Improving environmental decisions: a transaction-costs story

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Abstract

A multidisciplinary team of researchers made efforts to influence the design and implementation of environmental policy in Australia. A focus of these efforts was the development of the Investment Framework for Environmental Resources (INFFER). In addition, the team undertook a diversity of communication activities, training, user support, and participation in committees and enquiries. Transaction costs were relevant to these efforts in a variety of ways. Environmental managers who adopted some elements of INFFER incurred higher transaction costs than they did using traditional, simpler methods for planning and prioritising. The benefits that could be generated by bearing specific transaction costs were carefully considered, and a balance was struck between the system having simplicity (and low transaction costs) and delivering valuable environmental outcomes in the long term. Transaction costs were factored into the planning and prioritisation processed developed for INFFER. For example, public and private transaction costs are accounted for in the calculation of the Benefit: Cost Ratio for each project, and in the analysis of which type of policy mechanisms would be most suitable. The researchers' experiences highlight the importance of transaction costs and the diverse roles that they play in the processes of developing, implementing and influencing environmental policy programs.

Keywords: transaction costs; policy mechanism choice; benefit: costs analysis; prioritisation; planning

1. Introduction

In 2000, the Australian government announced a new environmental program, the National Action Plan for Salinity and Water Quality (Anonymous, 2000). The stated goal of the program was "to motivate and enable regional communities to use coordinated and targeted action to: prevent, stabilise and reverse trends in dryland salinity affecting the sustainability of production, the conservation of biological diversity and the viability of our infrastructure; improve water quality and secure reliable allocations for human uses, industry and the environment" (Anonymous 2000, p. 5). The program provided A$1.4 billion for expenditure largely on extension services to farmers and financial support for salinity management by farmers, various organisations and government departments (Pannell and Roberts, 2010).

At the time, the lead author was involved in a range of salinity-related research projects, including research on: the farm-level economics of salinity management strategies (Bathgate and Pannell, 2002); the externalities that arise from salinity (Pannell et al., 2001); hydrological processes that lead to salinity (Ferdowsian et al. 2001); and the behaviour of farmers facing salinity problems on their farms (Pannell 2001b). His assessment of the new program was negative (Pannell, 2001a). It appeared to have been designed without a sound understanding of bio-physical and socio-economic research that had strong implications for public investments in salinity.

As a result, the authors were motivated to become engaged with policy makers and natural-resource managers to attempt to address the shortcomings of the program. The focus of these efforts has been development and delivery of tools to assist with decision making about environmental projects, initially the Salinity Investment Framework (Ridley and Pannell, 2005), the Public: Private Benefits Framework (Pannell, 2008) and later the Investment Framework for Environmental Resources (INFFER) (Pannell et al., 2012). In addition, strategies have included: making public comment on existing programs; presentations to various audiences; research to better understand neglected issue; pilot testing of the decision tools (Roberts and Pannell, 2009); provision of training programs and user support; participation in committees, reviews and inquiries; and broad communication through web sites and publications. These strategies have been continued since 2000 in an evolving effort to improve decision making about public investment in the environment (as documented at www.inffer.org).

Transaction costs, broadly defined, have been a central issue in this history. Transaction costs have been incurred by a team of collaborators working to address the identified problem. Through our actions, we have imposed transaction costs on people and organisations involved in environmental programs. We have taken steps to limit the transaction costs involved in decision processes, involving judgements about the appropriate balance between certain transaction costs and the benefits that they can generate. And we have developed methods to account for transaction costs explicitly in the environmental decisions we have analysed.

This paper provides descriptions of each of these transaction-cost-related aspects of this history of engagement with environmental programs since 2000. The aim is to provide a comprehensive picture of the various ways that transaction costs are relevant to (a) decision making and (b) attempts to improve decision making, in such programs. It is intended to provide insights that may contribute to ongoing development of knowledge, theories and measurement of transaction costs in environmental policy. Given the observation of McCann et al. (2005) that "transaction costs are not usually included in empirical evaluations of alternative environmental or natural resource policies", this project appears to be unusual, and may provide lessons that are broadly useful. This paper complements the work of Coggan et al. (2010), who studied the various causes of transaction costs in environmental policy programs and which participants bore them, and of the growing list of authors who have quantified transaction costs of environmental programs (e.g. McCann and Easter, 2000; Howitt, 1994; Falconer et al., 2001; Falconer and Saunders, 2002; Mettepenningen et al., 2009).

