

Accounting concepts relating to soil quality

**A study of broadacre dryland farming
in the Loddon Catchment.**

**A report for the Rural Industries Research
and Development Corporation**

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May 2000

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FOREWORD

Objective

This study addresses the RIRDC priority area of agricultural systems, in particular, information systems which are developed to monitor and report on farm accounting and the maintenance of the capital assets, the soil.

Accounting is expected to provide information on profitability and wealth, including wealth in the land. The mechanisms used are market prices in an accounting system consisting of gross profit, net profit, return on assets. These reports have been adopted by the Australian Government in their search for sustainability indicators.

Within this publication a number of impediments to the widespread use of traditional accounting are identified.

Background

Dryland farming in Australia produced grain, wool and meat worth \$8.3billion in export income in 1992 proving it is economically successful (the study was conducted in 1994-95). However, this production comes at a cost. Over \$1billion per year in lost production occurs through dryland salinity, soil acidification, soil structure decline, as well as nutrient loss with commodity removal (The Challenge 1994).

This situation exists in the Loddon catchment, an area which has been nominated as one of the five focal catchments for study in Australia. Accounting indicators that exist seem to be inappropriate for use by farmers when measuring wealth. There is little evidence of how farmers make their decisions regarding wealth, specifically the wealth in their soil quality.

This report provides evidence from a survey within which structured interviews were undertaken with seventy-five farmers and their spouses. The farmers provided information on their views and their financial and physical monitoring and recording practices in the High Level Riverine Floodplain land management unit of the Loddon Catchment in Victoria.

This report identifies and assesses the current status of the importance of accounting in decision making and the management of soil quality for the survey population.

Peter Core

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A special acknowledgment to Dawn McBride for her invaluable help and support during the implementation of the survey.

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Executive Summary

This study addresses the RIRDC priority area of agricultural systems, in particular, information systems used to monitor and report on the attitudes towards accounting and soil quality of dryland broadacre farmers in the Loddon Catchment, Victoria. The attitudes relate to the use of monitoring and accounting for activities and in particular the use of market prices to measure sustainable performance.

The mechanisms used to assess farmers by others are based on market prices and an accounting system which produces reports such as gross profit, net profit and return on assets. It is argued in this study that these measures provide information of a short-term nature principally about profits; whereas sustainable agriculture is primarily based on maintaining and increasing wealth over the long term. It was decided to test the usefulness of the market price accounting measures through an interview survey. The significance of this endeavour is based on the importance the Australian Government has placed on the choice of market prices and the use of financial indicators to measure a farm's sustainability.

At a physical level, the Loddon Catchment has been chosen because it was one of five focal catchments for study in Australia. The reason being that it is one of the areas prone to current and future salinity degradation.

The project commenced with a study of the literature. Previous research undertaken into land value and by implication soil quality indicated a reliance on economic principles and can be categorised under three headings; (1) market-based empirical studies, (2) theoretical economic studies, and (3) experimental agricultural economic studies. The assumption made in these studies is that the market needs to be informed of the value of land and then farmers could be informed. It is argued in this report that the market for soil quality cannot be fully informed using market prices and existing accounting reports, therefore the results of these other studies are inconclusive. One empirical study has demonstrated some movement in the market price when fully informed but extenuating circumstances existed. Experimental agricultural economic studies use gross margins, a short-term measure, limiting the usefulness of the results. Previous surveys concluded that farmers do not use the accounting recommended for them although a few researchers consider that farmers are being asked the wrong questions.

A questionnaire administered through interviews asked farmers a number of questions on the usefulness, to them, of market prices when monitoring their performance and when valuing their land. On the premise that farmers might not use market-price based accounting to monitor their soil quality, a model of soil quality was tested. The model incorporated the three attributes of soil, soil depth, soil fertility, and soil structure.

The survey conducted by the author is described, the most pertinent information being that the area was based on an ecological unit, the High Level Riverine Floodplain Land Management Unit in which all the farmers have similar physical and topographical characteristics. The aim was to identify commonalities and differences between farmers based on their management practices.

The results showed that these farmers owned farms that are above the average in size for Victoria which yields them above average earnings. Their monitoring shows an inverse relationship between financial accounting and physical monitoring and reporting. The assets of the farms are continually monitored in physical terms while financial accounting is used primarily for whole-of-farm reporting. The results indicate that these farmers have multiple objectives and they tend to rank wealth maintenance above income maintenance. In evidence of this, the most important factor in valuing land was soil quality and 91.7% ranked it as of great importance. Similarly, quality of product was ranked 1st in competition and the quality of product and soil quality showed a very strong positive correlation.

Recommendations

The results demonstrate that different participants in the agricultural industry require and use different information. The farm owners have a view of accounting and reports which differ from that adopted by or assumed by accountants and other external parties, including government advisors and accounting standard-setters. In effect a number of professional advisors of farm clients are providing information on one set of assumptions without accepting or perhaps even realising that farmers are thinking and making decisions under a different set of assumptions.

The findings also provide evidence to suggest that the current approaches adopted by the government in monitoring sustainability of broadacre farming in Australia are unlikely to

capture either the issues of importance of the information that farmers find relevant in managing and maintaining their soil quality. For accounting standard-setter, the study would suggest that the selling-price (market price) and views embedded in recent accounting standards is unlikely to generate useful information for decision making about broadacre farming, either for external users or for the farmers themselves.

There needs to be recognition of the limitations of financial indicators in that they represent short-term results. To correctly distinguish between sustainable and non-sustainable farmers involves the assessment of on-farm soil quality over the long-term and to acknowledge the external negative influences, particularly water quantity and quality, which is not wholly in the control of these farmers. Earlier recommendations to government have been overridden by the acceptance of financial indicators.

