THE ENVIRONMENT OF FARM MANAGEMENT

INFORMATION SYSTEMS

A thesis presented for the degree of Master of Commerce in Accounting in the University of Canterbury, Christchurch, New Zealand

by

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1970
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CHAPTER 1.
INTRODUCTION.

Since the late 1950s researchers, advisors and accountants involved with farming or farmers have spent some time discussing and evaluating the information needs of farmers from almost every viewpoint. Early in the discussions there came an awareness of the need to consider the farm as a business.

"Greater emphasis is now being given by advisory officers to the consideration of the whole farm as a business unit and to close co-operation with, for example, accountants, lending institutions and stock and station agents, in order to help the farmer to improve the profitability of his enterprise." (1)

Further evidence of this need to treat farming as a business was evident in the number of conferences held throughout the country in 1961 and 1962 with the theme "The Farm As A Business". At the same time efforts were made by the New Zealand Society of Accountants to raise the standard of farm accounting and they produced a first Research Report (2) which highlighted several areas in which farm accounting reports could be improved.

In 1966 the Society published a new report on farm accounting (3) which updated the previous one. This new report called for greater consideration of the uses of accounting statements both by farmers and by others associated with farming. Hence the outline of standardised accounts and a uniform code and classification of accounts.

Other developments during the 1960s have included the Agricultural Development Conference of 1963-64 which studied problems of the future

(1) N.Z. Official Year Book 1965, p.409
(2) The 1961 Research Report on Farm Accounting
(3) Farm Accounting in New Zealand
growth of farming; the National Development Conference of 1969 in which the Agricultural Committee studied the problems of and outlined the needs for the growth of farm production until 1978-79; and the establishment of management and economic research units such as the Lincoln College Agricultural Economics Research Unit.

While this attention has had some effect on the farming industry, the impact could have been greater had deeper studies into all areas of farm management been carried out.

Farm management is as old as civilization. Scientific management, however, is a more recent development, and it has been applied since the First World War to industrial organizations with significant results. However, while the farming industry has made use of some management techniques, the general application of scientific management to farming has not been widely considered.

Currently the computer is proving to be one of the most powerful tools in history for advancing the science of management and in the first half of 1969, the author was actively involved in writing a number of computer programs for a system to provide timely managerial and financial accounting reports for farmers and their associates.

This work and the knowledge gained through working with farmers and farm accounts served to increase the author's awareness that accounting information was often unsatisfactory. Not only does accounting information make up a relatively small proportion of farming information needs, but because of the style of presentation, it is sometimes inadequate.

(h) Perhaps one of the earliest examples may be found in the book of Genesis where Jacob, in shepherding his father-in-law's flocks, ensured that his own share of the flock would have a predominance of spotted animals.
as management information.

It appears that only a little work has been done on designing management information systems for farmers, and that which has been carried out has usually been isolated and often approached in an unsatisfactory way. For example, some systems of accounting reports have been designed without consideration of the farmer's desire to receive the reports or his ability to understand them.

It is not intended to describe or design a management information system for farming in this thesis. Rather the author intends to discuss aspects of the environment of farming which would be relevant to the designer of such a system.

It is felt that the designer of a farm management information system needs to be aware of the growth and changes in New Zealand farming over the last eighty years. An understanding both of the current environment and the extent and causes of past changes will help the system designer not only to recognise the current sources and needs for information but also to create a system which is flexible enough to allow for possible future changes. The development of the farming industry, the growth of exports, marketing problems, land use and production are described in Chapter 2.

The sources, needs and uses of farm management information are many. In Chapter 3 the information needs of farmers are discussed and the extension services which at present provide much of the information are described. The system designer should be aware of the different types of extension organization that exist and the role they play in aiding farm management. Because these organizations are both sources and users of information, both their needs and their contributions must be considered in the system's design.
However, the farmer is the ultimate user of farm management information. It is he who makes the decisions for the farm, so information must eventually be presented in terms which he can understand. While accountants, advisors and research organizations are intermediate users of farm management information, their ultimate aim is to supply information — information that farmers can use. For this reason they must be aware of the objectives of farmers. Only if they are aware of farming objectives can they provide information which is relevant. A sophisticated farm management information system which must supply information to and through these intermediate advisors should be designed with corresponding attention to the farmer's objectives. Chapter 4 presents a brief survey of farmers' objectives.

In Chapter 5 there is a discussion of principles of farm management, the importance of them to farmers and information requirements derived from the application of these principles.