2. Incurring transaction costs within the project

Efforts to influence policy and management were motivated by concerns about the poor quality of decision making about policy design, and about the resulting poor quality of decision making about priorities for investment in environmental projects. When we commenced we had limited knowledge of the decision-making processes we hoped to influence.

We found that attempts to influence environmental policies can involve very substantial transaction costs for those attempting to apply influence. Because there is no clear pathway to influence, and because there are so many competing demands on those we would seek to influence (Shaw et al., 2000), one must resort to a diversity of strategies in order to create a reasonable likelihood of achieving change (Pannell and Roberts, 2009).

Since 2000, the portfolio of communication and persuasion methods used has included: preparing numerous media releases and being interviewed for the electronic and print media, resulting in over 100 media appearances; dozens of discussion papers, briefing papers, fact sheets and the like; 220 blog posts, most of them on issues relevant to environmental policy (www.pannelldiscussions.net); actively maintained web sites for relevant projects (e.g. www.inffer.org had 10,000 visits in 2009); numerous meetings, workshops and presentations with policy makers and environmental management bodies (of the order of 100 events per year by members of the team in recent years); development and delivery of a two-day training program (delivered 17 times to a total of in excess of 500 participants); provision of support, feedback and quality assurance to users of our environmental decision tools (around 35 users); around 20 submissions to government inquiries; membership of more than 10 government committees and panels on environmental policy issues; and publication of research papers in academic journals.

These activities were conducted in conjunction with research on related topics, including development of various decision aids, notably the Investment Framework for Environmental Resources (INFFER) (Pannell et al. 2012). Overall, of the core project team (four people devoting around 2.5 full-time equivalents to the project), the total proportion of time devoted to communication, persuasion, training, etc. since 2008 is estimated to be around 60 per cent.

3. Imposing transaction costs on others

Just as the decisions of land managers to adopt a decision support system are influenced by the transaction costs they would bear (Morrison, 2009), the decisions by environmental managers to adopt an improved decision making process would be influenced by the transaction costs involved. Even without use of sophisticated decision-making processes, the environmental programs we sought to influence already included substantial transaction costs.

To illustrate, in 2008, following completion of the National Action Plan for Salinity and Water Quality, the Australian Government provided the authors with a database containing information about the 1728 projects that it funded (Pannell and Roberts, 2010). We used this database to estimate the allocation of funds within the program to the following categories: on-ground works, which includes direct actions by governments and payments to farmers to undertake works; extension and capacity building, which includes information provision, technology transfer, environmental management systems, training, awareness raising, farm planning and demonstrations; information generating actions, such as R&D; monitoring and evaluation; planning; and overhead costs for regional environmental bodies, including administration and actions to build organizational capacity. Each project was assigned primarily to one of these categories on the basis of reading the project title and in most cases a summary project description. In 618 cases a secondary category was also assigned due to the breadth of the project. If a secondary category was assigned, then funds were notionally allocated according to this rule: 67 per cent to the primary category and 33 per cent to the secondary category.

The numbers reported here (Table 1) relate solely to the expenditure of program funds provided by the Australian Government. Apart from the first item, all of these expenditures were conducted by 56 regional environmental management bodies. In addition, there were transaction costs borne by state governments, private landholders and others.

Table 1. Allocation of program, funds to different categories of expenditure in the National Action Plan for Salinity and Water Quality.

Category of expenditure	Share of budget	Cumulative share
Central administration of the program	8%	8%
Administration and capacity building of regional environmental bodies	4%	12%
Planning	6%	18%
Monitoring and evaluation at regional level	6%	25%
Data, analysis, research	6%	31%
Extension, information provision, persuasion, networks	37%	68%
On-ground works	32%	100%

Based on McCann et al.'s (2005) typology of transaction costs associated with public policies (adapted from Thompson (1999) and McCann and Easter (1999)), transaction costs amount to 31 per cent of the Australian Government's funds. This would understate the true transaction costs, because projects that emphasised extension or on-ground works would also include transaction costs not included in the other categories. Such large transaction costs could partly explain why we found it difficult to persuade some stakeholders that a more sophisticated (and, hence, potentially more expensive) process for planning and decision making should be used. Others have observed that transaction costs can cause implementation of a natural resource policy reform to lag (e.g. Garrick and Aylward, 2012). We frequently heard the view expressed that a greater priority was to spend more money on changes 'on the ground', rather than further increasing the transaction costs. In the context of Table 1, this seems a reasonable sentiment.