Reporting in 1993, the Australian Standing Committee on Agriculture and Resource Management (SCARM) identified a set of practical indicators which were defined as a composite set of measures or attributes which embody a particular aspect of agriculture. The indicators chosen were, (1) Long-term real net farm income, (2) Land-water quality to sustain production, (3) Managerial skills, and (4) Off-site environmental impacts (SCARM 1993, p.48) These indicators more closely resembles how the survey farmers viewed their farms over the long term. Of particular importance is that there should be a willingness, over the long-term, to understand how the off-farm and on-farm activities and practices interact with each other. In particular not all problems in dryland farming in the Loddon Catchment are caused by the farmers themselves. Infrastructure decisions and water diversion decisions are causing increasingly unmanageable problems for these farmers. Off-farm activities were not a formal part of the survey but emerged from the analysis of the data. They are also not a formal part of this report but any changes in the policies directed towards soil quality would not be effective without taking into consideration outside influences which have on-farm consequences.

1. Introduction

The Australian government has been influential in guiding research and industry policy towards sustainable agriculture. Briefly their major platforms have been; (1) the 'whole of society' policy whereby benefits must be seen to go to society while the costs are largely borne by the farmer. The rationale for this is that farmers either make a profit or sell; (2) the exclusion of research into soil quality at the farm level because of the requirement that monitoring of resources must take place 'outside the farm gate'; (3) the use of financial indicators to measure a farm's sustainability; and (4) the choice of market prices to measure natural resources. This report will concentrate on the latter two platforms in their relation to how farmers use financial indicators, market prices, and accounting when making decisions on their financial status and their soil quality.

Little public information is available about one group of participants, the farmers themselves. To obtain first-hand knowledge the author conducted an interview survey with dryland broadacre farmers in the Loddon Catchment. The indicators advocated by government and agriculturalists are gross margin, net margin, and return on investment all based on market prices (Walker and Reuter 1996). These indicators, developed for the manufacturing sector, may not be appropriate for managing long term, complex resources such as soil. As a result of the survey the role which accounting plays in providing useful information to decision makers is questioned. Soils, and soil quality in particular, are major elements in determining land value, yet, potential buyers and other decision makers, particularly policy makers, make decisions concerning soil quality on the basis of incomplete and often misleading information. In addition, increasing inputs or changing technology can give the market a significant profit signal (Dumsday and Chisholm 1990), but not a wealth signal.

The results show that farmers do not use market prices in assessing their financial status or the status of their soil. It is proposed that a major reason is due to the fact that different participants in the agricultural industry require and use different information.

This report is arranged in two parts. The first part will briefly discuss the general direction other research has taken in the search for market prices. This is then compared with the result of the survey in the Loddon Catchment. The second part will discuss another stream of accounting in which non financial indicators are used to assess value and quality and

again this is compared with what the farmers do to monitor their soil quality. Again, the results indicate that market prices and financial indicators are not the most valuable tools.

1.1 Market Prices

Economists, governments, policy makers and accounting standard setters have accepted that market price can represent the value of natural resource assets. There is the proposition in the theoretical agriculture economics literature that the capital value of land rests on the quality of the soil itself. This is true, but it was found in this study that market prices are an imperfect surrogate for land value and the quality of soil when the market is not fully informed.

One problem in the search for market prices for resources such as soil quality is the use of on-farm resources. These resources, particularly land are not traded, neither the land nor the intellectual capital accumulated over time. Value and quality are not necessarily measured using market prices especially if the best land is not sold. This problem has not been satisfactorily solved by accountants over the past forty years and the special case of agriculture could make this task even more problematic.

The only public data, apart from production figures, are the accountings prepared by farmers for taxation returns and government surveys such as ABS and ABARE. These accountings do not capture, record, measure or report the quality, or changes in quality of the land itself, except at historical cost in the balance sheet.

The research undertaken into land value based on economic principles can be categorised under three headings, namely, market-based empirical studies, theoretical economic studies, and experimental agricultural economic studies.

Market-based theoretical economic studies seek to inform the market of soil quality through the market price. However, one limitation noted is that in an imperfect market any difference in productivity among parcels due to soil problems can be masked by differences in technology and management, especially in the use of non-land inputs such as fertilizers (Gardner and Barrows 1985, p.945).

As reported in the literature, market-based studies have been undertaken on the premise that the market needed to be informed and market prices were the least-cost way in which to achieve this. At least since 1990 market prices and financial indicators have been explicitly

linked also to land degradation on the assumption that if the market price of agricultural land was more sensitive to soil degradation and its effect on productivity, it would increase the economic incentive for farmers to adopt conservative soil management practices (Geeves, G.W., Ringrose-Voase, A. J., Merry, R. H., Chartres, C. J., 1995, p.4).

What the above statement implies is that farmers need market prices to be pro-active, but, in fact, what individual farmers are doing on their land is not known because there have not been any in-depth surveys undertaken. The conclusions from the study reported in this paper do not support these assumptions about market information.

Empirical studies on soil quality have been used to determine the extent to which the market capitalizes any conservation measures undertaken to improve or maintain soil quality. The results are mixed. In Australia, Sinden and King (1990) made a study of gully erosion in a local council region in New South Wales. They showed that the market price changed as a result of investment in soil conservation. For every \$1 spent on conservation the land value increased by \$2.28. In the Sinden and King study there were extenuating circumstances. The government had spent a considerable amount on both advertising the project as well as providing generous grants to farmers. In addition, the land degradation consisted of gully erosion, a very visible form of degradation.

