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Social benefit cost analysis of *Dairy Moving Forward* extension activity

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Abstract. Dairy Australia has delivered a program entitled *DMF* involving a series of activities to enhance the expertise of dairy farmers and encourage their use of expert services. A substantial investment of \$5.2m (adjusted to 2005 dollars) has been made by Dairy Australia in the program. In this report, justifications for DA using farmers' and taxpayers' funds in this way are explored; a Social Benefit Cost Analysis has been carried out. The conclusion is that the public and industry investment in *DMF* is likely to have earned a return on capital that justifies the investment.

Keywords: dairy extension, benefit cost analysis, public funding of extension

Introduction

Dairy Moving Forward (DMF) is the overarching title for a collaborative extension program aimed at improving the capacity of dairy farmers to understand and manage their businesses. The *DMF* program has been underway since December 2003. The outreach component of the program started in mid-2004 and is continuing.

The stated objective of *DMF* is to give dairy farmers greater 'knowledge, choices and control' over their farm businesses.

The program had its genesis in the 2002 drought and its aftermath. It brought together more than 50 participating industry groups. The resources used in the *DMF* program have come from:

- Dairy Australia (DA)
 - Dairy farmer research and development levy
 - Matching funds from the Australian Government
- Dairy companies and organisations servicing the dairy farmers
- Australian Dairy Farmers Ltd

In addition participating dairy farmers, independent consultants, other advisors and some staff from some Departments of Agriculture have contributed time to participate in the program.

As documented, *DMF* was designed to:

- focus on the individual dairy farm family;

- be fast track;
- be short term (finishing September 2005) but leading to new and on-going approaches;
- be built on genuine partnerships across the industry; and
- take account of major regional differences.

The activities under *DMF* included:

- A national survey of dairy farmers, and an expert analysis of national and regional drivers and post-farm gate issues, published as *Dairy 2004: Situation & Outlook Report* and then repeated as *Dairy 2005: Situation & Outlook*;
- 42 'farmer forum' meetings conducted across Australia from June to November 2004. These were attended by 1,000 dairy farmers and 28 organisations participated;
- More than 20 business briefing meetings at which over 1,000 service providers to the dairy industry were briefed;
- An e-mail communication network linking service providers. Monthly bulletins were circulated through this network and sent to over 3,000 service providers and other individuals involved in the dairy industry;
- Sponsorship of business tours of the New Zealand dairy industry for young dairy farmers. A total of 24 young dairy farmers went on these tours in 2004 and 2005. They learnt about

the global nature of the dairy industry and reported on strategic issues to be addressed in Australia;

- An eight-page report mailed in December 2004 to every dairy farmer (on the research levy database) and over 2,000 service providers in Australia. This report outlined the progress of *DMF*, and advised farmers on how they could participate;
- A major sub-program called *Taking Stock* – described below;
- An information resource on financial management – the *Farm Finance Package*;
- A number of regional projects under the general category of *Taking Action* that align extension resources with regional needs. These include projects addressing feeding pasture for profit that involve a mix of group and individual activities:
 - *Walking Through The Seasons* in Victoria
 - *20/12 Pasture Business Program* in Tasmania
 - *Focus on Forage* in South Australia
 - *Feeding Pastures for Profit* in Western Australia
 - *Dairy Pathways* (in development) in NSW
 - *Nutrition Plus\$* in Queensland

Taking Stock

The aim of *Taking Stock* is to improve dairy farmers' understanding of their businesses. The stated aims of *Taking Stock* are to:

- determine the current financial and operational status of individual dairy businesses;
- identify the issues that the dairy farm family can control;
- suggest actions that could be taken to improve profitability;
- prepare a plan to move the participating dairy business forward; and
- review progress on the plan with a follow-up visit one to two months after the analysis

The tool used in *Taking Stock* is a computerised whole-farm budget analysis that was designed in consultation with a broad cross section of participants in the

dairy industry. The *Taking Stock* budget analysis integrates a comprehensive range of information financial, herd management, feed management and other farm management information into a whole-farm systems analysis. It is designed to be used by extension/counselling advisers during consultations with dairy farmers.