On the other hand, the existing choice and design of projects funded by the program was generally so poor (Pannell and Roberts 2010) that increasing the allocation of funds to on-ground works would probably have achieved little in terms of improved outcomes. The problem was not a lack of planning and analysis, but a lack of quality in the planning and analysis that was done. This illustrates that some transaction costs are more productive than others in delivering program outcomes. Randall (1981) noted that transaction costs are expended in exchange for transaction services, and so should not all be assumed to be wasteful. However, some of the purchased transaction services may clearly be better value for money than others.

Weighing up benefits and transaction costs of improved decision processes

Regional environmental managers considering the use of INFFER need to weigh up its benefits versus its extra transaction costs. There are two main benefits to environmental managers from using INFFER: (a) increased environmental benefits, and (b) competitive advantage in gaining funding. The potential to increase environmental benefits through improved decision making is high. For example, we conducted simulations of millions hypothetical project prioritisation decisions and found that omitting key variables from the metric used to rank projects typically resulted in selection of projects that delivered of the order of 50 per cent less environmental value than did a process based on a comprehensive and well-structured metric (Pannell, 2009). However, we find that many environmental managers are unaware of this and generally feel satisfied with their existing planning and decision making processes. The weaknesses in those processes that are of concern to the INFFER team are salient to only a minority of the environmental managers.

The second potential benefit, from the perspective of individual environmental management bodies, is an increased probability of success of their proposals to government for project funding. There is some evidence that this is the case, following the success of several large INFFER-developed applications by the North Central Catchment Management Authority in 2011, but an increase in explicit signals from government would increase this benefit. Even with those signals, the magnitude of this category of benefits would be relatively uncertain to environmental managers, whereas the transaction costs of using INFFER (outlined below) would be relatively certain.

Transaction costs for the planning and decision-making parts of INFFER are associated with its first three steps. Step 1 involves development of an inventory of important environmental assets that are candidates for investment in the managed region. The process includes drawing on existing documents and plans, and conducting workshops with interested community members. These activities are not radically different from what these bodies do routinely, although INFFER requires users to be more spatially explicit when identifying environmental assets than typical users have previously been. However, a concern in terms of transaction costs is that they have already consulted and planned extensively, so undertaking the INFFER step 1 process involves additional cost. In recognition of this, the INFFER process can use an existing list of important environmental assets, rather than requiring additional transaction costs to develop one. We have found that, even where there is an existing list, step 1 is usually a positive experience for the environmental organisation, particularly the workshops where participants from the community are asked to identify environmental assets that are of particular significance to them.

In step 2, the list from step 1 is filtered to remove environmental assets with low probabilities of supporting cost-effective investments. This is done in a one- or two-day workshop involving a group of key stakeholders from the region, including staff from the environmental body, staff from state government agencies and other people with knowledge of the environmental assets. A relatively simple set of criteria is used, typically considering the significance of each asset to the community and the severity of threats to asset condition. In addition, a short checklist is applied, asking questions such as whether the asset is identified clearly and whether there is evidence that management actions can make a worthwhile difference to asset condition.

This step is something that the environmental managers we work with (including both government agencies and independent regional bodies funded by government) have typically not done, so it constitutes as an additional transaction cost. However, it is a brief, one-off, occasional event involving a modest number of people, so the transaction costs are relatively small. In addition, as discussed in the next section, the purpose of this step is to reduce transaction costs in the next step.

The third step is to develop and assess a detailed project for each environmental asset that remains in consideration after the filtering stage. This process draws together readily available information, consisting of desktop review of publications and reports, and consultation with the community and with relevant experts. Information required at step 3 includes: asset significance, threats, project goal, works and actions, time lags, effectiveness of works, private adoption of actions, delivery mechanisms and costs. Using this information, the Public: Private Benefits Framework (Pannell, 2008) is used to help select policy mechanisms. The output from step 3 is a report for each project documenting: its Benefit: Cost Ratio, risk factors (practice change, technical feasibility, socio-politics, long-term funding), spin-offs, quality of information and key information gaps.