Experimental agricultural economic studies concentrated on input/output relationships measured by the change in the gross margin. This methodology is common to most studies whether they are assessing traditional or organic farming (Klonsky 1992, Oram et al 1991, Wynen 1989). In these studies an evaluation of fertility was the decision objective and this was obtained by using the traditional breakdown of costs between direct costs and overheads to arrive at the gross marginⁱ when comparing conventional and organic systems of farming. The cost of the product was arrived at by apportioning the overheads equally between all products in the manner of manufacturing costing systems. Assumptions were made that capacity costs, or fixed costs, were similar between farms in the same industry.

Many researchers now consider that this type of costing, and the expansionary policies of government has created a neglect of long-run productivity amongst farmers, a method easily encouraged by a short-term emphasis on gross margins where overheads and capital are excluded from the calculations. In addition, the evaluation of farming operations, the profitability, is based on short-term profits whereas soil quality is a long-term factor in farming decisions.

Previous surveys on farm accounting using mailed questionnaires indicate that farmers do not use recommended accounting packages for decision making (Stephens 1992, Lees and Reeve 1991, Luke 1992) with a minority of writers claiming that the farmers are not being asked the correct questions (Malcolm 1988, Schnitky and Sonka 1986). This raises the question of what attributes should be studied, what attributes the farmers do use, and the attributes which would be amenable to measurement in maintaining soil quality.

The gap in the literature, therefore, is information on farmer decision-making and the role that market prices do play in the accounting used by farmers and the maintenance of land and soil quality.

1.2 Soil Quality

To date, soil quality itself has been given an implicit valuation through the use of market prices. Theoretical economic studies have attempted to measure the terminal (sale) value of land as a result of farming methods. Models were developed that identified the attributes of soil quality as being soil depth and soil fertility. McConnell (1983) added soil structure to these models. From this, Milham (1994) developed a model of soil quality as capital maintenance that incorporated the three attributes of soil. The contribution of each variable was calculated after the addition of inputs, farming techniques and uncertainty. In the Milham model these qualities would then be capitalized in the land value leading to a decision to keep or sell the land. However, these models have had no empirical backing to date. These matters were tested in the survey.

2. OBJECTIVES

Given the current state of knowledge, this was a descriptive study undertaken in order to describe farmers' attitudes and practices towards accounting and their soil quality. The primary objective was to try and detect what farmers find decision-useful in the management of their wealth, not merely their profits. This was achieved in two ways; (1) asking the farmers to what extent they used accounting for their decision-making, and (2) what they did to maintain their soil quality. These were achieved and described in Sections 3 and 4 of this report.

A second objective was to test the use of market prices by these farmers. The use of market prices has produced inconclusive results in studies and the extensive normative models which use market prices have had no empirical testing. Thus in this report, the relevance of

market prices to the survey farmers was tested together with the relevance of non-financial indicators. This was achieved and discussed in Section 4 also.

A third objective was to determine the survey group based on an ecological unit in which all the farmers have similar physical and topographical characteristics. The aim was to identify commonalities and differences between farmers based more on their management practices. This is in contrast to studies that are based on industrial or political boundaries. This was achieved and discussed in Section 3 of this report.

3. METHODOLOGY

In 1994-95 seventy-five broadacre farmers and their spouses were interviewed in the Loddon Catchment. The interviews consisted of structured interviews with the families. The questions covered the accounting used by the farmers, both financial and management, and their activities in relation to their soil quality using the three attributes of soil depth, soil fertility and soil structure.

3.1 Selection of The Area to be Studied

The Loddon catchment is part of the North-Central region of Victoria and comprises one and half million hectares of land, situated between the northern foothills of the Great Dividing Range and the irrigation districts of northern Victoria. Cropping and sheep for wool and meat production are the major broadacre farming enterprises in the region (Kennelly 1996, p.1). The area supports approximately 1200 commercial farms, primarily managed for wool, beef, fat lambs and grain production, with potatoes grown in the upper catchment areas. Wool production is the major enterprise accounting for 47% of the gross value of agricultural production, which was calculated to be \$103 million in 1988/89 (ABS Agricultural Census for 1993-94, LCSMP 1992 P. x, 3, Appendix 1 for a map of the study area).

Each catchment in Victoria has been divided into Land Management Units (LMU) (LCSMP 1992, p. 48, 117) to provide the basis for the government in evaluating salinity control options in the catchment. These units group together areas with similar groundwater, salinity features, geology, physiography, soils and land use. This conforms more to an

ecological management unit rather than a political management unit such as a shire. The Loddon Catchment has been divided into twelve Land Management Units (LMUs)

The area chosen for this study is the High Level Riverine Flood Plain (HLRF). This choice was made because it was considered a major location for commercial broadacre farming in the one land management unit, and it was economically important in that it provided forty percent of the agricultural production for the whole Loddon Catchment.

3.2 Selection of Respondents

One of the variables identified to be tested was the value of diversification, thus, some farming businesses, such as irrigation farming, horticulture, dairying, vineyards and hobby farms were excluded. For the remaining area of the High Level Riverine Floodplain most farms were operated as a mixture of sheep and cropping broadacre farms. There were no public data on the number of viable broadacre farmers in the study area, therefore, a process of identification was undertaken to develop a comprehensive list.

The High Level Riverine Floodplain comprises 31% of the Loddon catchment, therefore, of the 1200 commercially viable farms in the Loddon Catchment, 400 farms could be attributed to the HLRF. The 1992 Census of Agriculture, which is collected on a Collection District basis for the four relevant Shires, namely, Korong, East Loddon, Bet Bet and Marong provides the smallest collection basis. Their statistics include cropping and livestock data collected in the annual Agricultural Census from establishments undertaking agricultural activity.