Free *Taking Stock* sessions are available to all Australian dairy farmers. These sessions have been provided by participating advisers including: independent consultants, dairy company staff, rural counsellors and, in some States, Department of Agriculture staff. The farmers may choose who they wish to use as their adviser.

Since its initiation *Taking Stock* has provided training for over 150 advisers and these advisers have assisted over 1,600 farmers evaluate their businesses using the *Taking Stock* program. An independent survey of 130 farmers who had participated in *Taking Stock* from November 2004 to May 2005 was conducted by Quantum Market Research in June 2005. Approximately 60% of interviewees reported that as a result of their experiences in *Taking Stock* they had taken action on important aspects of their farm management.

Rationale for public funding of *DMF*

A substantial proportion of Dairy Australia's funding comes from the Government of Australia. The expenditure of public money for the private benefit of part of the population of dairy farmers requires justification. The Australian taxpayer has the right to expect that the public benefits accruing from this expenditure, at the very least, equal the opportunity cost of spending the funds on (i) other public goods and services; or (ii) the opportunity cost of the funds if they were to be used for other dairy R,D&E investments; or (iii) given that there are private providers willing to supply advisory services for a fee and other public providers of farmer educational services, the level of service available from the existing private and public providers was sub-optimal.

The economic case to justify the involvement of Dairy Australia in farmer education and extension and advisory expenditures might lay, in parts of three areas of economic theory, viz. public goods, economics of information and 'X-efficiency'.

The first concerns the under-provision of goods or service because of the non-rival and non-excludable (public good) nature of the

good or service¹. This is the case for public-funded agricultural research. Following from this justification for public investment in agricultural research is a related case for further public funding in education and extension to enhance the rate of adoption to increase the benefits that flow from the investment in research.

The discussion below considers Dairy Australia funding from this perspective.

Second, the case for Dairy Australia funding extension activities might also lie in an information argument that stems from theory about the conditions for perfect competition. This suggests that markets work best when participants are well informed. Information deficiencies (Stiglitz 2004) could be the cause of considerable economic costs. The 'well-informed' (sometimes expressed as 'fully informed') part of economic theory has two main interpretations. The first refers to buyers and sellers being fully informed about the qualities and prices of similar goods and services in the market and in transactions currently being negotiated. This criterion developed from Adam Smith's interpretation that participants in markets needed to have 'tolerable' knowledge of the market opportunities (Stigler 1957).

The second aspect of information is used by Knight (1921) in the context of there being no uncertainty about the future dimensions of the transactions taking place in the competitive markets. Tisdell (1972) argues that firms or production units are assumed to act in a way which maximises their anticipated profits and 'deficiency of knowledge' can cause the optimisation conditions of perfect markets and competition to be violated. In the case of over-optimistic expectations, that if pursued will lead to social losses, the government could intervene to reduce the range of price expectations, and this could lead to an improvement. A case can also be made for government subsidisation of some market knowledge since externalities generally stem from its provision.

¹ One form of market failure is defined as the situation where a socially sub-optimal amount of a good or service is supplied or demanded because the benefits or costs of supplying the good or service in question cannot be contained only to the participants in a transaction (non-excludable); or the consumption of the 'product' by one party does not diminish the consumption of it by another party (non-rival). That is, the market fails to provide the right amount of a good or service because the good or service is non-rival and non-excludable in consumption. The good or service will not be provided at the optimum level because potential providers cannot capture sufficient of the benefits of doing so, or others can capture benefits without contributing to costs.

The theory of second best comes into play when the first-best optimisation conditions are violated (Tisdell 1972). Then, government expenditure can be justified if it is necessary to reduce ignorance; or, to produce or subsidise the production of a good which cannot be supplied in optimal quantities by the market; or to correct specific defects in the operation of markets; or to improve the working of markets by improving mobility and information. More recently, the implications of asymmetry of information held by market participants have come to the fore in thinking about constraints on efficient resource allocation in economics.