Although a number of simplifications have been applied in the project assessment process to limit transaction costs (see next section), it remains significantly more comprehensive and detailed than regional environmental management bodies in Australia have previously used. Typically, these bodies would consider of the order of 25 per cent of the information that we judge to be essential for sound project evaluation, so INFFER does involve higher transaction costs for them in this step. Nevertheless, in our judgement, the scale of those additional transaction costs is low relative to: the scale of funding for successful projects; other transaction cost borne by the organisations; and the level of benefits that can be attained through improved planning and decision making.

4. Balancing transaction costs and benefits

As outlined in section 3, our expectation is that, relative to the simple processes used for planning and decision making by some environmental managers, the additional transaction costs borne in the process of applying INFFER would be easily outweighed by additional environmental benefits. However, it does not follow that the sophistication and comprehensiveness of the approach can be increased indefinitely with ever-increasing net benefits. A well-established result of decision theory is that there are commonly diminishing marginal returns to investment in higher quality information for decision making (Anderson 1975).

For that reason, the design of INFFER attempts to strike a balance. It is more comprehensive and detailed than most of our target users have previously used, but it is much less comprehensive and detailed than it could be. Researchers who analyse decisions using the sorts of sophisticated models that typically appear in economics or operations research journals would consider INFFER to be very simple indeed. We hope that, as a result of various simplifications, the marginal environmental benefits are approximately equal to the marginal transaction costs.

Simplifications in the INFFER process that save on transaction costs include the following.

In step 1, the processes of collecting a list of important environmental assets is not comprehensive or sophisticated. Any asset that is considered to be important by any stakeholder or in any existing document is included on the list.

Step 2 is included as an extremely quick and simple assessment of potential projects to reduce the number of projects in contention for funding down to a modest number. Typically, the filtering process reduces the number of potential projects from something like 500 down to 20-30. This greatly reduces the transaction costs in step 3, which involves detailed assessment of each project. If transaction costs were ignored, an ideal approach would involve detailed assessment of all 500 projects, but since only a small minority of these projects will actually be funded in practice, that would involve a large amount of wasted resources. The cost of the highly simplified approach to project assessment conducted in step 2 is that there is an increased risk of excluding good projects or including poor ones. Failing to exclude some poor projects at this stage is not a serious problem, as they will be excluded in the more detailed step 3. Excluding good projects does potentially result in the loss of some environmental benefits. However, as long as the number of good projects included in step 3 is larger than the number that is likely to be funded, the loss will probably not be large.

In designing Step 3, detailed project assessment, we adopted a philosophy that the process should be comprehensive, in the sense of including all important factors, but that the way that each of those factors is handled could be simple. Simplifications include the following.

- Environmental assets are valued subjectively by the environmental management body, rather than by non-market valuation studies (e.g. Carson, 2000; Adamowicz, 2004).
- Users are advised to focus on up to three main threatening processes affecting the asset, rather than every threatening process.
- Most quantitative variables are elicited using a Likert scale, with default numerical values assigned to each point in the scale. For example, Figure 1 shows Question 3.3(a) from the Project Assessment Form. Response options to the question of how attractive the proposed management works will be for people to adopt are: highly attractive, slightly attractive, neutral, slightly negative or highly negative. The response is combined with that from another question and used to estimate a default value for the proportion of the target audience that will adopt the proposed works. If the user has additional knowledge or evidence, the default value may be over-ridden.
- The time lag to benefits from the project is specified as one number for the whole project, rather than different numbers for different parts of the project. It is assumed that benefits occur suddenly after that time lag has elapsed, rather than having a gradual onset.
- A default discount rate is specified by the developers.

- Benefits from implementing works and actions are estimated as a proportion of the value of the asset in good condition, combining market and non-market benefits into a single value.
- Only benefits arising from protection of the specified environmental asset are quantified. Spin-off benefits (or costs) relating to other natural assets are captured qualitatively.
- The various risks that could affect the success of the project are simplified to four: risk of technical failure, adverse adoption, socio-political risk and long-term funding risk. In each case, risk is characterised as a discrete distribution with only two levels, success or complete failure, rather than multiple possible levels of success. It is assumed that the four risks are independently distributed.
- Costs of the initial three-to-five-year project phase are not discounted.
- Maintenance costs beyond the initial project phase are discounted. They are assumed to be constant for 20 years beyond the initial project phase.