In Bendigo Victoria, a government funded research project, The Centre for Land Protection Research and Farm Advance undertook a study of farms that were known to use a farm management workbook, Farm Smartⁱⁱ. Using Australian Bureau of Statistics figures and the criteria of \$100,000 minimum turnover, they claimed that only 20% of the broadacre farms in the Farm Smart area were of an economic size. The remaining 80% were considered uneconomic and were probably managed as hobby farms with the bulk of income being derived from off-farm activities. Thus the Centre for Land Protection and Farm Advance believed there may only be as few as 500 viable broadacre farms in the entire area covered by Farm Smart. This provided a guideline for the potential number of broadacre farms in the High Level Riverine Floodplain as between 200 and 300 farms. The map of the HLRF was

superimposed on the relevant Collection District maps to delineate the ecological area rather than a political or industry area.

3.3 Survey Farmers

The resulting area was then superimposed on Country Fire Authority maps that show the location and name of the property holder of every building for rural Victoria. Maps number twenty and twenty-two indicated the total number of farms to be 1505. Subtractions were made for consolidation of family holdings, farms smaller than 1000 acres, piggeries, sheds, hobby farms and irrigation farms. The initial possible population was 251 farms (see Table 1).

Table 1 Total Possible Number of Farms to be Interviewed

Initial Population	251
Less adjusted population to take out repetition and multiple farms managed as one business to determine similar units	<u>58</u>
Contacted all 193 farmers. Contact response rate was 100%	193
Less Adjustment for wrong criteria not as described	<u>38</u>
Possible total to be interviewed	155

The services of Farm Advance were employed by the researcher to undertake a farmer survey to identify every nominated building in the area (Farm Advance 1994). The results of this investigation were then compared with ABS (1992) figures and the profile of the members of Farm Advance and are shown in Table 2.

Table 2 Validation of Sample Size

Size (acres)	Total Catchment > 1000 acres	No. of farms %	Total Survey 1000 acres	No. of farms > %	Total Advance acres	No. of farms > 1000 %
1000 – 1999		579 68		39 50		42
2000 – 3999		222 26		22 32		27
4000 – 5999		39 5		8 12		3
6000+		<u>17</u> 2		<u>4</u> 6		3
Total Number		857		73 *		750

Source ABS 1992, Farm Advance Membership Records 1993.

* Two interviews could not be processed.

4. Results

At the interviews, it was then possible to determine several important variables. These were: (1) the size of each farm; (2) the type and scale of production between cropping, grazing or both; (3) the type of business organisation under which each farm operated. In summary, 98% of farms were above the average in size for the Loddon and above what is considered sufficient for commercial viability. The predominant type of farming is wool but with all farmers using diversification as a form of risk management. Legally these are family farms organised as partnerships and proprietorship, with companies being a small minority.

4.1 Physical Dimensions

In the survey area, of the total property size, land owned is 173,739 acres (90.8%), and land leased is 17,454 acres (9.20%). The major farming activity is sheep grazing (148,761 sheep), and some cattle grazing (6,804 cattle). Total area of land that was cropped in 1993/94 was 48,920 acres (25.50%). A good proportion of this cropping was either for fodder or as a supplementary form of income. Of the grains, 20% is kept and 80% is sold because it is dryland cropping. The total area of land in the survey that was used for grazing

in 1993/94 was 131,949 acres or 69.00%, and the number of acres under pasture was 124,401 acres or 94.20% of the acres used for grazing. Of the acres under pasture (124,401 acres) 15,092 comprised native grasses or 12.10%.

To verify that the survey area was representative and a meaningful study area, a comparison was made for the same year 1993-94 between the survey area, ABARE figures for the Loddon-Campaspe catchments (ABARE's smallest collection area) and Victoria. The results are shown in Table 3:

Table 3 Average Property Size

		n=72	n=54	n=131
Average Property Size in Acres	Survey Acres	Area	ABARE Loddon-Campaspe Acres	Victoria Acres
Mean		2655	1418	2215
Range		1000-9000	N/a	N/a

What can be noted in Table 3 is the diversity in size indicated by the range, 1000 to 9000 acres. The size of areas cropped, grazed, owned and leased indicate commercially viable farm businesses, and a security of tenure evidenced in the comparison between the areas owned and leased. According to these farmers diversity gives them the choice of cropping or grazing which may be one reason for the small number of acres not farmed. These different measures could also indicate diversity in efficiency measures that are dependent on location, that is, place in the sub-catchment, rainfall, and soil characteristics. However, the data in Tables 3 and 4 verify that the survey farms are representative of the larger farms in the region and commercially viable.

Table 4 Dimensions of Farmed Area Compared with ABARE and Victoria for the Years 1993-94

	n=72	n=54	n=131	
Area	Operated	Survey Area	ABARE	Victoria
Acres		%	Loddon-Campaspe	%
			%	
=/< 1500		29.2	51.3	33.4
>1500<2000		20.8	35.4	35.2
>2000<3000		28.0	11.1	17.2
>3000		22.0	2.1	14.3
Av. Area Grazed				
Mean		1832	n/a	n/a
Av. Area Cropped				
Mean		679.4	256.0	947.0

ABARE Census figures for 1993-94

What can be concluded from these figures is that the survey reflects the results for the whole population in the statistical region of Loddon-Campaspe Catchment.

The financial results for the survey year were also provided to the researcher the results of which are not the subject of this report; however, what can be said is that the average earnings for the farmers was \$135,000 which is above the average reported by government and other studies.