There is also a third area where the case for DA involvement in extension may lie: the approach to the theory of the firm suggested by Leibenstein (1966) known as 'X-Efficiency' losses. He argues that neither individuals nor firms work as hard, nor do they search for information, as they could (Mansfield 1979, p.231), or as they would, under different incentive and information circumstances. So-called X-Efficiency losses, or inefficiencies or sub-optimal utilisation of labour and capital - operating on sub-optimal production functions - can come about through not knowing enough to do it better, or through not using knowledge that is already known within the firm. Leibenstein argued that costs from inefficient use of resources arising from factors within the firm such as poor incentives or motivations (so called X-Inefficiencies), that leave some firms operating on lower production functions when technical knowledge exists that enables other firms to operate more efficiently, are likely to be greater than the costs arising from misallocation of resources caused by market imperfections such as non-competitive market structure.

Referring to studies from non-agricultural industry, Leibenstein cited evidence of the need for management to be motivated to pursue the gains from greater labour incentives and, pertinent to the DMF program, of the need for top management to accept the idea of obtaining and implementing consulting advice (p.230). This was because the returns to consulting advice in these industries were high. He continued:

It is quite clear that consulting services are not only profitable to consultants but also highly profitable to many of the firms that employ them. But it is rather surprising that more of

these services are not called for. Part of the answer may be that managements of firms are not motivated to hire consultants if things appear to be going 'in any reasonably satisfactory rate'. There are of course numerous resistances to calling for outside advice. If the motivation is strong enough, e.g. the threat of the failure of the firm, then it is likely that such resistances would be overcome. But these are simply different aspects of the motivational elements involved (Mansfield 1979, p. 231).

The argument about use of consulting services, and lack of use, resonates in dairy farming.

There exists in dairying a wide range of levels of performance of firms, and of partial productivity indicators like pasture utilisation per hectare. Some of the difference in performance is attributable to different capacities to command resources such as capital, and different attitudes to the risks involved. At the same time, some of the difference in firm performance is attributable to differences in command of knowledge and information. It is this source of X-efficiency loss – sub-optimally informed decision-makers operating on lower production functions than they could be – that DMF aims to address.

Private and public

If the supply of advisory services is simply left to the private market, the use of knowledge and speed of adjustment will be slower than in a more informed situation. The individual, industry and social benefits will therefore be less than would be achieved if more dairy farmers were better informed and operating on higher production functions. If DMF succeeds in (i) improving the understanding by some farmers of their business, to a degree that would not otherwise have been attained without such help; (ii) accelerating the adoption of improved techniques and systems; (iii) increasing the use of private consulting services and other sources of advice; (iv) improving the capacity of private consulting and other sources of advice to provide useful advice or (v) facilitating the departure of non-viable farms from the industry, then the

productivity of the dairy industry as a whole will probably increase. If that increase in productivity has a reasonable probability of being an increase that would not otherwise have been achieved at all or not achieved as quickly, because of gaps in information that DMF has helped to fill, and if the benefits exceed the public cost of funding DMF, then the expenditure of dairy farmers' and public funds on the program may be able to be justified drawing on public good, information and X-efficiency arguments.

The further the publicly funded extension/education situation gets away from publicly providing extension/education to groups about widely appropriable (non-excludable, non-rival in consumption) information and technology and about how to evaluate the implications of adoption of innovations in the whole farm context, and the more these activities trend towards the provision of individual financial and risk advice for individual private businesspeople, the weaker is the case for the public involvement, at least in terms of economic efficiency.

Non-economic objectives are more effectively addressed in other ways. The case for public provision of advice about financial management – the comparative advantage of the best dairy business people in an extremely competitive type of business – rests to a considerable extent on the notion that information gaps are inhibiting seriously the effective operation of the market for advisory services. i.e. a 'market-assist' role.