We found that reducing transaction costs through these simplifications assisted in our efforts to have the framework adopted and used by environmental managers. Even so, some potential projects would involve benefits that are too small to justify even those reduced transaction costs. Therefore, we developed an even more simplified version, called INFFER Lite, for use to evaluate small projects. We suggest that this may be appropriate for projects with total budgets of less than $200,000. The main additional simplifications in INFFER Lite are: removal of many of the qualitative questions that provide background or justification for responses to the quantitative questions; removal of a question related to adoption; further simplification of asset valuation, through offering a set of discrete options; and reducing the number of questions related to information quality and information gaps.

Training and user support was also found to be beneficial in limiting the transaction costs that users needed to bear in the process of learning about how to use INFFER. Although the process is well documented, including both simple accessible documents and detailed technical documents, we found that new users often had difficulties interpreting questions or knowing how to collect the required information. This problem was addressed by developing a comprehensive training program, delivering it face-to-face within organisations adopting the framework, and providing follow-up support responding to users' questions.

Figure 1. Question 3.3(a) from the INFFER Project Assessment Form.

3.3 Private adoption of works and actions

(a) Consider the works and actions that have been specified for private land and water managers (and other private citizens) in Q2.2. In the absence of this project, how attractive is full adoption of these works to the relevant private citizens?

○ Highly attractive. Even without this project, the works/actions would probably be adopted at the required scale over the coming decade.

- Slightly attractive. Without this project, the works/actions would probably be adopted to some extent, but at less than the required scale, and reaching peak adoption would take more than a decade.
- Neutral. There is currently little or no adoption of the works/actions, and it is unlikely that they would proceed to higher levels of adoption without a policy intervention based on payments or regulation. However, it is expected that only modest payments or light regulation would be needed to prompt long-term adoption.
- Slightly negative. The works/actions would not be adopted without moderate ongoing payments or regulation.
- Highly negative. The works/actions would not be adopted without large ongoing payments or strongly-enforced regulation.

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5. Accounting for transaction costs

As well as considering transaction costs to be borne by users when designing INFFER, transaction costs are accounted for, explicitly or implicitly, in various parts of the framework. They are factored into both the calculation of the Benefit: Cost Ratio for the project, and the Public: Private Benefits Framework that is used to recommend a category of policy mechanism for the project.

5.1 In the Benefit: Cost Ratio

See Pannell et al. (2012) for details of the variables and formula used to calculate the Benefit: Cost Ratio for a project. Within those variables, transaction costs are accounted for in the following ways.

C = cost of the proposed project ($ million in total, over the three- to five-year life of the project). The estimate of C provided by the user should include all transaction costs that are funded out of the project budget, as well as those provided as in-kind input that is not funded by the project.

M = annual cost of maintaining outcomes ($ million per year, beyond the immediate project). The maintenance costs should include estimates of relevant transaction costs.

In defining the project, the user specifies a set of works and actions that would need to be adopted by the target audience (generally a set of land or water managers) in order to achieve a particular target outcome. A = the proportion of required adoption of new works and actions that is expected to be achieved by the project. If full adoption is assured (e.g., the required works and actions will be undertaken by the organisation running the project) then $A = 1$. If adoption must be undertaken by private landholders or by another organisation, $A < 1$ would usually be expected. The estimate of A should account for the private transaction costs of participation. If a program involves relatively high private transaction costs of participation, the estimated level of adoption should be reduced accordingly.

P = probability that socio-political factors will not derail the project, and that required changes will occur in other institutions. For many projects, there is a risk of failure due to non-cooperation by other essential organisations, or due to social, administrative or political constraints. Projects with relatively high transaction costs may have a higher risk of failure due to one or the other of these factors. To illustrate, suppose there is another organisation whose cooperation is essential for the success of the project. An example could be that a regional environmental management body requires a government agency to actively enforce existing pollution regulations, as part of a package of measures in the project. This is likely to result in additional transaction costs being incurred by the government agency (such as legal costs, administration costs, monitoring costs, costs of dealing with public protests) which the agency may be unwilling to bear.

The process accounts for transaction costs borne by the government (*C*, *M* and *P*), participating land and water managers (*A*) and other members of the community (*P*). As a result of capturing transaction costs in these ways, differences in them can have an important influence on the ranking of projects according to Benefit: Cost Ratio.