Farming is unusually subject to uncertainties and external fluctuations beyond the farmer's control. In designing a farm management information system, the system designer should seek to allow for this uncertainty both by estimating and reporting its effect within the information system and by assisting the farmer to plan with sufficient flexibility. Chapter 6 provides a discussion of the types of uncertainty and it also includes a discussion on long-term planning. Long-term planning is a relatively new application in farm management, but it is one of the best methods of minimizing the effects of uncertainty.

A number of managerial techniques relevant to farming are outlined in Chapter 7. It is important that the system designer be aware of the techniques, their uses, limitations and their associated information inputs
and outputs because upon them depends the success of the planning and control functions of management. The information system would not only need to provide information for the use of the techniques, but also allow results from the application of the techniques to become part of the output from the system.

Finally, in Chapter 3 a number of computer accounting systems are compared and contrasted. It is argued that such computer-based accounting systems will form an important part of any future farm management information system.

The last three chapters will have special relevance to accountants who have the potential to be the chief suppliers of information for planning and control, and who will presumably either operate the accounting systems or control their operation by subcontractors such as computer bureaux. Accountants should be aware of the environment of farming as discussed in the first five chapters, and any information system designer needs to recognize the total sources, needs and uses of farm management information, whether they be accounting, technical or scientific.
Traditionally, farmers are slow to change their type and methods of farming and it has been external pressures such as war, depression, scientific advances and politics which have been the causes of the most significant changes in the farming industry. These events have altered the whole economic climate of the country and caused changes in types of farming, methods of production and marketing channels. As a consequence, information needs also changed.

Until the introduction of refrigerated shipping in 1882, wheat and wool were by far the most important products, but since that time perishable products such as meat, butter and cheese have risen so much in importance as exports that wheat production has been all but eclipsed, while in the last three years, 1966-67, 1967-68 and 1968-69, wool has been pushed back into second place in total export value behind meat and meat products.

Wheat and other cereals continued to be important as exports until the First World War, but the acreage in cereals has decreased from a peak of 1.1 million acres in 1900 to less than 400,000 acres in 1965, in spite of the fact that the total acreage cultivated has increased by over four million acres in this period.

On the other hand meat and dairy exports have shown steady increases (meat 150,000 tons in 1910 - 550,000 tons in 1966; butter 42,000 tons in 1910 - 475,000 tons in 1966), with a corresponding increase in wool production (165 million lb in 1910 - 650 million lb in 1966) over this period, each type of farming having its setbacks during this period.

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(1) Unless otherwise stated the statistics in this text are derived from the New Zealand Official Year Books or the Dept. of Statistics' Monthly Abstract of Statistics and Agricultural Production Statistics of New Zealand.
Table 1 on page 8 seeks to show the shape of development since 1920. The figures will be further elaborated on in the discussion of the farming industry which follows under the following broad headings.

Land-Development, Use and Value

Production and Income

Marketing and the Producer Boards.

Land-Development, Use and Value

Of New Zealand's total land area of 66 million acres 42.8 million have been occupied at some time for farming purposes. By 1920 42.8 million acres had been occupied and of these 18.2 million had been cultivated. Since that time little more than one million additional acres have been occupied, but with better farming techniques and the use of machinery the number of acres under cultivation has increased by 4.4 million acres to 22.6 million acres in 1967.

The average area per holding was showing a steady decline until the 1950s as more and more people took up farming as an occupation and as some larger holdings were split up. However since the early 1950s, with the country's growing emphasis on the need for secondary industries, the farming population has been decreasing, mechanization on a larger scale than previously has been necessary, and the size of an economic farm unit has increased. Hence the trend since that time to larger holdings, although on a survey carried out in 1960, over half of the holdings were still within the range 50-320 acres. The most common size for dairy farms was 75-99 acres and for sheep and beef, 250-399 acres.