4.2 The Use of Market-Based Accounting Reports

4.2.1 Recording and Monitoring

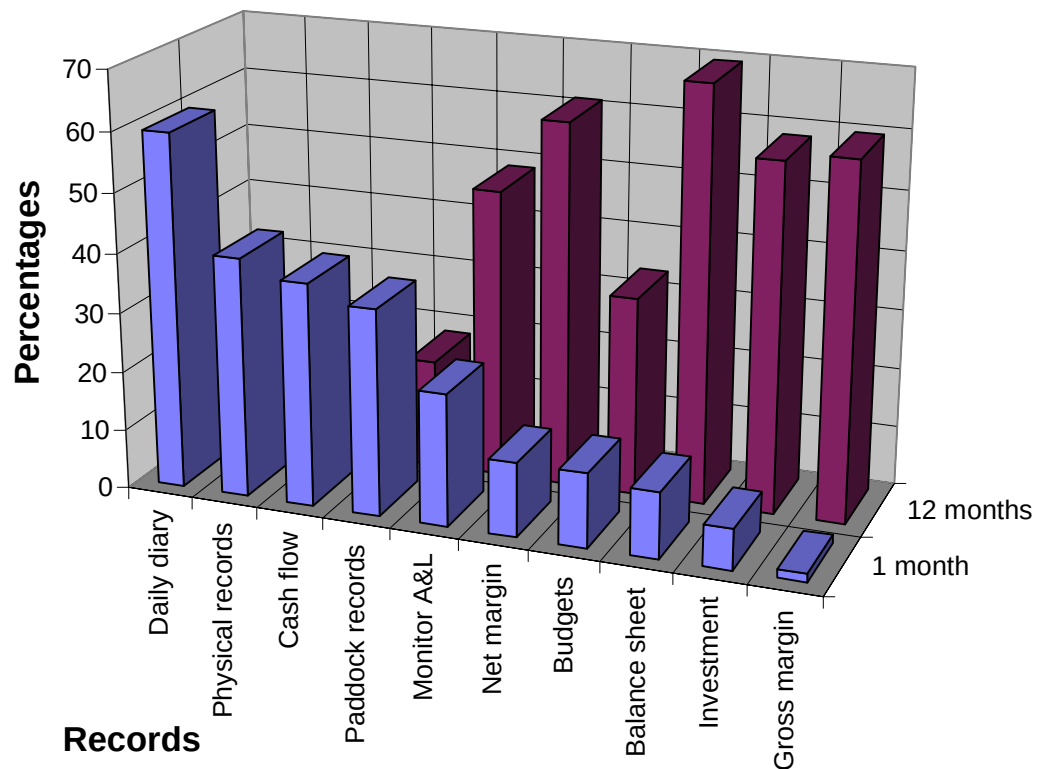
Market-based accounting reports, called financial accounting, provide transactions-based information for gross margins, net margins, return on assets and balance sheets. The farmers were asked to choose from a representative list of accounting recommended by agriculturalists. The results indicate that financial accounting is used for 'whole farm' profit and loss reporting predominantly at year's end. What information the farmers find important and monitor at least once a month compared with every twelve months is detailed in Table 5 and represented graphically in Figure 1. What the Table 5 shows is that cash-flow monitoring is undertaken by 37.5% of the farmers every month, compared with 12.5% for the net margin, 11.1% for balance sheets and 1.4% for gross margins

Table 5 Frequency of Record Keeping Comparing One Month and Twelve Months**

n=72

Activity	1 month%	12 months%
Daily diary	59.7	
Physical records	40.3	12.5
Cash flow	37.5	25.0
Paddock records	34.7	18.1
Monitor assets & liabilities	22.2	48.6
Net margin	12.5	61.1
Budgets	12.5	33.3
Balance sheet	11.1	69.4
Capital improvements	6.9	58.3
Gross margin per paddock	1.4	59.7

Figure 1 Frequency of Record Keeping Comparing One Month and Twelve Months



It would seem from the results that the farmers do not use formal accounting for decision making on quality issues. This is in direct contrast with experimental studies in the literature on sustainable agriculture. These other studies allocate overheads to obtain the full cost of production where all decisions were based on market traded resources. It appears that assessments of both positive and negative results by those outside the farm are assessed by gross margin multiplied by production gain or loss in monetary terms. The farmers were also able to do this but this is after the event. The above results indicate considerable planning and monitoring.

The results indicate that the assets of the farm are continually monitored in physical terms. Four types of physical monitoring are undertaken by between 59.7% and 22.2% of the

farmers daily and monthly. In contrast, financial monitoring during the same period is undertaken by between 12.5% and 1.4% of the farmers. Once every twelve months between 33.3% and 69.4% of the farmers record financial data and reports, many of them in preparation for taxation reports.

In evidence of this, the question on monitoring based on physical data generated an extensive range of claims (Table 6). At least once a month, 59.7% of the respondents kept a daily diary, 34.7% kept paddock records, 40.3% kept physical records, and 22.2% monitored assets and liabilities but not necessarily in financial terms. These claims show that they consider, and monitor very carefully, cash flow and the physical quality of their land and product.

Table 6 Monitoring Financial and Physical Attributes per Month

n=72

Financial Decision Making per Month - %		Physical Decision Making per Month - %	
Budgets	12.5	Physical records	40.3
Cash flow	37.5	50.0 Paddock records	34.7
Net margin	12.5	Daily diary	59.7
Gross margin	1.4	Assets & liabilities	22.2

The findings of previous studies (Stephens 1992, Luke 1992) which found that farmers made little use of financial management may be correct but their conclusions cannot be supported. In this survey the farmers undertake a comprehensive range of management records based on activities and quality issues. The farmers do not use a uniform or formal way of accounting for management purposes. They do not use the traditional industrial costing system, which includes gross margins and allocated overheads presumably because their businesses are too complex. This supports the findings of Schnitkey and Sonka (1986).