5.2 In policy mechanism choice

A less widely recognised influence of transaction costs is on the choice of policy mechanisms for environmental projects. Pannell (2008) and Pannell and Wilkinson (2009) showed how transaction costs should be factored into these choices. This framework is included in INFFER.

Figures 2 to 4 show the influence of transaction costs in the framework. Figure 2 shows the framework in the absence of transaction costs. The private (internal) and public (external) net benefits of each project are quantified and used to position the project on the graph. Different projects would be distributed across the graph. Depending on the location of a particular project, different policy mechanisms are recommended, as shown in the figures. The logic behind these recommendations is provided by Pannell (2008). The categories of policy mechanisms are as follows. Positive incentives are financial or regulatory instruments to encourage change in land or water management. Negative incentives are financial or regulatory instruments to inhibit change. Extension includes approaches such as technology transfer, education, communication, demonstrations, and support for community networks. Technology development means development of improved land management options, such as through strategic research and development (R&D), and participatory R&D with landholders.

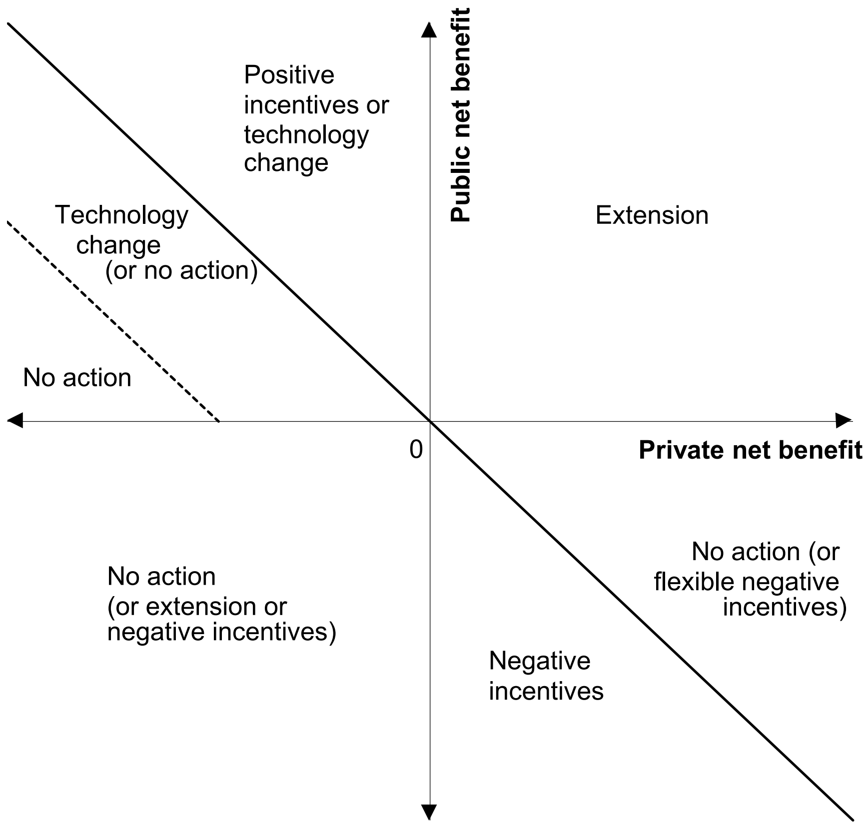

Figure 2. Simple version of the Public: Private Benefits Framework with no transaction costs (based on Pannell 2008).

If there are no transaction costs (Figure 2), the policy mechanisms are mostly contained within a quadrant or a half quadrant of the graph. For example, for any project that falls within the top-right quadrant, the recommended main policy mechanism is extension. For projects that fall within the upper right half of the top left quadrant, the recommended mechanism is positive incentives and/or development of improved technologies, depending on the benefits and costs of the latter option.

Figure 3 shows the framework with transaction costs included. It also allows for a time lag to adoption of a new practice (unlike Figure 2 which is based on the assumption that adoption is immediate) and for the fact that extension does not completely eliminate that time lag. For the specific quantitative assumptions underpinning this figure, see Pannell (2008).