Land values have shown dramatic increases, especially since the relaxation of restrictions on land sales in 1950 and the value of land and improvements continues to grow at a price exceeding that for unimproved value.
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<tr>
<td>Number of Farms over 10 acres</td>
<td>68,300</td>
<td>72,000</td>
<td>74,100</td>
<td>77,700</td>
<td>76,900</td>
<td>69,900</td>
<td>68,200</td>
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<td>Total Area in Occupation (M.acres)</td>
<td>42.8</td>
<td>43.2</td>
<td>42.9</td>
<td>43.2</td>
<td>44.0</td>
<td>43.3</td>
<td>42.9</td>
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<tr>
<td>Total Area under Cultivation (M.acres)</td>
<td>18.2</td>
<td>19.0</td>
<td>19.7</td>
<td>20.2</td>
<td>20.7</td>
<td>22.2</td>
<td>22.6</td>
</tr>
<tr>
<td>Average Area per Holding (acres)</td>
<td>513</td>
<td>509</td>
<td>497</td>
<td>478</td>
<td>572</td>
<td>620</td>
<td>629</td>
</tr>
<tr>
<td>Number of Sheep (millions)</td>
<td>23.2</td>
<td>29.8</td>
<td>31.1</td>
<td>33.9</td>
<td>47.1</td>
<td>57.3</td>
<td>60.0</td>
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<tr>
<td>Number of Cattle (millions)</td>
<td>3.1</td>
<td>4.1</td>
<td>4.5</td>
<td>4.9</td>
<td>6.0</td>
<td>7.2</td>
<td>7.7</td>
</tr>
<tr>
<td>Average No. of Sheep per 1000 acres</td>
<td>484</td>
<td>638</td>
<td>676</td>
<td>731</td>
<td>1000</td>
<td>1135</td>
<td>1285</td>
</tr>
<tr>
<td>Average No. of Cattle per 1000 acres</td>
<td>76</td>
<td>93</td>
<td>105</td>
<td>115</td>
<td>116</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Cap. Value of Land &amp; Improve. in Counties £M</td>
<td>£615</td>
<td>£690.8</td>
<td>£664.4</td>
<td>£884.0</td>
<td>£2564.4</td>
<td>£3495.1</td>
<td>£3828.0</td>
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<tr>
<td>Unimproved Value in Counties £M</td>
<td>421.2</td>
<td>422.0</td>
<td>331.0</td>
<td>351.2</td>
<td>801.8</td>
<td>1135.2</td>
<td>1285.0</td>
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<tr>
<td>S.A.C. Lending to date £M</td>
<td>38.2</td>
<td>46.2</td>
<td>50.6</td>
<td>78.0</td>
<td>112.4</td>
<td>181.5</td>
<td>*</td>
</tr>
<tr>
<td>S.A.C. Lending in each of these years £M</td>
<td>2.0</td>
<td>7.2</td>
<td>0.6</td>
<td>10.4</td>
<td>11.6</td>
<td>10.1</td>
<td>14.3</td>
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<td>Total Exports from N.Z. £M</td>
<td>92.0</td>
<td>89.8</td>
<td>147.4</td>
<td>377.6</td>
<td>605.0</td>
<td>767.3</td>
<td>727.2</td>
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<tr>
<td>Pastoral Percent of Total Exports %</td>
<td>92.3</td>
<td>95.8</td>
<td>94.6</td>
<td>95.6</td>
<td>95.6</td>
<td>90.0</td>
<td>89.7</td>
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<tr>
<td>People employed on Farms - Males only</td>
<td>101,350</td>
<td>119,300</td>
<td>*</td>
<td>122,520</td>
<td>113,560</td>
<td>112,480</td>
<td>*</td>
</tr>
<tr>
<td>Total area topdressed (M.acres)</td>
<td>*</td>
<td>2.65</td>
<td>4.2</td>
<td>5.7</td>
<td>8.9</td>
<td>13.1</td>
<td>13.6</td>
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* Reliable figures unavailable.
Although the statistics shown will include some land used for housing and industrial purposes, the trend is nevertheless apparent. The Monthly Abstract of Statistics for example has shown that in 1965-66 the average annual increase in the value of land and buildings on dairy farms was $570.

The use of fertilizers, especially by aerial application has been instrumental in the greater intensification, use and value of properties. This, coupled with increased mechanization and scientific advances, has played a great part in increasing New Zealand's agricultural production. The number of tractors has increased from a mere 3900 in 1920 to 34,680 in 1950 and further to 91,700 in 1967, the number of milking machines in terms of cow capacity has increased from 72,100 to 188,500 in the same period and the number of shearing machines in terms of the number of stands has increased from 21,500 in 1920 to 51,000 in 1960. These are only a few examples and fail to indicate the growth in the usage of such machinery as hay balers which were not even in existence in 1920.

Mechanization and the increased value of land has placed stress on the financial situations of farmers generally. With the average total capital for dairy farms in 1965-66 being $25,300 and for sheep farms $41,000 in the same year, and allowing for annual increases in this value, the typical farm is by no means a small business.