If a program equips consultants better to deliver their service, or motivates and equips farmers to better utilise advisory services, then this creates the potential of better informing market participants and hence helping markets work better, and reducing the extent of Leibenstein's X-Efficiency losses. If sufficient farmers change the way they run their businesses in response to being better informed, then social benefits should follow. Judging whether these benefits exceed costs is a matter for Benefit Cost Analysis. Judging the distributional, or equity, effects of the change in costs and benefits is a political question. For example, if a new demand/supply situation for consulting services emerges, as well as net social benefits being attained (defined as extra producer and consumer surplus), transfers of some previous 'consumer' surplus (the difference between farmer benefits and price paid for consulting services) and producer surplus (the gains of consultants above cost of providing services) will occur as well.

On balance, the case may be able to be sustained that some public provision of information to groups of private business people – to farmers and their advisors and other supply chain allies - can meet economic criteria. One criterion is to invest in an area in which there would otherwise be under-investment and in the provision of goods and services that would otherwise be supplied to a degree that is less than socially optimal, such as research into new technology and the adoption and implementation of the findings of that research. Another criterion is to invest in providing information that will enhance farmer mastery of information, motivations and incentives to improve whole farm efficiency. The trick is to know just where to stop so as to avoid 'crowding out' private providers and reducing the comparative advantage of the best operators. Public involvement should aim to ensure that the motivations, incentives and potential comparative advantage in business management that some dairy farmers have over others (e.g. those already utilising the available private sources of advice) is given full rein.

A Social Benefit Cost Analysis of DMF

The effects of *Taking Action* are only now being evaluated: indications are that 75% of farmers involved in the *Taking Action* component of DMF have made changes – 50% 'significant' changes, 25% 'some changes'. In addition many other participants have stated that they will probably be taking action in the future and, as the program continues to be used in the future, it is likely that even more dairy farmers will take some action that is, in part or in full, a result of using *Taking Stock* or being influenced by someone who has done *Taking Stock*. Furthermore, the influence of the *Situation and Outlook* reports (2004 and 2005) on farmer decision making has not been evaluated. If the dairy industry considers it critical to determine the full empirical Benefit: Cost ratio of the entire DMF program then a follow-up series of studies will be required in 9-12 months. These studies would require a combination of in-depth case studies and comprehensive surveying of participating and non-participating farming businesses.

At this stage in the delivery of DMF the first step is to evaluate the level of benefit that would be necessary to justify the expenditure on DMF. The standard social benefit/cost approach is used. The financial and opportunity costs are detailed in Tables 1 and 2. These costs were adjusted to reflect their present value in 2005 dollar terms, and the resulting figures were used to calculate the present value of cost per participant and per

adopter in 2005 dollar terms after allowing for the opportunity cost (required rate of return).

Note that the estimate of costs and required benefits that follows is conservative, in two ways. First, a relatively high discount rate (required rate of return on investment) is used. Second, all costs of the DMF program are counted but the required benefits are constrained to coming from two sub-parts of the DMF program, namely the *Taking Stock* and *Taking Action* activities, i.e. all the costs are counted but only some of the benefits.

Present Value of DMF

To estimate the present value of cost it is necessary to:

- (i) adjust the future costs to reflect the opportunity cost of using resources in the DMF program instead of in some other productive way;
- (ii) adjust the value of expenditures that have occurred prior to the date of analysis (2005). These were compounded forward to equivalent present value at a rate that reflects the opportunity cost of utilising those resources in other ways.

The net effect is to derive an estimate of the total cost of the program expressed in present values after adjusting for the annual percentage earnings these funds could have earned if used in some other way. One thousand dollars spent in 2006 is equal to \$909 in 2005 at 10 per cent opportunity cost or discount rate. (Similarly, a \$1000 benefit received in 2006 is equivalent to \$909 benefit in 2005 at 10 per cent opportunity cost.)

Different discount rates were used in the analysis for Dairy Australia, processing companies, dairy farmers, government officials, and consultants and advisors.