The majority of farmers, who stated that they are not using the financial information which agriculturalists recommend, were asked what they do use to monitor financial decisions (Table 6). Once a month, 50% of the respondents undertook budgets and cash-flow analysis. In most instances, the farmers made use of columnar cash books and they provided a fairly detailed breakdown of individual categories. Many of these were shown to the interviewer and in most cases they were business entries; not housekeeping books. These were also kept for many years in support of the trends in costs and prices of produce. In summary, cash flow management is the prime financial task for the farmers.

Overall, there is an inverse relationship between financial accounting and physical monitoring and reporting which indicates a decided emphasis given to the planning and decision-making stages of management. Financial accounting, on the other hand, is about reporting on the past. As in other complex market environments, it would not be decision-useful to calculate full cost if price-taking dominates the industry. This is especially true of agricultural products. Many resources on farms are not traded, in particular good land, therefore it is unlikely that the cost of products reflect the full cost of resources used. This is still not an argument for market prices or surrogates for individual farmers as they would not find it worthwhile on a cost-benefit basis. These problems are being faced in manufacturing industries by the introduction of activity-based accounting whereby activities are traced throughout the organisation with monitoring of quality, waste and cost savings. This was also a major motivation for the methodology used in the study reported in this report.

A tentative conclusion can be made that the farmers respond when the focus is technical and they consider that the information comes from the appropriate technical person. This was shown in the results of a soil program 'Soil Care' which was conducted in the North-Central Region of Victoria over four years from 1989 to 1992. The results indicate that farmers respond when programs are couched in physical terms and in particular practices relating to the care of their soil. Thirty-three (41%) of the farmers in that program reported that the program increased their awareness of better soil management (Bendigo Advertiser 1993).

4.2.2 Annual Objectives

The evidence in Figure 1 and Tables 4 - 6, suggests they do not see the need to record market prices formally. Throughout the year, except at sale, prices are no more accurate than the reported market prices for stocks and shares. Which price should be used on any one day? The highest or lowest or the weighted average? In essence these prices are only as good as historical cost and not useful for predictions and for making decisions about the future.

Decision-usefulness for these farmers is achieved by constantly monitoring market prices and non-market on-farm resources in a changing mix of products in their crop rotation and diversification programs. There is already a well-developed daily commodity market reported in the media of which all the farmers avail themselves. The farmers were asked to rank four possible annual objectives namely, maximise short-term profits, maximise annual cash flows, obtain long-term profitability and do what is best for each paddock. Tables 7 and 8 show the results in two different ways and in each case “doing what is best for each paddock” ranked the highest.

Table 7 Achievements of Importance in Each Year (a)

Information Set	Resp. Mean	Std. Devn.	Media n	Mode
Do what is best for each paddock over time	1.1	.387	1.0	1.0
Long-term profitability	1.2	.587	1.0	1.0
Maximise annual cash flow	1.7	.872	2.0	1.0
Maximise short-term profits	2.2	.909	2.0	2.0

Legend: 1 - Great, 2 - Some, 3 - Little, 4 - None.

Although the farmers wanted to achieve both short-term and long-term success, 32% (Table 8), were willing to forego short-term profits in preference to cash flow and long-term profitability, while everybody wanted to do what is best for each paddock over time.

Overall, the farmers aimed to protect their liquidity and asset base in the short-term indicating a preference for protecting their wealth and that does not depend on current market prices.

Table 8 Achievements of Importance in Each Year (b)

n=72

Attribute	Great Importance %	Little or No Importance %
Do what is best for each paddock over time	100.0	0
Long term profitability	94.4	5.6
Maximise annual cash flow	83.3	16.7
Maximise short term profits	68.0	32.0

Legend: 1 - Great, 2 - Some, 3 - Little, 4 - No Importance, 5.

These figures indicate that these farmers recognise they have multiple objectives but they tend to rank wealth maintenance above income maintenance. Short-term profits are not the most important which would be a rational response to the cyclical business they are in. Therefore, short-term financial indicators will not necessarily provide the appropriate information.

4.2.3 Importance of Market Prices In Valuing Land

Table 9 provides a very clear indication of the level of importance of market prices when valuing land. From a list of twelve attributes of importance when valuing land the respondents ranked price of products eighth, and market value of land tenth.

Similarly, return on investment and return on assets showed mixed and interesting results. In Table 9, the farmers ranked return on capital as 5th out of 12 factors offered. It must be surmised that given the responses to the measurement of income and assets, they would be referring to a general objective and notion of a return on capital, because they would not be

keeping sufficient records to calculate a return on investment or return on assets. Gross margin for a paddock was last, or 12th.

The most important factor in valuing land was soil quality, ranked 1st, where 91.7% ranked soil quality as of great importance or very important. In evidence of this, when asked about the factors of importance in competitiveness, quality of product was ranked 1st: Every respondent ranked this as of the greatest or some importance. In the views of the farmers, quality of product and soil quality have a very strong positive relationship.

Table 9 Most Important Factors in Valuing Land

n=69

Attribute	Rank	Attribute	Rank
Financial and Physical Factors			
Soil quality	1	Profit over a five year period	7
Access to water	2	Price of products	8
Annual cash flow	3	Capital improvements	9
Total production	4	Market value of land	10
Return on capital	5	Changes in yield	11
Disposable income	6	Gross margin for a paddock	12

4.3 Soil Quality Model

As an overriding objective, the farmers do not measure their success by measuring annual returns based on productivity measures such as volume or value, but indicate that they try to do what is best for each paddock over time. If market prices could not describe what or how the farmers tried to maintain their soil quality then another method had to be found. A “set of information” concept using the ideas from Activity Based Costing was chosen in this study.