In the same year the average external financing for these types of farms was $10,400 for dairying and $14,500 for sheep. The State Advances Corporation, which is one of the biggest single lenders to the farming community advances over $40 million annually and in 1966 had total debts owing to it of $181.5 million. This is only a portion of the total outstanding on farming investment because it is estimated that 40-45% of all
loans and mortgages are private, usually family farms or estates.

The financing problems of farming have at times been acute, for example during the depression years of 1929-34, when Acts of Parliament were passed to assist farmers in financial difficulties to stay on their farms. Throughout this country's short history the government has played an important role in keeping the farming industry alive by use of regulations and incentives, as well as by helping farmers get started on new land.

The National Development Conference (2) of 1969 (hereinafter referred to as N.D.C.) reports that to achieve the projected levels of production for the next eleven years to 1979-79, an annual investment in farm finance of £140 million is needed, made up of £45 million for buildings, £30 million for plant and machinery and £55 million for land development and intensification. This covers replacement, breaking in new land, consolidation of land, increasing fertility, new techniques and livestock improvement.

Emphasis is, however, laid on the fact that the farmer's willingness to invest depends on his evaluation of the future profitability of his outlay. If this is eroded by cost increases, revenue available for re-investment will be reduced and the psychological incentives to borrow will be weakened. (3)

If past trends in land use and development are to continue, it is desirable that great study be made of the financial implications of the types of farming, and the effects on the financial situation of each farm caused by technological changes, cost increases, price changes and general...

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(2) National Development Conference Agricultural Committee Report to the Second Plenary Session May 1969

(3) N.D.C. Para. 120 page 39
management ability. Furthermore farm management information systems should be capable of providing information about these changes so that farmers can evaluate alternative courses of action necessitated by the new situation.

**Production and Income.**

While using the same amount of land for the past forty years, New Zealand farmers have managed to almost treble the numbers of livestock carried. Sheep have increased from 23.3 million in 1920 to over 60 million in 1967 and cattle have increased from 3.1 million to 7.7 million in the same period. The export figures for the various products from livestock have already been quoted and they form the major part of agricultural exports which until 1967 made up over 90% of New Zealand's total exports.

The figures for sheep and cattle per 1000 acres shown in Table 1, while not showing the degree of intensity which has been achieved, e.g. 8 sheep to the acre in parts of Southland, nevertheless give some indication of the increased use of the land made possible by scientific methods, fertilizers, etc.

More recent figures (4) have shown a 25% increase in ewe equivalents between 1962 and 1969 with production increases for butterfat from 568 million lb to 662 million lb, for wool from 620 million lb to 732 million lb, and for meat from 827,000 tons to 1 million tons for the same period. All cereal crops are showing increases in acreage and yield, there being a small exportable surplus of wheat in the 1968-69 season.

While such production increases are realized and gross farming income is also steadily increasing, individual farmers have faced severe cut-backs at times, and a generally uneven increase in income. With increased intensity has come increased costs; skilled, permanent labour has been

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difficult to find and in many instances the reward to the farmer for his labour and management has declined.

From 1890 to 1920 the average rate of increase in volume of farm production was 5% p.a. with an even faster rate of increase in value of production. Since that time, however, the average rate of growth in volume has been only 2.6% p.a. although in the past five years this rate has increased to an average of 4% p.a. While there has been steady growth in volume of production the increase in value of production has shown marked peaks and troughs, for example from 1957 to 1963 there was no significant increase in value of production, in 1963-64 it rose by 1%, in 1965-66 it rose a further 6.2% and in 1966-67 it fell by 5.2%.

To achieve the annual rate of increase in volume of production has required a 2.8% p.a. increase in fixed capital, a 3.3% p.a. increase in working capital, and an efficiency rate of output to input increase of 1% p.a., all during a time when the labour force has been dropping at the rate of 0.3% p.a. It is easy to see from these figures an indication of the uncertain nature of farming, and how increasingly expensive and difficult it is becoming. Every 1% increase in output, over and above that contributed by increased efficiency, has required roughly double this amount (i.e. 2%) increase in fixed and working capital. It is felt that efficiency will have to contribute more to this increase in output if annual rates of increase are to be maintained.