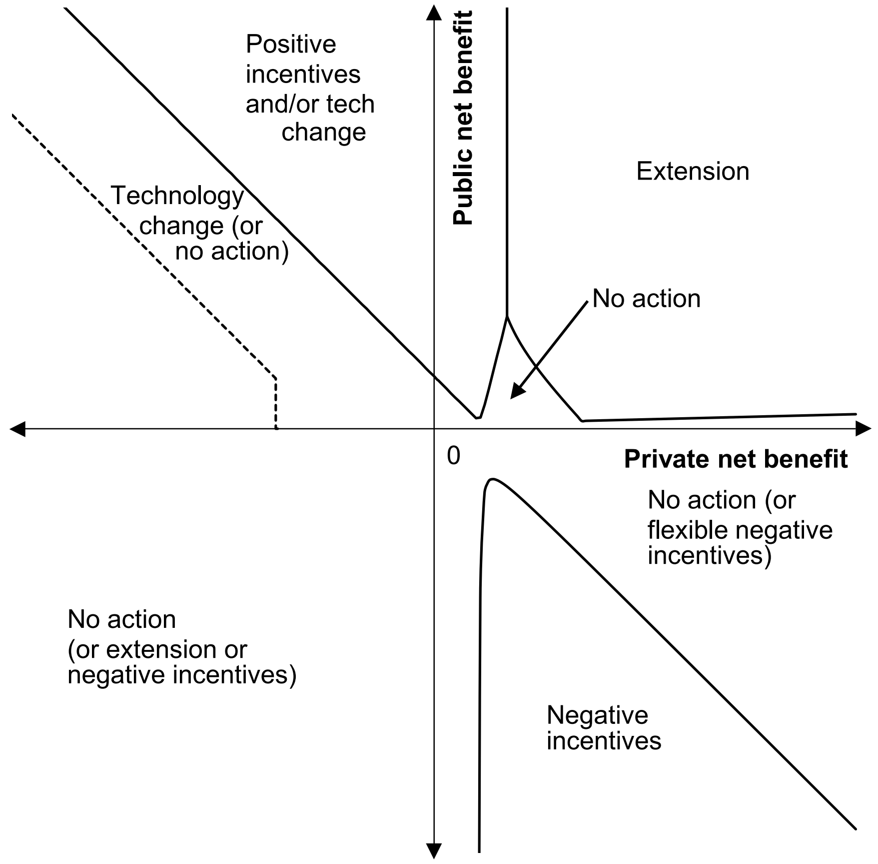

Figure 3. Version of the Public: Private Benefits Framework including transaction costs (based on Pannell 2008)

Both public and private transaction costs are included. The private transaction costs are described by Pannell (2008) as 'learning costs', although they could include any private transaction costs associate with adoption of a new environmental practice, such as demonstrating compliance, meeting requirements for financial accountability, attending meetings, and so on. It is assumed that the incentive required to prompt adoption must be increased to cover those transaction costs. In addition, when the need to bear transaction costs in the process of adoption is recognised, there arises the possibility of paying incentives to cover those learning costs for projects in top right quadrant, which originally only included extension. The level of private transaction costs assumed in deriving Figure 3 is the equivalent of $10 per ha per year (i.e., the cost is annualized). To put that in context, the X axis in Figure 3 ranges from −$100 to +$100 per ha per year.

Public transaction costs are also included (at the equivalent to $2.50 per ha per year in Figure 3). These are the costs to taxpayers of implementing a program to promote adoption of environmental practices. This cost is additional to any incentive payments made to people. The transaction costs would include costs of administration, monitoring, negotiation, communications, enforcement of contracts, and so on.

The main effect of these inclusions in Figure 3 is to move the boundary lines to the right, by approximately the distance of the private transaction costs. For example, if the set of management changes being sought by a project has positive public net benefits and would generate private net benefits of $5 per ha per year, this project would be in the 'extension' quadrant in Figure 2, but is in the area for which positive incentives are suggested in Figure 3. This is in recognition of the fact that transaction costs of $10 per ha per year would more than outweigh the private net benefits generated by the environmental practices themselves.

Figure 4 shows the effect of doubling both public and private transaction costs on the areas for positive incentives and extension. One effect is to move the boundary lines of mechanism areas further to the right due to private transaction costs, as outlined above.