There has been debate in the accounting literature since the 1960's as to the limitations of financial reporting in determining a "true" income, and in "maintaining operating (productive) capacity". Several measures have been proposed, including concepts and measurements encapsulated in a 'set of information' particularly for assets which are location specific (Tweedie and Whittington 1984, p.12). This approach seemed to be appropriate in the farming context. Such suggestions range from the reporting of two figures, trend net income, trend measure of physical properties (Mattessich 1991), to cash flow as the most direct measurement of both the short-term and long-term results of decisions (Ijiri 1978, Mathews in Clift and Kerr 1989, p.17)ⁱⁱⁱ. All of these measure different properties but physical properties are most directly related to soil quality.

This notion of a 'set of information' can conform to a wealth view. This connection was made on the basis that economic events encompass transactions plus changes within the organisation that do not have market values. These ideas were incorporated into the section of the survey questionnaire on soil quality in physical terms. The concept of productive capacity is tested through the physical activities and farming techniques relating to soil quality undertaken by each farmer. The soil quality model used in the survey is based on measuring some readily recognisable and definable objects. For instance, soil loss can be measured with every crop^{iv}. Soil itself is also one of the variables which is capable of precise measurement. Farmers must manage sets of variables within an uncertain risk profile; they work with a range of probabilities within a range over both the short and long term.

The above discussion does not imply that the farmers can be assessed in this report as to their absolute level of soil quality. In order to decide this issue, it would be necessary to obtain knowledge of the quantity and cost of inputs vis-a-vis output. What can be shown from this study is the preferred way in which these farmers manage their soil quality. It can only be shown if the farmers understand and prefer to make decisions using physical monitoring for management decisions, and whether or not they have very clear ideas of the productive capacity of their soil.

The farmers were asked the following questions for each attribute of soil quality that is, for their soil depth, soil fertility and soil structure.

- (1) Do you have problems with soil depth (fertility, structure)?
- (2) What are the causes of the problem?
- (3) What problems does this create for you?
- (4) What have you done to avoid/alleviate this problem?

Responses to these questions are discussed in the following section. As an overall statement, the farmers responded very definitely and clearly to the idea of three attributes of soil being managed separately. Farmers who said that they had problems responded as follows: soil depth 20.8%, fertility 20.8%, and structure 52.8%.

4.3.1 Causes and Problems with Loss of Topsoil

Of the 20.8% of farmers who reported problems with loss of soil depth, results from the data show clearly two types of problem for the farmers, loss of topsoil from cultivation for weed control (53.3%) and in preparation for planting (53.3%); and run off and increased flooding (73.3%). All farmers were asked what they did to alleviate or avoid soil depth problems and the results are given below:

Table 10 Activities Undertaken to Avoid and/or Alleviate problems with Loss of Soil Depth over the past five years on average. (Please tick one or more boxes)

n=72

Activities	%
Changed cultivation to minimum tillage	80.6
Changed method of weed control	80.6
Substitute other inputs	77.8
Tree planting for wind breaks/regeneration	70.8
Use of fallow (growing wheat, chemical fallow)	34.7

One unexpected and interesting outcome of the use of the soil quality model was the emergence of trade-offs and this highlighted the dilemmas faced by the farmers and their preferred responses.

4.3.2 Causes and Problems with Loss of Fertility

One aspect which became clear in the section on fertility was that the increased use of chemicals did not enhance fertility of the soil and therefore the product, and this was a concern for the farmers. More importantly, they understood and acted upon these concerns.

Of the 20.0% of farmers who reported they had problems with loss of soil fertility, results from the data show clearly that cultivation for planting was given by 47.0%, stubble burning 47.0% and cultivation for weed control 40.0%. Maintaining yield by increasing use of sprays and fertilizers were reported by 27.0%. Using correlations it was shown that according to these farmers a problem with fertility had a strong statistical relationship with increasing fertilisers ($r = .74$), increasing herbicides ($r = .64$) and these lowered the quality of the product ($r = .69$).

The results indicate that in the minds of these farmers both soil depth loss and soil fertility problems are related to their cultivation practices, and to a lesser extent to the increasing use of inputs.

4.3.3 Causes and Problems with Loss of Soil Structure

Of the 53.0% of farmers who reported they had problems with loss of soil structure, results from the data show clearly in the chart below the causes and the problems they create:

Table 11 Causes of Loss of Soil Structure and Problems they Create for the Farmers

Causes n=38	%	Problems	%
Multiple cultivations for weed control	66.0	Water logging as capillary action reduced	90.0
Cultivation in preparation for planting	66.0	Lower production per acre	87.0
Stubble burning	45.0	Breakdown of soil	69.0
Fallow	37.0	Wind erosion	47.5
Water damage	24.0	Compaction and extra costs	37.0
Laser levelling/drains	8.0		

The results indicate that in the minds of these farmers cultivation practices are a key factor that causes problems with loss of soil structure which then has a flow-on effect to production losses.

