted for.

5.2 Transactions Costs of Bargaining

Governments or private parties striving to address resource degradation are plagued by information problems. Information required relates to measurement of the product or service associated with the natural resource of interest, identification of the concerned parties and elicitation of their preferences (Wills). It also relates to identification of technologies available to address resource degradation, and their costs, for each set of local conditions.[5]

Government intervention to reduce transactions costs to such an extent that bargaining among concerned parties becomes feasible and true preferences become revealed in the market exchange process is one way of

[4] The effect of non-zero income effects in combination with positive transactions costs is analysed in Randall (Figure 8.5). The analysis shows that positive income effects result in the outcome of bargaining in our simple catchment being a lower reduction in upstream production and a lower increase in economic surplus than without income effects.

[5] Such information is often not held collectively but rather in the hands of individuals who develop or trial solutions (eg., saltbush as a groundcover for salt-affected soils) on their own properties.

dealing with the problem of identifying the preferences of concerned parties.[6] ICM is one such form of intervention, reducing transactions costs of bargaining by making only a relatively small field of parties (each party representing a particular sub-catchment community) eligible to participate in the bargaining process. The effect is to reduce dramatically the number of lines of communication that need to be pursued in order to negotiate a bargain, thereby hopefully leading to a commensurate reduction in the number of transactions required and, consequently, in the aggregate transactions cost.

ICM is in effect an attempt to relocate "presumptive policy entitlements" (Bromley and Hodge) from individual land holders to their sub-catchment communities. The state can exercise financial leverage, by indicating willingness to consider funding projects with wide community acceptance, to minimise resistance to this relocation. To the extent that this attempt succeeds, the costs of individuals striving to affect government decisions by influencing their sub-catchment committee are lowered relative to those of striving to resolve conflicts by directly lobbying the state.

The transactions costs of bargaining are thereby also reduced since relocation of this policy entitlement increases the incentive for individuals to become involved in committee deliberations, consequently lowering the transactions costs for the committee of obtaining the information it requires from local individuals to enable it to bargain successfully. The increased incentive for individuals to become involved in committee deliberations may also lower a committee's costs of obtaining, collating and analysing information from local individuals by allowing economies of scale to be realised with respect to these activities.

Locating policy entitlements with sub-catchment communities also lowers the transactions costs of government agencies attempting to influence decisions at the community level relative to those striving to influence decisions by the state by lobbying it directly. The increased incentive this provides for government agencies to become voluntarily involved in community-level debate can be expected to lower substantially the transactions costs of each sub-catchment committee obtaining and integrating information from government agencies.

An ideal ICM process would involve a network of relatively few sub-catchment committees with each committee brokering a market whereby the preferences of local individuals and government agencies, and the biophysical interrelationships among them, become revealed. The information each sub-catchment committee requires from its constituent community to negotiate with other committees and the state would thereby be obtained at a relatively low transactions cost.

Since information is not depleted by use, the increase in the flow of information from individuals to sub-catchment committees and from sub-catchment committees to government as a result of a successful ICM process results in stocks of information held by these various parties accumulating faster than would otherwise be the case. Thus by lowering the transactions costs of bargaining with respect to an immediate resource degradation problem, current activities within an ICM process can also have dynamic benefits by reducing the transactions costs of resolving related problems arising at later stages. By increasing the incentive for parties with diverse perspectives to debate with each other, ICM may also add to the stock of information by increasing possibilities that new insights will arise.

5.3 Transactions Costs of Enforcing Bargains

Government has coercive powers which can give it advantages over private parties in enforcing solutions to resource degradation problems. However, even if government has precise knowledge about cause and effect, the cost of the accurate monitoring required to enable enforcement can be very large if the number of parties contributing to the problem is large and/or the contributions are variable over space and time (Wills). Even if technological advances reduce the physical costs of monitoring by government, the political cost of interfering with land holders' presumed right to privacy may remain a barrier to effective monitoring (Wills).

Land holders usually have some scope within the law to obstruct or co-operate with efforts to monitor their behavior (or the outcomes therefrom). Government can reduce the cost of monitoring by providing incentives for individuals to co-operate more in the monitoring process, thereby also lowering the political cost of challenging individuals' presumed right to privacy.

[6] This problem is exacerbated where parties have an incentive to distort strategically the information they provide regarding their preferences (Wills).

One way of increasing the incentive for communities to co-operate with resource conservation policies is to gain their acceptance of those policies (Wills). ICM strives for this outcome by actively involving sub-catchment communities in the policy formulation process. Participation in this process can be expected to create increased peer pressure on sub-catchment committees to co-operate with government in monitoring compliance with bargains or policies they have agreed to on behalf of their constituents[7]. Following Marston, increased involvement by local individuals in committee discussions can also be expected to strengthen peer pressure on local individuals to behave in accordance with bargains or policies agreed to on their behalf.

