

Institutional and social influences on R&D evaluation in agriculture

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Benefit-cost analyses of R&D activity in agriculture increasingly form part of the decision-making process of allocating R&D funds. This article describes how institutional and social influences can affect the rigour and quality of R&D evaluations. The article explores some possible mechanisms for quality control in benefit-cost analysis so that appraisals are more likely to be accountable and credible assessments rather than false advertising or biased assessments.

1. Introduction

R&D managers in both the public and private sectors increasingly are interested in improving the efficiency and effectiveness of operations of their organisation's R&D effort. Increasingly they are held accountable for their organisation's performance and are required to report to their stakeholders or shareholders audited evidence of the quality and profitability of their organisation's investment in R&D. In providing performance indicators these managers often depend directly or indirectly on methodologies such as benefit-cost analysis. Certainly in the public sector provision of agricultural R&D, and also among the rural industry R&D corporations in Australia, there has been increased use of benefit-cost analysis in reporting or assessing the profitability of investments in R&D (Prinsley 1994; Brennan and Davis 1996; CIE 1997). The Industry Commission (1994) in its review of R&D in Australia noted favourably how all rural R&D corporations were formally assessing projects against priorities identified in five-year and annual plans.

A common finding in many studies of investment in agricultural R&D is that these investments often are highly profitable. The seminal *ex post* economic studies of returns to investment in agricultural research (Griliches 1958 and 1964; Peterson 1967) estimated real internal rates of return of 20

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per cent to 40 per cent. Compilations of later studies (Peterson 1971; Evenson and Kislev 1975; Evenson *et al.* 1979; Norton and Davis 1981; Ruttan 1982; Fox 1987) also indicated moderate to high internal rates of return from a range of investments in agricultural research. Makki *et al.* (1995) assessed returns to agricultural research in the United States, Widmer *et al.* (1988) for Canada, Edwards and Freebairn (1985) for Australia and Boyle (1986) for Ireland.

Occasionally the results of such studies are used to defend or extend investment in agricultural research. However, as discussed by Martin (1977), Lindner and Jarrett (1978), Fox (1985), Norton *et al.* (1987) and Harvey (1988), many studies of the returns to investment in agricultural research are flawed theoretically or practically. The sorts of flaws include inadequate costing such as only considering the salary costs of researchers and ignoring costs of support staff and equipment (Araji *et al.* 1978). Price-offsetting effects of increased agricultural production are improperly ignored. The basis for production outcomes can be incorrect (e.g., assuming the wrong form of supply shift or ignoring market structures (Holloway 1998)). Deadweight losses associated with taxation, the revenue source for much public research, are usually ignored as are demand shifts caused by population and income changes. Also, inferior functional forms are sometimes used in regression analyses of returns to agricultural research. Secondary impacts are almost always ignored and fallacious conclusions can be drawn from average rather than marginal rates of return. For further discussion of such limitations see Wise (1986), Norton *et al.* (1987), Harvey (1988), Harris and Lloyd (1990), Harrison *et al.* (1991), Alston *et al.* (1995), Thirtle (1995) and Wohlgenant (1997).

Similar criticisms have been levelled particularly at *ex ante* benefit-cost analyses of agricultural R&D activity in Australia. Fisher *et al.* (1996) list many sources of inconsistency in benefit-cost analyses. Wilson (1996) points out some inadequacies in the benefit-cost analysis templates in common use in Australia. Stewart has questioned the rigour of analyses and said: 'Benefit-cost exercises undertaken in "mid-air" risk either banality or unacknowledged politicisation' (1995, p. 125).

The problem of undue optimism in benefit-cost analysis has been raised by several discussants in Daniel (1997). For example, Peter Bardsley (*ibid.*, p. 47) has asked, 'why do we see such high benefit-cost ratios put forward by serious people?'. Jock Anderson (*ibid.*, p. 38) has observed that, 'We know from many forms of public investment analysis that appraisal optimism is rampant. You can look at *ex post* versus *ex ante* rates of return on public investment and typically find a systematic disconnection between these.' Such comments suggest that *ex ante* benefit-cost analyses often are more like false advertising rather than sound assessments.

Further, John Brennan (*ibid.*, p. 41) has said that, 'It's entirely useless to essentially get scientists to estimate their own parameters, put them in a proposal, submit it and say that's the answer. Unless there's some peer review in that process to ensure some comparability it's an entire waste of time.' Such comments question whether the application of benefit-cost analysis truly facilitates resource allocation decisions for R&D. Are benefit-cost analyses mainly sound assessments of the social profitability of the R&D investment or are they in reality more a form of advertising?