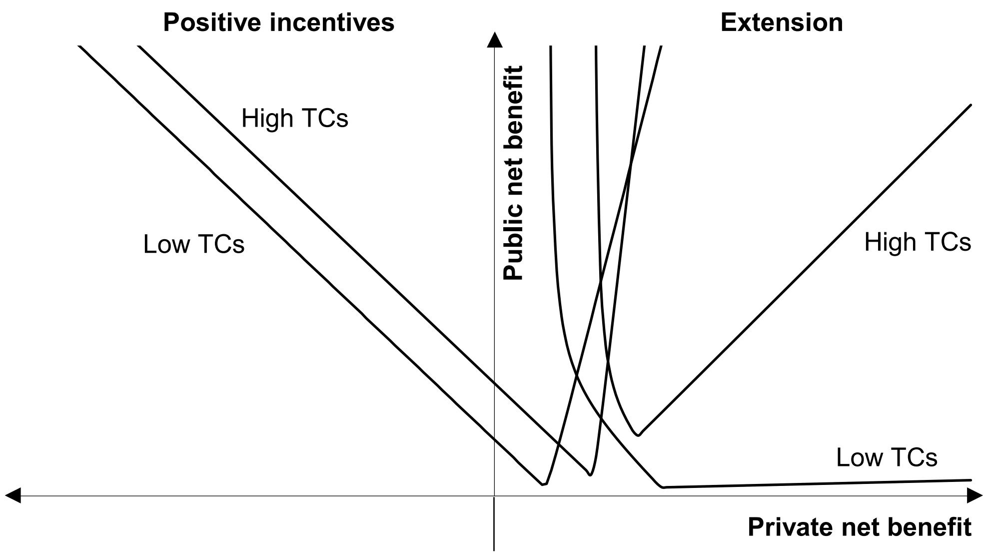

Figure 4. Impact of higher transaction costs (TCs) on sets of projects for which positive incentives or extension would be efficient policy mechanisms.

The second main effect is to raise the lower boundary of the extension area significantly. This is due to the increased public transaction costs making it less likely that the benefits of extension will outweigh the costs. Notably, the impact of doubling the public transaction costs on the area of extension is much greater than the impact of reducing them to zero (which can be seen by comparing the low transaction cost line in Figure 3 with Figure 2).

6. Conclusion

There is a great deal of research related to planning and prioritisation of environmental projects. Within this body of work, the INFFER project is relatively unusual in the prominent focus given to transaction costs. This is likely to be because the project is not solely a research project, but includes a focus on influencing real policy and investment decisions, with strong participation by users who wish to use the framework in an institutional environment that is characterised by high transaction costs. From the earliest origins of the project, when the researchers were responding to weaknesses in a national salinity program, discussions with stakeholders about improvements to planning and prioritisation processes have featured transaction costs as a key consideration. Given the focus of the work on influencing real world outcomes, the researchers found that dealing well with transaction cost issues was an inescapable requirement. We concur with the observation of McCann et al. (2005) that "by ignoring important costs, which are obvious to the agencies involved, the economics profession is less credible" (p. 527-529). Ironically, a consequence was that the research team incurred unusually high transaction costs associated with communications, training, and so on.

Resistance to processes that would increase the transaction costs that would be borne by environmental managers was encountered – understandably so given the high transaction costs documented for participants in this sector. Unfortunately, addressing the existing weaknesses in planning and prioritisation processes in public environmental programs would necessarily result in some increases in transaction costs. In order to minimise the adverse consequences of this for uptake of the framework, careful consideration was given to the balance between the additional transaction costs of the process (through greater complexity, comprehensiveness and consultation) and the resulting benefits. As a result, the process was simplified in a number of ways that would not have been considered in a project that aimed to increase environmental outcomes at any (transaction) cost. Notably, a filtering process based on a simplified set of criteria was introduced prior to detailed assessment of proposed projects, and the detailed project assessment process, while dealing with all important factors, does so in a relatively simple way in many cases. Training and user support also helped to limit the transaction costs involved in learning the system.

The environmental investment framework at the heart of the project addresses transaction costs explicitly in a variety of ways. Both public and private transaction costs are considered in the calculation of the Benefit: Cost Ratio for each project, and in the identification of the most effective class of policy mechanism for the project.

The project provides insights into the importance of transaction costs in the environmental policy process and in environmental planning and prioritisation. In environmental programs such as the one documented here, transaction costs can be large, with consequences for the behaviour and preferences of participants. The experiences documented here highlight the importance of striking an appropriate balance between the benefits and transaction costs of decision processes in the design of decision support tools such as INFFER. They also demonstrate how transaction costs can be explicitly factored into the decision process for two important related decisions.

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