Peer pressure relates to the problem of assurance recognised in the economics literature as critical to achieving economically efficient use of communally-owned resources. Assurance is required if a mutual bargain among parties is to be achieved so that they subjugate their short-run private interest to the collective interest of the community: "Each individual needs assurance that others will also behave in a co-operative fashion, otherwise there will be a temptation to 'break ranks' and seek the maximum private gain" (Pearce and Turner, p.77).

Increasing the level of peer pressure can be interpreted in economic terms as increasing the psychological cost associated with going against the collective interest. Thus the incentive to act according to the collective interest is increased. Conversely, for a sub-catchment committee the transactions costs of monitoring and gaining compliance from the community it represents are reduced.

5.4 Efficiency Losses from Rent-Seeking

In Section 5.2 the ways in which ICM can increase the flow and stock of information were discussed. The foci of this information accumulation, however, are sub-catchment committees pursuing the interests of their respective communities. There is therefore a critical gap through which information must pass from community committees to the state if the latter is to be able to capitalise on this information. Even if government officers are members of a committee, land owners will typically be in the majority and will be tempted as suggested by Wills to rent-seek by strategically providing to the state only that information anticipated to influence intervention in their favour.

The scope for this rent-seeking behaviour being successful will be constrained due to the state being the target of similar strategic behaviour by an array of sub-catchment committees with conflicting interests. Subsequent negotiations (brokered by the state) among these committees can be expected to go some way toward 'correcting' the information originally provided to the state. The presence of government officers on committees can also be expected to place limits on the extent of strategic distortion of information by committees. Nevertheless, the potential the ICM process affords for increasing economic efficiency may be negated if the information advantages of the process for sub-catchment committees are, as a result of rent-seeking behaviour by the committees, not also captured by the state.

Competition among committees for the rents available from obtaining government decisions 'sympathetic' to their respective constituent communities can also undermine prospects of enhancing efficiency by resulting in scarce resources being used in ways that do not contribute to social welfare. In the absence of ICM, of course, competition for rents would also occur, although on a more *ad hoc* basis. The question of whether ICM is likely to reduce or increase efficiency losses due to resource use in non-productive rent-seeking activities is an area for further research.

6. Conclusions

ICM can be viewed as an institutional instrument designed to ameliorate losses of economic efficiency which have arisen due to incomplete specification of the privileges and restrictions attached to property rights (particularly relating to rights to use land in ways that cause off-site effects). If applied appropriately it can facilitate the emergence of a market in which parties disadvantaged by incomplete specification attempt to bribe those advantaged, with the aim of obtaining the latter's agreement to more complete specification. The instrument provides potential for transactions costs of bargaining to be reduced substantially by reducing the number of parties eligible to participate in, and installing the state as broker and ar-

[7] The strength of peer pressure can be expected to increase with greater involvement of parties in deliberations. This is because transactions costs of monitoring compliance by parties should decline as the number of parties 'owning' decisions increases.

biter of, the bargaining process. Participation by sub-catchment committees and their constituents in the bargaining process can also, by fostering peer pressure, reduce the transactions costs of monitoring and obtaining compliance with any bargains successfully negotiated.

The extent to which transactions costs are reduced in practice, and bargains are entered into and complied with as a result, depends on how successfully ICM principles are applied in practice. Poor application of ICM can mean that its potential is not realised. Potential failings include:

(a) 'generic' policy settings (such as relating to water pricing) being changed unexpectedly, thus requiring negotiations (either in progress or finalised) to be repeatedly restarted on a new footing and cumulative transactions costs to escalate accordingly;

(b) the structure of the process being poorly designed in terms of such factors as: (a) the level of geographical aggregation represented by each sub-catchment committee; (b) the method whereby representatives of each community are appointed to a sub-catchment committee; and (c) requirements for, and capacities of, committees to consult with the communities they represent; and

(c) inadequate safeguards against a situation whereby, because of strategic distortion of the information submitted to the state by sub-catchment communities, the state has insufficient information to perform its role of brokering bargains in the national interest.

The question of whether economic efficiency is enhanced by adoption of ICM can only be answered empirically. An answer requires comparison not only of the costs and benefits resulting from the decisions arising from these approaches (including costs of enforcing the decisions and the costs and benefits of works and management changes that occur as a consequence) but also of the total transactions costs incurred in reaching those decisions.

As noted by Industry Commission, ICM represents an experiment in the way natural resources are managed. For economists to be able to contribute to an *ex post* evaluation of this experiment, it is first necessary to understand conceptually how ICM results in the benefits claimed for it. In this article we have aimed to contribute to this understanding. Such an understanding should also provide an improved basis for gauging *ex ante* how successful this institutional instrument is likely to be in any given situation and also how the instrument should be tailored to the situation.

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