This article begins to explore this question by examining the institutional or social settings of the economic analysis of R&D projects. It describes how these settings can bias analyses and diminish their credibility and also suggests some ways to improve or protect the quality and integrity of economic analyses of R&D. Because benefit-cost analysis is a commonly applied tool in R&D assessment, this article restricts discussion to this technique, although some of the observations and comments here perhaps have relevance to a wider portfolio of assessment methods.

The next section examines the nature and causes of institutional and social problems that can deleteriously affect benefit-cost analysis. In a subsequent section ways to combat these problems are discussed. A final section gives concluding comments.

2. Institutional and social factors affecting the process of benefit-cost analysis

Some studies (Miller 1986; March 1988; McLaughlin 1995; Velasquez 1998) identify how behaviour within institutions is influenced by the institutions' organisational structure and social systems. Because benefit-cost analysis occurs within an institutional or social setting, this setting will affect the process of benefit-cost analysis. This can lead to analyses not being sound assessments as outlined below.

This view of institutional influence is not new. Bardsley, for example, uses principal-agent theory to show how the relationship between corporate research managers and scientists affects optimal R&D resource allocation. He concludes that, 'the proper economic analysis of research projects should take into account the structure and incentives in the organisations which carry out research' (1995, p. 591).

Institutional and social influences can compound technical deficiencies or inconsistencies in benefit-cost analyses. Fisher *et al.* (1996) list nine main categories of inconsistency in benefit-cost analyses. Among the categories are methodological inconsistencies, inadequate or inaccurate data, difficulties in specifying the 'without' R&D scenario, inadequate representation of project costs and problems in defining adoption responses. The problems outlined by

Fisher *et al.* can affect the credibility of benefit-cost analyses and weaken the soundness of allocation decisions based on the analyses.

These technical deficiencies or inconsistencies also arise from utilising different software tools for R&D assessment. For example, Antony and Culpitt (1995) and Wilson (1996) describe the several main software packages in use in Australia for project appraisal and provide some comment about the omissions or deficiencies of some of the packages.

Apart from these technical deficiencies in applying benefit-cost analysis, there are institutional and social influences that affect the efficacy and role of benefit-cost analyses. These influences are described in the following subsections.

2.1 Information asymmetry

Analysts should be aware that in general, the need of people to believe in the utility of their work can lead them to be optimistic about its relevance or possible impact. Such optimism can translate into upward bias in estimates provided for benefit-cost analyses. The bias will shift rightwards the benefit distributions associated with projects. In practice, shifts in both the benefit and cost distributions or their expected values are likely for a variety of social reasons.

Those who propose, manage or work on a project may see a highly favourable project evaluation as a prerequisite to secure further funding. These people closely aligned with the project may be concerned principally with receiving further funding. Hence, where these people are sure that their work has been profitable, they will be keen to participate in a benefit-cost analysis as it represents both a form of reporting as well as a vehicle for advertising the merits of their project.

In contrast, where these people are unsure about the profitability of their work then their response to a benefit-cost analysis may be to view the analysis as a judgement or examination to be avoided. For example, Luukkonen describes how scientists who received unfavourable reviews 'met with decreased status and reputation and suffered adverse psychological impacts' (1995, p. 364). In such cases project staff may prefer selective disclosure of the costs and outcomes of their projects or, to diminish the impact of a benefit-cost analysis, they may seek support for their projects within the organisation prior to and after the analysis.

Staff concerned about a review of their project may question aggressively the assumptions or findings of any benefit-cost analysis to reduce the credibility of the analysis. Occasionally criticisms of the analysis will extend to those undertaking the analysis. Fear of loss of reputation or future funding can fuel such criticism. Such fear is understandable where the skill

base of project staff is so narrow as to make their transfer to other projects or activities difficult. As Mullen observes, 'Perhaps the difficulty of transferring human capital is why scientists are threatened by program reviews whereas economists are more amenable to sudden changes in direction' (1996, p. 218). Those scientists threatened by review, for reasons of self-preservation, may avoid, modify or sabotage the review, thereby weakening its credibility or validity. By contrast, scientists confident in the profitability of their projects may supply very detailed high quality data to facilitate a review.