The N.D.C. puts it this way

"During the last five years, impressive increases in farm output have been made in New Zealand, and to a large extent these have been the result of land development, as well as intensification of farming on existing grassland. During the next ten years we may expect a lesser contribution from new development and consequently the burden of additional
output must fall on the land already in production.

Intensification is less demanding on investment capital than is land development, but it requires a greater degree of managerial skill and reduces the margin for error in the effect of management decisions. (5)

The targets set by the N.D.C. for the next ten years are impressive but nonetheless attainable provided incentives and farm finance continue in their present pattern and efficiency itself accounts for a greater percentage of the increase in volume of production. Assuming a 2.6% growth in volume of production livestock numbers are expected to increase from 97.6 million (1967-68) to 130.0 million in terms of ewe equivalents, all this without an appreciable increase in land occupied. Agricultural exports are expected to increase from the £660 million of 1967-68 to £1,131 million in 1978-79, an increase of 72% over the whole period.

Whether New Zealand can achieve this will depend greatly on increased managerial skills and advice, on scientific developments, and on diversification, growth and maintenance of markets. Farm management will require new and more sophisticated information systems through which the knowledge of these new management skills, scientific aids and marketing opportunities can be communicated to the farm manager.

Marketing and the Producer Boards.

'A feature of New Zealand farming in the 20th Century has been the State control, or partial control, of the marketing of much of our primary produce, notably wheat, meat and dairy products. This has been carried out by direct Government control, by various marketing agencies, boards, committees and commissions, and by the Marketing Department; and

(5) N.D.C. paras. 98-99 p.35
has been referred to at different times as the Commancheer, controlled marketing, fixed prices, guaranteed prices and bulk purchase.\(^{6}\)

Because New Zealand is a country which has been, and will continue to be, dependent on its overseas trade in primary produce, organization of the marketing of primary produce takes on a special importance, so much so, that the Government has been as vitally interested as the farmer in the markets and prices obtained.

The development of marketing on a national scale has exhibited five phases.

1. Before 1914 marketing was carried out on an individual basis, even though leaders of the meat and dairy industries gave some thought to improvements in the accepted pattern of marketing. Criticism was levelled at the lack of organization by New Zealand producers in the face of more tightly controlled groups of shipping and marketing interests. The dairy industry marketing was virtually in the hands of buyers in the U.K. who regulated the price to be paid to the dairy companies. Too often it was the farmer who took all the risk. Wheat was so poorly controlled that surpluses and shortages, good prices and poor prices seemed to come in regular yearly intervals.

However during World War I a centralized organization was established by the Government to speed up the flow of produce to the needy markets in the U.K. Various agreements were established to cope with and control the organization and marketing of the different agricultural products. These agreements, though very successful in maintaining prices, were removed in the early years after the war, because they were wartime restrictions and there was a general reversion to the pre-war style of marketing.

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2. In the depression of 1921-22 agricultural prices fell sharply, while the high costs brought about by the war had not eased. The experience of the war had shown, however, that a great deal could be said for a system of centralized control over marketing, and there was ample scope, without the need for complete control, for the rationalization of selling methods. Hence the establishment of the Meat Producers Board in 1922, and the Dairy Board in 1923. Both these Boards were given wide powers, but through lack of co-operation from farmers or by choice, they satisfied themselves initially with organizing shipping, negotiating agreements for freight, etc. and promotion of sales. During the same period export control boards were established for fruit and honey.

3. Both the meat and the dairy industries suffered severely during the 1929-30 depression, which led to further investigations into the marketing of these products. At the same time private organizations with State blessing were trying to bring some measure of control to wheat. They had little success because of the lack of farmer co-operation, and eventually the Wheat Board was set up.

The Labour Government which came to power in 1935 sought to solve some of these problems by establishing a Marketing Department, and although it had very wide powers, confined its trading to dairy produce.

4. After the outbreak of World War II, bulk purchasing agreements with the U.K. were again arranged, and financial pool accounts were formed for each industry. The profits, subject to a general policy of stabilization, were paid out to the suppliers with some reserves held for the benefit of the industry. The Marketing Department had sole responsibility for the bulk purchase and shipment of dairy produce, wool, meat and tallow.
5. In most cases the pooling arrangements were continued after the war for some time because of the benefits derived from them. However, since 1947 the final phase has seen the progressive transfer of the responsibility and authority for the effective marketing of their products to the various Boards and Committees concerned, or in some cases, the return to private enterprise with the Boards assuming their pre-war functions.