The 30% rate used for Dairy Australia is the opportunity cost of using those funds for other research and development activities. There is a considerable body of research that shows that the return from investment in agricultural research and development is usually quite high and therefore the expected return from using these funds for R&D is at least 30% per annum (Alston and Pardey 2000). It is arguable that 30% real discount rate is too high because DA, or any R&D organisation, will fund projects that return, after the event, less than this rate. However, because there is much uncertainty associated with what the actual benefits will be, it is

prudent to set the 'hurdle' of required benefits high to add confidence to the conclusions about the likelihood that the required benefits will be achievable in practice.

Furthermore, often, it is not straight-forward to identify the total recurrent and capital cost of extension activities of public and private organisations. In this case, costs directly attributable to the DMF program are able to be identified well.

The 10% rate used for processing companies, dairy farmers, consultant and advisers represent the opportunity cost of their investing the time and resources committed to *Taking Stock* in other ways. The 8% rate used for Government's direct contribution of time and resources approximates the bond rate.

Benefits Accruing from DMF

At this stage the primary source for estimating the benefits accruing from DMF is a survey done by Quantum Market Research in June 2005. Quantum surveyed farmers who had participated in *Taking Stock* to gain an insight into the farmers' perception of the value and effectiveness of the program. The responses reported in this survey are unequivocal. A high proportion of the farmers interviewed stated that they felt the program was useful and effective: 94% reported that the program had improved their awareness and insight into the industry and their farm operations; 90% said that they would repeat their participation in *Taking Stock*; around 60% of the interviewees reported that they had used their improved awareness and insights to guide actions that they had already taken by the time of the interview in May and June 2005. Forty-nine percent of the interviewees mentioned that they had been prevented from following through as far as they'd like. In nearly all cases the limited follow through was due to financial constraints.

As far as the Quantum report goes the farmer responses are a strong endorsement of the information they have gleaned from *Taking Stock*. The Quantum study was limited in its scope. The results are self-reported experiences by farmers who have participated in *Taking Stock*. While it is apparent from the responses to the survey that participating farmers felt more confident than they were prior to the implementation of *Taking Stock*, it cannot be known to what extent their new found confidence would be solely attributable to *Taking Stock*. Higher milk prices, the breaking of the drought and good medium-term prospects for increased farm profitability would be important.

However, it is also reasonable to assume that activities like *Situation and Outlook* and *Taking Action* would have contributed to some more-informed farmers, which in turn contributed to a greater confidence. For these reasons a follow-up analysis using a stratified random sampling of both participant and non-participants in a survey that included all activities associated with DMF would be required if the industry required stronger empirical evidence of the impact of DMF. In this respect it is instructive to note that the information collected in the 2005 National Dairy Farmer Survey and reported in *Dairy 2005: Situation & Outlook* indicates that there was a marked increase in farmer confidence in the industry over the past 12 months. It is also interesting to note that some of the specific outcomes attributed in the Quantum report to *Taking Stock*, including restructuring of farm debt and controlling feed costs, are also identified in the *Dairy 2005: Situation & Outlook* as having occurred across much of the industry.

Another important consideration of any follow-up study would be to estimate the value of *Taking Stock* to the farmers. *Taking Stock*² was intended to engender an inquisitive farm business practice and assist farmers analyse their whole farm operations using information that is readily available but seldom organised and presented in the required coherent and comprehensive manner. Given that the information presented in *Taking Stock* is available to farmers from other sources, it would be very helpful to know why many are not using those other sources.

It would also be useful to know why some farmers have decided not to participate in *Taking Stock*. We have been advised (Brightling, P. 2007, per comm.) that 50% of dairy farmers are aware of *Taking Stock*. Of that 50% around a third have participated in *Taking Stock*. Some of the remaining two-thirds are undoubtedly using private advisers and may not feel the need to participate, others may be planning to participate in the future, yet others may have decided not to participate. Without this information it is not possible to estimate the value of the benefits that might be attributed to farmers participating in the *Taking Stock* program.

Analysis

The financial and opportunity costs of DMF to the end of September 2005 are summarised

² Note that aspects of *Taking Stock* warrant a closer look. This is particularly so with respect to separating economic and financial components of the analysis, and estimating economic efficiency (operating profit).

in Table 1. The body of the table shows the actual costs in the values of the year they were incurred. The program cost was \$6.7m in actual costs and the present value of these total costs is \$9.7m, in 2005 dollars.