A related problem of disclosure of all costs is identified by Bardsley (1997) who suggests that there is a moral hazard of failing to report sunk costs in *ex ante* analyses as this enables the benefit-cost ratio to be higher and therefore makes a project appear profitable. A solution he supports is to undertake more *ex post* analyses. However, organisations that fund R&D projects commonly are guided in their allocation decisions more by the relative prospective returns of new projects rather than the actual returns from previous projects. Accordingly, undertaking *ex post* analyses may not be a practical or directly relevant solution to under-reporting of costs in *ex ante* studies.

2.2 Analyst capture

Application of benefit-cost analysis is rarely mechanistic or simple. The human element and interaction that underpin a benefit-cost analysis cannot be overlooked in influencing both positively and negatively the nature and content of a benefit-cost analysis. A positive influence can arise where a benefit-cost analyst gradually forms a rapport with those contributing to the analysis and this rapport enables the quality of assumptions and the quality and quantity of data that underpin the analysis to be greater than otherwise might occur. Further, the role of the analyst in guiding and assisting those involved in the analysis has its own set of benefits (Davis and Lubulwa 1995; Luukkonen 1995; Thomson and Morrison 1996).

However, human interaction in the process of benefit-cost analysis can also have a negative aspect. Where a benefit-cost analyst routinely assesses the work of institutional colleagues then there is a risk of analyst capture where the analyst subtly becomes less independent and less critical of the data or assumptions provided by colleagues. Like a chameleon the analyst can change subtly to accommodate the ethos, views and biases of those whose projects or activities are being assessed.

The analyst can also be subject to organisational political tactics (Velasquez 1998) of ingratiation, image building and creation of obligations. Such tactics, whether intentional or not, foster in the analyst positive

attitudes towards the organisation and help ensure assessments are more favourable than might otherwise occur.

Further, where the salary of the analyst is paid by the group whose projects or activities are being subject to analysis, then there is a risk that analyses will be influenced by the analyst's need for further employment. Given that staff are increasingly employed on contracts, and given limited alternative employment prospects for some staff, this risk may not be negligible. Certainly some private consultants may not be fearless in conducting detailed benefit-cost analyses when their clients suggest that projects to be investigated should be profitable and when the consultants also expect further work from the same clients. The conflict of interest between the professional desire to undertake proper investigation and the immediate need for further employment can be a problem.

2.3 Inconsistent scrutiny

Those who provide data and those undertaking a benefit-cost analysis occasionally confuse the outcome of a benefit-cost analysis with its credibility. Often a moderately high benefit-cost ratio is interpreted as a good or sound analysis. In such cases, there is often less incentive or pressure to extend the analysis and undertake sensitivity analysis. The thinking appears to be that once an initial analysis provides a ballpark figure of moderate profitability, then all may rest easy.

By contrast, when a slightly positive or extremely high benefit-cost ratio is recorded, then often participants are keen to undertake sensitivity analysis to identify either the conditions under which the project or activity will be shown to be highly profitable or the causes for the level of the ratio.

Where the outcome of a benefit-cost analysis is confused with its credibility, then inconsistent scrutiny of data and assumptions is likely. Unless there are routine processes in place to ensure consistency in project appraisals, then the rigour of error-checking can be eroded which will affect the validity of project appraisals.

2.4 Volume and urgency

Time is a crucial ingredient in benefit-cost analysis. Often institutions or organisations have appraisal deadlines that constrain the quality of benefit-cost analyses. There is often inadequate time to question data and assumptions, or to undertake sensitivity analysis. Resultant analyses are often partial and overlook some costs or benefits. Further, critical relationships or other competing areas of R&D that importantly could change conclusions of the analysis may be ignored.

In some settings the tightness of deadlines is exacerbated by the volume of analyses expected to be undertaken by each analyst. In these situations often analysts trade off analytical quality against quantity in order to provide required information. Even where checklists are used to impose some quality control upon analyses, it is not always possible to discern the care or honesty of adherence to the checklist.

The problem of volume and urgency also militates against the analyst forming productive relationships with researchers. Although restricting contact between analysts and researchers may lessen the problem of analyst capture, it can prevent synergies and growth of insight that often form part of the interactive process of benefit-cost analysis.

2.5 The 'straw men'

Occasionally benefit-cost analyses are used either to falsely advertise an institution's commitment to greater rigour and accountability in resource allocation or to falsely advertise its performance. The falseness lies in adopting the veneer rather than the substance of benefit-cost analysis to guide resource allocation decisions or to provide greater accountability. The use of benefit-cost analyses in these situations is the appraisal of 'straw men'.