**Table 12 Activities Undertaken to Avoid and/or Alleviate problems with
Loss of Soil Structure over the past five years on average
(Please tick one or more boxes)**

n=72

Activities	%
Sowing pastures**	90.3
Crop rotation**	80.6
Changed cultivation to minimum tillage	77.8
Changed method of weed control	73.6
Better use of water**	62.5
Stubble retention**	59.7
Increased use of inputs	56.9
Other (Lost yield in early years of changeover, mulch, bank overdraft, agronomist, machinery purchase/modified, changed to minimal fertiliser, drains, vermin treatment) *, **	54.2
Direct drilling**	44.4
Gypsum	43.1
Taken a longer view of the returns **	38.9
Soil/water testing**	30.6

* Indicates diversity

** Attributes of conservation farming

In undertaking this survey it was expected that there would be many variables which are equally important in the management of soil, and that the gross margins and net margins would not provide relevant information for farmers or provide significant information on soil quality. Table 12 confirms this expectation, not only are there multiple variables such as the combination of soil/water testing, direct drilling and better use of water but also trade-offs. For activities relating to minimum tillage, soil/water testing and direct drilling there

was a significant positive correlation with both increased inputs and changed method of weed control indicating again the trade-off involved in many of these decisions. On a more particular investigation, when the relationship between levels of awareness of activities relating to the better use of water alone with increased inputs and weed control, we find that there is not a significant positive correlation between better use of water variable and increased inputs variable, and between the better use of water variable and changed method of weed control. This result indicates that there are two groups of farmers; those who practise conservation farming and minimise inputs, and those who use chemical solutions in response to their soil problems.

5. Discussion

The following relationships were expected and confirmed. That the farmers are able to gauge the effect of internal and external activities specifically in relation to soil depth, soil fertility and soil structure. This management of complexity has implications for the type of assessment used about farmers' behaviour. If reports are for users in order to make decisions about economic events then this implies reporting on transactions, but just as importantly on other non-traded events including non-monetary measures (Staubus 1961, Goldberg 1965, p.226).

Those outside the farm use financial data because of its seeming visibility and comparability. In contrast, when valuing land, of the twelve attributes offered to the farmers, price of products ranked 8th, market price of land ranked 10th, and gross margin for a paddock ranked 12th or last. Soil quality (which they linked directly to quality of product) and access to water were ranked first and second. Market prices, however, are particularly important to the farmers in certain areas, although not formally recorded. The marketing strategies display a wide ranging scanning of market prices being undertaken by the farmers.

They do use daily commodity markets for price changes. Market prices are monitored continuously in order to make decisions on buying or selling. They do not specifically measure their success by their productivity in the short term but conduct their business from

a long-term point of view. Their accounting and attitude towards reporting has a distinct emphasis on ownership and protection of their capital.

Accounting is one of the main mechanisms for collecting and reporting information at the farm level, but it is little understood by those outside the accounting discipline and even by some within the profession that neither long-term income nor changes in wealth can be reported using current accounting practice. To maintain long-term profits requires the maintenance of wealth over several periods, and this is not represented by annual profit and loss principles or in the balance sheet because there are no agreed approaches to reporting assets in use.

One reason could be that they do not risk the ownership in their land. In evidence of this, 82.1% of the farmers owed less than 20% in long-term debt as a percentage of the capital value of their land. Answers to questions on land value, competition, marketing and the future, strengthen the ownership interest.

Market prices may not be the best 'least cost' option for the government, because there are many non-market uses of resources. There is so little control of prices by farmers and government that they do not reflect any underlying values to the owner. A tentative conclusion offered is that what the farmers do for their soil quality and productive capacity cannot be assessed through the use of the financial indicators which rely solely on market prices. They do not reflect individual circumstances and have no meaning for the farmers in technical terms.

Economists see the problem as being one of market failure. However, a continuing emphasis on productivity measured by gross margin and other short-term accounting measures such as return on investment, coupled with market prices, may not achieve any of the changes they have in mind. Without further consideration of the quality of the land itself, this method of accounting can hide the effects of soil depletion. The differences between short term and long term in principle, are being recognised but little connection is being made with the signals that accounting reports give to those outside the firm, and to some inside the firm.

The evidence shows that these farmers don't use market-price based financial accounting and then only when they are preparing their tax returns and for 'whole farm' profits. They do use market prices as an on-going basis for management planning but not for financial accounting reporting. These farmers have readily available and unique information on which to base the management of their soil quality. The overwhelming number are very aware of their soil quality regardless of whether or not they are 'good' or 'bad' farmers. They are aware of whether their soil quality is better or worse than the area average but in general they compete against themselves to improve the quality of their product predominantly through the quality of their soil.

One unexpected and interesting outcome of the use of the soil quality model was the emergence of trade-offs and this highlighted the dilemmas faced by the farmers and their preferred responses. The results from the questions on soil structure in particular, indicates that there are two groups of farmers; conservationists, those who practise conservation farming and minimise inputs, and high tech farmers, those who use chemical solutions in response to their soil problems. Further analysis needs to be undertaken to delineate more precisely in which group each farmer belongs.

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ⁱ This is a product costing technique which categorizes all costs into direct material, direct labor, and the remainder in overhead. Gross margins are considered useful in comparing enterprises, that is, cropping in the same paddock over a period of time, or between farms.

ⁱⁱ The Farm Smart area covered three adjoining catchments, the Avoca, Loddon and Campaspe.

ⁱⁱⁱ According to Mathews, the main purposes of balance sheet and incomes statements have been to report on the periodic profit of the enterprise as in accordance with Generally Accepted Accounting Principles, the entity view. However, for owners and managers, “because of the large number of valuation options which are available to firms (Chambers 1965) and the arbitrary allocations which needed to be made to derive a profit and loss the measures of income and capital are not precise, they are estimates which reflect the arbitrary application of rules which may or may not be relevant to the circumstances in which they are applied” (Mathews in Clift and Kerr 1989, p.17).

^{iv} During interviews with a leading farmer, he reported that CSIRO had devised a formula for soil loss from cropping. The loss used to be 10 cm of topsoil = 2 tons per hectare, and more recently 5 cm of topsoil per 1.5 tons per hectare. The variation in soils and location are also noted in that some tests result in 1 cm loss of topsoil per 1 ton per hectare.