The Wheat Board is responsible for all wheat produced in the country. All wheat must be sold to the Board which sets a guaranteed price before each planting season.

The Dairy Board acquires and markets all New Zealand butter, cheese, milk powder and casein intended for export, and regulates the marketing of butter and cheese within New Zealand, under its present regulations set down in the Dairy Board Act 1961.

The functions of the Meat Producers Board are to ensure all export meat is graded to a standard, negotiate shipping details and organize advertising and promotional work in existing and new markets. The actual selling is done by individual companies who buy direct from the farmer.

The Wool Commission, established in 1951 when prices soared because of the Korean War, assures minimum prices for wool in accordance with the table of minimum prices for New Zealand wool sold in New Zealand or the United Kingdom. The only marketing function occurs when the Commission sells wool it has previously bought in when minimum prices have not been reached. Because of its basically non-perishable nature wool has not come under the same control as other products, the only periods when it has not been sold by auction being during the two World Wars.
There are other boards with similar functions and varying degrees of control, including the Apple and Pear Marketing Board, the Potato Board, the New Zealand Milk Board, the Egg Marketing Authority, etc.

Summary.

Farming in New Zealand, because of its importance in providing the bulk of export earnings, is effectively an industry protected by the government. Successive governments, as the apparent needs arose, have created new regulations and incentives to stimulate or protect the establishment, growth or marketing of most agricultural products. Further examples of these regulations, apart from those described above, include the prohibition of rabbit-farming; the possible establishment of deer-farming; the changes to tax laws which occur annually; and the restriction on the purchase of land by overseas interests. These regulations and incentives, and the effect they may have on the financial stability of farms, are such that they should be recognized and understood by the farmer when he formulates his plans and by the system designer when he designs the farm management information system.

Any graph of the development of the major parts of the agricultural industry in New Zealand will show many ups and downs, indicative of the effect outside forces have on the domestic industry, but nevertheless, the trend in any of these graphs is always upwards, both in value and volume of production. To maintain this growth, New Zealand needs educated farmers, educated advisors and more scientific studies and applications. If current trends and history are any indication, such growth rates will be achieved providing management keeps pace with science.
CHAPTER 3.
THE NEED FOR MANAGEMENT INFORMATION AND THE
EXTENSION SERVICES.

Why do farmers need management information? An indication of the need for farm management information lies in the results of a survey of thirty-seven farmers in the Rangataiki Plains which showed that the major factor hindering increased production on the farms surveyed was lack of knowledge and confidence.

The knowledge lacking included information on both services available to farmers and development technology. As a consequence of the lack of knowledge, confidence was also lacking. (1)

Other factors disclosed by the survey included satisfaction with the status quo and inability to develop the farm because of unsatisfactory credit arrangements.

Management information can help to reduce the effects of these constraints. For example, three of the five farmers in the survey were satisfied with the status quo because they thought they were farming efficiently. They became dissatisfied and wanted to improve once they were shown that they could farm more efficiently.

This survey went on to show that the farmers who actively sought farm management information were in fact producing more, and earning more on a net income basis than those who were not. The butterfat per acre on farms in the sample where management advice was sought ranged from

210 to 475 lbs., while that for farms where no management advice was sought ranged from 87 to 280 lbs. Also it was concluded from results of the survey and interviews that the reason for the lack of knowledge in many cases was not so much the apathy of the farmers, but the shortage of extension officers in the district. Not only is there a need for farm management information, but there is a need for people who will communicate this information to the farmers, and show them how to apply it.

The Need for Information.

While it is said that farmers are inordinately troubled by the uncertainties of weather and nature, for any given area the physical conditions such as rainfall, temperature, soil type and prevailing winds are roughly the same each year, varying predictably with the seasons. Admittedly drastic changes in these physical conditions do occur but, generally speaking, the farmer can rely fairly well on the climate, drainage patterns and soil fertility from year to year. Evidence that this is the case can be seen in the concentration of types of farming carried out in New Zealand. Most of the dairy farms are in the Taranaki and Waikato areas; most of the cereal crops are grown in Canterbury; fruit growing tends to centre round Nelson, Hawkes Bay and Central Otago, etc. Experience has shown what type of enterprise thrives best in a given area, and the scientific study of these determining factors by research units has enabled more profitable farming to take place.

However, economic situations are continually changing. Changes in processing methods and facilities, fertilizer developments and costs, changes in taxation incentives, development of new markets, price fluctuations both for inputs and outputs, new machines which make older ones obsolete
and other similar factors may change from year to year. More important than these changes themselves, however, is that they follow no set pattern. Because of this and other factors agricultural economics has not been as widely used as other sciences related to farming.