To date approximately 2,500 dairy farmers have participated in the program (1600 *Taking Stock*, 400 *Taking Action* and 500 *Farmer Forums*). Approximately 60% of the *Taking Stock* participants report that they have taken some form of action as a consequence of their participation. Approximately 75% of participants in *Taking Action* pasture projects are estimated to have already changed aspects of their feeding management.

Table 2 shows the unit cost per participant and per adopter. In this case the 'adopters' are the proportion of participants in *Taking Stock* who are reported by the Quantum research report as having done something as a direct consequence of having participated in *Taking Stock*.

The present value of unit costs (in 2005 \$) of the *DMF*, to the end of September 2005, are: \$7,746 for adopters and \$3,903 for participants. These figures can be interpreted as the opportunity cost of the resources, financial, time and other in-kind that have been expended delivering the program to the adopter and the participants.

In effect the unit cost is an investment that Dairy Australia and the other organisations supporting *DMF* have made in improving the productivity of the industry through the participating dairy farmers after allowing for the opportunity cost of these resources invested. If the present value of the productivity gains, discounted at the opportunity cost of benefits received in the future, at least equals the cost of the investment, it will have been justified.

The time horizon for estimating the present value of the benefits should be kept relatively short because there is a reasonable probability that the information provided in *DMF* would have been delivered sometime in the not too distant future by a similar program. In addition the number of adopters and the degree to which they adopt will increase over time but the impact of the adoption is likely to degrade over time.

Interpreting the Required Benefit

The rule for accepting an investment is if the Benefit: Cost (B:C) ratio is greater than or equal to one at the required rate of return, or accept if NPV is equal to or greater than zero at the required discount rate, or accept if the IRR is equal to or greater than the required rate of return.

The present value of the required total benefits per participant (\$3,903 at 30% discount rate for DA funds, \$3,200 at 15%) or per adopter (\$7,746 at 30% discount rate for DA funds, \$6350 at 15%) can be envisaged as being achieved in many ways, over different numbers of years, with different rates of adoption. Therefore, depending on how many years into the future benefits are considered to be validly attributable to *DMF*, and the rate of adoption that might happen different annual sums will be required to accumulate the required total benefits.

One approach is to express the required benefit in different ways to assist appreciation of the magnitude of the figure and place it in better perspective. For instance:

Treating the costs as all occurring in Year One) and if all the benefits were to occur in Year One, each of the 2,500 participants would need to benefit on average by \$3,903 in Year One, or each of the 1,260 adopters would need to benefit by on average \$7,746 Year One.

Another situation would be where the benefits of the project are to be received over a medium term of say 3 years including Year One, because without *DMF* they would have made the change to their system anyway after three years. Treating the 1,260 farmers who have 'done something' as a result of the expenditures on *DMF* as the total of farmers who will benefit from *DMF*, and getting all the benefits they are to get from their actions over 3 years, a benefit profile of Year One \$4,000, Year Two \$3,000 and Year Three \$2,000 on average per adopter, converted to present value using a market rate of interest (8%), would sum to a present value of \$10m of industry benefit, as required to earn the necessary return for investments in R,D and E. Alternatively, an average benefit of \$3,000/adopter for each of three years from 2005 - 2007 would be enough to justify the investment. Counting benefits over a longer time period, or at a lower required rate of return, reduces the required annual benefits.