There are two types of 'straw men'. The first is a project or activity that is known to be wasteful or peripheral or unprofitable. This 'straw man' is subject to benefit-cost analysis in the knowledge that the analysis will generate an unfavourable conclusion. Culling the project and openly reporting this decision provides the institution with an appearance of greater accountability.

The second 'straw man' is the project(s) or activity that is known to be profitable and often politically attractive. This 'straw man' is subject to benefit-cost analysis in the knowledge that the analysis will generate highly favourable conclusions. Identifying the social profitability of this 'straw man' often is used by the institution or part of the institution to defend or increase its funding. In this case, benefit-cost analysis is used to advertise the worth of investing in the institution or its components. Benefit-cost analysis is not used to provide a fair or sound assessment of all the investments in the institution. Rather, benefit-cost analysis is used to advertise the institution to its funders. Generating the appearance of profitability rather than providing a sound overall assessment of the nature of investment in the institution is the chief purpose, in this case, for employing benefit-cost analysis.

The use of 'straw men' does not represent a flaw in benefit-cost analysis so much as a muzzling of its potential wider role in facilitating resource allocation decisions within an institution or in providing a full appraisal of

activity. Such a proscribed reliance on benefit-cost analysis limits the technique to identifying only low-return or very high-return areas rather than facilitating overall investment portfolio decisions. This constrained use of benefit-cost analysis limits the role of the technique to serve the particular advertising requirements of the institution rather than serving a wider role in resource or activity assessment.

3. Some solutions to institutional and social influences that weaken benefit-cost analyses

To ensure credibility and accountability in applying the technique of benefit-cost analysis, several authors (Department of Finance 1992; Johnston *et al.* 1992; CIE 1997) outline the technical requirements and procedures to improve the technical validity of a benefit-cost analysis. For example, many authors advocate the adoption of technical standards and checklists.

A checklist or menu of activities can dictate appraisal procedures (CIE 1997) to improve the rigour and quality of analyses. Adoption of standards can ensure comparability of analyses. For example, some basic ingredients of the appraisal such as discount rate should be identical and others should be drawn from the same database (e.g. salary costs, crop areas, commodity prices). However, as already noted, after imposing a checklist it is not always possible to discern the care or honesty of adherence to the checklist.

It is not the purpose of this article to discuss such technical avenues for improving the accountability of benefit-cost analyses. Rather, the purpose is to describe ways in which other problems arising from institutional or social pressures, as outlined above, can be addressed. To improve the accountability and effectiveness of benefit-cost analysis is to implement facets of audit, quality assurance, business ethics and incentive programs (Chambers and Rand 1997; Buchholz and Rosenthal 1998).

3.1 Independent reviews

The quality of benefit-cost analyses can be improved by requiring independent reviews of assessments. Employing independent reviewers can combat the problems of analyst capture and inconsistent scrutiny as well as performing a check on the technical merit of analyses and comparability of analyses. If independent reviewers are specifically employed as gate-keepers of quality, then they are more likely to be fearless, yet fair-minded, in their assessment of analyses. Such reviewers need not examine all analyses. Just the prospect of forming part of a random selection of analyses may be sufficient to encourage project analysts to be serious and thorough in their appraisals.

Experienced independent reviewers are also likely to be aware of the problems of information asymmetry and bias and may through their comments or requests combat to some degree these problems. Also peer reviews, particularly involving knowledgeable staff in related but not competitive projects, are liable to identify questionable or inaccurate technical data and assumptions in benefit-cost analyses.

The findings of independent reviewers also can form part of an incentive program for benefit-cost analysts. For example, the promotion or reward of these analysts could be linked to the receipt of favourable reports from the independent reviewers concerning the technical quality of completed benefit-cost analyses.

3.2 Mentoring and training

The quality of benefit-cost analyses also can be improved through mentoring or training. A system of mentors or training ensures that staff undertaking appraisals receive support and tuition and therefore are likely to improve the quality and perhaps speed of their analyses.

Mentoring and training can also assist to lessen the problems of analyst capture and inconsistent scrutiny. Mentoring and training should also make analysts aware of the information asymmetry and bias issue and inform them as to how in practice this can be reduced. Finally, better trained and skilled analysts are more likely to cope with the problem of volume and urgency occasionally imposed on analysts.

3.3 Rotation of analysts

Another way of lessening analyst capture yet also provide additional training is to rotate analysts. This broadens the experience and knowledge of the analyst and prevents bias being subtly introduced in analyses through analyst capture.

3.4 Outsourcing or sub-contracting

Sometimes it is cost-effective for an organisation faced with the problem of volume and urgency to outsource or sub-contract part of its evaluation workload. This can enable more analyses to be completed without the undue sacrifice of quality. Occasionally this offers the additional advantage of independent assessment and fresh insight. However, ensuring that outsourcing delivers independent, cost-effective analyses is not a simple exercise (White and James 1996), plus outsourcing has its own set of problems (Tisdell 1994).

3.5 Adequate funding with conditions

If an R&D institution or funder of R&D activity is serious about encouraging sound benefit-cost analyses, then the task of analysis must be funded adequately. Providing sufficient funds for the hiring, training and support of staff engaged in benefit-cost analysis will mean they are more able to cope with problems of volume and urgency. Funding staff within or outside the institution to be gatekeepers of analytical quality will lessen the impact of analyst capture.

Conditions or caveats can be placed on funds provided to or disbursed within an R&D institution. These caveats would be like contractual obligations requiring those receiving funds to provide independent benefit-cost analyses of their major R&D activity. Such caveats would redress some of the problems of analyst capture, inconsistent scrutiny and volume and urgency. However, what level of funding and what form of R&D review should be required are themselves economic questions. As Alston *et al.* observe, 'even in the most generously supported system, it will not be worth overly investing in formal cost-benefit analysis of program alternatives' (1995, p. 378).

The problem of 'straw men' in project appraisal is difficult to overcome. As Thomson and Morrison observe, 'Senior level support is vital if economists and their methodologies are to be accepted' (1996, p. 13). In the political economy of organisations benefit-cost analysis is but one tool that managers may choose to use to affect resource allocation. How seriously senior managers advocate and support the broad practice of benefit-cost analysis will tend to determine the incidence of 'straw men'.

A genuine commitment to organisational ethics can discourage the use of 'straw men'. Ethics education and training or the implementation of codes of ethical conduct (Buchholz and Rosenthal 1998) can serve to reduce the possibility of 'straw men'. However, the introduction and commitment to ethics that mould the culture of an organisation depend on the assent and behaviour of senior management.

It could be argued that the problem of 'straw men' might often be a short-term problem in many organisations because increasingly the assessment of managerial performance requires wholesome analyses of institutional performance. Accordingly, partial or contrived use of benefit-cost analysis will rarely be acceptable and managers will be required to adopt more thorough indicators of performance which could include wider use of benefit-cost analysis.

4. Conclusion

Various authors have identified sources of inconsistency in benefit-cost analyses. Among the sources are methodological inconsistencies, inadequate

or inaccurate data, difficulties in specifying the 'without' R&D scenario, inadequate representation of project costs and difficulty in defining adoption responses. These problems affect the credibility of benefit-cost analyses and weaken the soundness of allocation decisions based on the analyses. It can lead to benefit-cost analyses being more a form of advertising rather than sound assessments.

There are, however, also a range of institutional and social influences that can diminish the efficacy and role of benefit-cost analyses. This article has described these influences and their likely impact on the quality of benefit-cost analyses. These influences include the problems of information asymmetry and bias, analyst capture, inconsistency of endeavour, the impact of urgency and workload and the muzzling of the application of the technique of benefit-cost analysis.

An issue for benefit-cost analysts is to what extent they should implement or argue for remedies to lessen these institutional and social problems that affect benefit-cost analyses undesirably. Certainly, it is clear that much of the focus of agricultural economists engaged in benefit-cost analysis in recent years (Brennan and Davis 1996; CIE 1997) has been to reduce technical deficiencies in its application.

Better software templates, more consistent data sets and more detailed checklists have been recommended or introduced to improve the quality of benefit-cost analyses. However, there has been limited discussion of the institutional or social factors that deleteriously can affect benefit-cost analyses. This author would argue that benefit-cost analysis practitioners should be made aware of these factors and their possible impact on benefit-cost analyses, as well as recognising how to combat their impact.

In short, agricultural economists, as social scientists, should not only be skilled in the technique of benefit-cost analysis but should also be skilled at ensuring, wherever possible, that the institutional and social setting of their analyses does not unduly restrict or weaken these analyses.

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