Would \$3,000 per year be achievable by improving pasture utilisation? There is no simple answer to this question because whole system changes affecting quantities and qualities of inputs and outputs are involved in changes to increase pasture utilisation. In some systems, say a medium-level performing system, one tonne dry matter (DM) increased pasture utilisation per hectare might add \$50 net profit/ha. after all the other related changes and extra costs are accounted for, i.e. 70- 80 tonnes extra DM

produced and utilised in the system could provide the required extra benefit. Maybe refinancing could save the equivalent of \$6,000 - \$8,000 over the life of the business? Would closer attention to purchasing decisions and overhead costs enable significant cost savings of the order identified? Would a decision to take up an investment opportunity – a decision in which *Taking Stock* has helped the adopter make – add \$6,000 - \$8,000 to their eventual wealth? Would better understanding of the whole business enable better decisions to be made during the next inevitable drought or market down-turn, to the extent of reducing costs that result by the equivalent of \$6,000 - \$8,000 in today's dollars? Would a better set of intergenerational transfer arrangements provide the required benefits? What if a better informed decision was made, say, not to adopt an innovation that would not have been appropriate or not to buy over-priced land that was tempting? There could be immense benefits from good decisions not to do something. There would be some cases in which the answer to each of these questions would be unequivocally 'Yes' – the issue then becomes 'but in how many cases and how much?' It is in these areas that any follow-up empirical studies need to focus their efforts if deemed necessary by industry.

The annual sum that some dairy farmers pay to professional private consultants is a good market indicator of the value of such advice e.g. can be \$3,000 - \$5,000 on an annual basis. The orders of magnitude of required annual benefit identified for the *Taking Stock* component of the *DMF* program is similar to such typical annual payments (note that the level of information provided in *Taking Stock* is introductory, but can be profound for this very reason, while the professional consultants are providing relatively sophisticated advice to the most sophisticated operators in the industry). The similarity between the fees typically paid annually to consultants by dairy farmers who use them, and the type of required benefits for *Taking Stock* adopters, gives good reason to think that the required benefits are realistically achievable.

Other potential benefits not counted include:

- gains from information from other *DMF* activities
- gain to processors from processing increased milk supply or reduced instability of milk supply. With elastic export demand for milk products, and competition for supply, much of such benefits end up with the producers.

- gains from increased utilisation of previously under-utilised (surplus capacity) advisory services
- gains to non-participants in *Taking Stock* acting under influence from actions of *Taking Stock* participants
- a continuing legacy of knowledge gained by deliverers participating in *Taking Stock*
- a potentially continuing legacy of closer collaboration among previously less collaborative service providers
- benefits that may accrue from the implementation of the *DMF* program, and the resulting information, playing a role in helping Dairy Australia subsequently manage better and make better R&D investment decisions.

To answer the question 'Has *DMF* been a good investment?' requires evidence of changes on farm, of the nature identified above. At the very least, valuable information would be about the key principles that have been taught – principles that are known to work well, such as principles of pasture measurement and grazing management that will result in increased pasture utilisation, and the extent to which these have been applied by adopters.

In the interim it is possible to form a judgement about the probability that farmers who say they have made a change to the way they run their system as a result of *Taking Stock* might benefit by around \$6,000 - \$8,000 in today's dollars from doing so (or, say \$3,000 p.a. over three years). On balance, such numbers seem reasonably realistically achievable. This judgement then needs to be considered in the light of other potential sources of benefits not quantified, but which are also reasonably possible. Overall, there is a good chance that the close to \$10m invested in *DMF* will show a return commensurate with the type of return that could be obtained from alternative uses of these public and private resources.

Conclusions

It will be some years before the benefits accruing for *DMF* can be properly valued. Even then it will be difficult to differentiate between the impact of *DMF* from the myriad of other influences that affect the decision making and actions of dairy farmers.

Nevertheless, the conclusion is that the public and industry investment in *DMF* is probably justifiable.

DMF has made information available to farmers who would otherwise have taken longer to adjust to changes in industry conditions. As such it has accelerated the adoption of improved techniques and systems and facilitated the exit from the industry of non-viable enterprises. Both these are positive private and social outcomes.

While it has not been possible to definitively quantify the value of *DMF*, the level of productivity improvement in dairy systems per participant required to justify the program is relatively low. For example this level of improvement could be achieved with slight increases in pasture production and utilisation or reductions in financing costs over the life of the business. Note also that there are sources of benefits not accounted for in this analysis, such as gains in processing efficiency by utilising surplus processing capacity with greater milk supply or greater stability of milk supply; or, increased use of any surplus advisory capacity in the industry, or gains attributable to *DMF* programs other than *Taking Stock*. To the extent these benefits exist, the required benefit per *Taking Stock* adopter or participant will be correspondingly less.

In large part the required gains per farmer involved in *Taking Stock* are relatively achievable in dairy systems in practice due to the hierarchical system of delivery used by *DMF*. By concentrating a large part of the programs resources on training the deliverers and then supporting their delivery activities, *DMF* has leveraged its outreach to overcome many dairy farmers' reluctance to "purchase" extension services.

It remains to be seen, but it is quite possible that one of the ancillary outcomes of *DMF* will be to accustom more dairy farmers to the use of private extension services and thereby have a long-lasting impact on dairy productivity. There may well be a legacy of improved standard of consulting services too.

References

- Alston J and Pardey P 1996, *Making Science Pay*, The AEI Press.
- Knight F 1921, *Risk, Uncertainty and Profit*, Houghton Mifflin, New York.
- Leibenstein H 1966, 'Allocative Efficiency vs X-Efficiency', *American Economic Review*. Reprinted in *Micro-economics, Selected Readings*, 3rd ed. by Mansfield, E., (ed.) Norton, New York.
- Mansfield E 1979, *Micro-economics: Theory and Application*, Norton, New York.
- Marsh SP and Pannell D 2000, 'Agricultural extension policy in Australia: the good, the bad and the misguided', *Australian Journal of Agricultural and Resource Economics*, 44: 605-627.
- Stigler GJ 1957, 'Perfect competition. historically contemplated', *Journal of Political Economy*. Reprinted in *Micro-economics, Selected Readings*, 3rd ed. by Mansfield, E., (ed.) Norton, New York.
- Stiglitz JE 2004, 'Information and the change in the paradigm in economics', Chapter 1 in Szenberg M and Ramrattan L, *New Frontiers in Economics*, Cambridge University Press.
- Tisdell CA 1972, *Microeconomics: The theory of economic allocation*, Wiley, Sydney.
- Watson AS 1992, *Review of field-based services in the Victorian Department of Agriculture*, Agmedia, Melbourne.

Appendix

Table 1: Costs – DMF³ (preliminary estimate – September 2005)

	2003-4 (Jan-June)	2004-5	2005-6 (July-Dec)	Total
Dairy Australia project funds	500,000	3,550,000	825,000	4,875,000
Dairy Australia staff time costs	79,918	160,795	88,877	329,589
Total DA Delivery Costs	579,918	3,710,795	913,877	5,204,589
Non Dairy Australia costs				
Management	38,767	38,767	34,384	111,918
Regional events, forums	91,000	91,000	36,000	218,000
Taking Stock	-	600,000	187,500	787,500
Taking Action (opportunity costs)				
WTTS	-	82,200	35,700	117,900
MG/Bonlac WTTS	-	15,000	81,000	96,000
Tas 20/12 project	-	-	87,750	87,750
WA Feeding Pasture For Profit	-	5,000	33,750	38,750
SA Focus Farms project	-	-	31,500	31,500
NIDG Feeding project	-	-	38,750	38,750
NSW Dairy Pathways project	-	-	-	-
Total Non-DA Delivery Costs	129,767	831,967	566,334	1,528,068
Total Costs	709,685	4,542,762	1,480,210	6,732,657
Present* Value of Costs (as at 10/2005)	1,221,891	6,938,330	1,571,474	9,731,695

* In this calculation to present value takes account of the opportunity cost of using the resources in other ways. The opportunity cost of DA funds is assumed to be 30% p.a.; all other opportunity costs are assumed to be 10% p.a., except for the time of government officials for whom an 8% opportunity cost applies.

Source: Pauline Brightling pers comm

Table 2: Unit Costs of DMF (adjusted to September 2005 values, 30% real opportunity cost of DA investment funds.

Cost per Adopter	
Dairy Australia	6,360
Non-Dairy Australia	1,386
Total Costs	7.746
Cost per Participant	
Dairy Australia	3,205
Non-Dairy Australia	698
Total Costs	3,903