Throughout the pre-industrial history of agriculture there was little need for such tools. Most farms were self-sufficient and had little use for analysis of markets, changes in demand, etc., because there was little to sell or buy. Farming was truly a way of life. However with growing industrialization and with more people living in cities and towns agricultural production increased and farming became more business-like. With the growth of farming in general, the expansion of markets, and later the increased intensity and greater mechanization of agriculture there arose a need for management and economic tools which would be relevant to farming.

Evidence of this lies in the remit at a Farmers Union Conference in 1938 calling for action to evolve a national system of farm accountancy. The specific complaint was that

'A farm might be going to pieces yet under present methods a balance sheet might be produced showing that the farmer was in a sound position.'(2)

However, accurate management information is necessary at all times, not only when the farm is "going to pieces". Unfortunately, in times of prosperity farmers have made little use of farm management information, and it is felt that had such information been used at all times, times of adversity would have been less severe.

(2) N.Z. Accountants Journal June 1938.
In the long-term, farming as a whole adjusts itself reasonably well to economic changes. From one generation to the next farmers have successfully changed their methods and management practices to meet new conditions, and in spite of the fact that the number of farms and farm workers has shown a steady decline, the volume of farm production has risen from 100 in the base year of 1938-39 to 189 in 1964-65, with a corresponding increase in net income.

In the short-term however there are lags in adjustments to economic changes. From one year or from one production cycle to the next some farmers find it difficult to make adjustments. Others who are capable of making the adjustments tend to be conservative, according to some farm advisors interviewed, and wish to wait to see if the changes will prove to be permanent. The result of this inability or waiting to adjust in the short-term often leads to a period of financial stress and uncertainty.

In the agricultural industry the effects of economic changes are more serious than in any other industry because of the biological nature of farm production. Since it takes months or years to bring an agricultural product to full maturity, the farmer should be aware of long-term economic information as far as it is available. Moreover since many products can be marketed at alternative stages of the production cycle (for example as baby calves, weaners and steers) the farmer must know what effect changing economic conditions will have on his markets in future months and years.

Therefore farm management information is needed to provide a basis for making the necessary adjustments more rapidly and more accurately. If the economic situation remained the same year after year, and if
physical features followed normal patterns, there would soon be little need for farm management information. After a few years of experience, farmers would find the ideal combination of enterprises, the perfect size of farm, the most profitable method of marketing, the ways to minimise short-term credit needs, and so on. With such a perfect classical situation they would not have to adjust from one period to the next, and the most profitable or desirable practices one year would be the same the next and ten years thereafter.

The economic history of New Zealand and the world has shown, however, that farmers must expect increasing economic change rather than a stabilising economy. The National Development Conference estimates that to maintain our present standard of living, the agricultural industry, as its share in economic growth will need to increase its exports by over 70% in the next ten years. As a result farm management information will continue to be necessary as a basis from which farmers can adjust their organisations and operations to meet new circumstances and challenges.

The needs for farm management information are summed up by the National Development Conference Report in this way:

"On the individual farm, output can be increased by higher stocking rates, by improved individual performance of existing livestock, or in some cases by a judicious blend of both. But whatever the method, greater emphasis must be placed on farm management. More precise information must be available to the manager so that he is able to assess the probable effects of his many decisions."(3)
The Extension Services.

Stuart, as a Department of Agriculture farm advisory officer, quoted the following as typical of questions asked by farmers:

- 'How much should I pay for a farm or block of land?
- Where can I borrow 50% or more of the purchase price?
- Have I sufficient equity?
- Should I grow more wheat and carry more or less ewes?
- At what speed should development be carried out?
- What are the economics of beef production?
- I have a taxable profit but my cash position continues to deteriorate - why?
- Should I produce more per cow or increase cow numbers and therefore increase production per acre?'

This sample of questions indicates two points. One is that there is a need for information to satisfy such queries as these. The second is that they unquestionably point to a need for extension services which are adequately supplied with up-to-date information or the means of generating it, and are adequately staffed to answer the queries of farmers. Much of the information that advisory officers use is of an accounting nature, or capable of being produced as part of accounting statements. Hence the need in designing an accounting system as part of a farm management information system, to take cognizance of extension service needs as well as those of the farmer.

(4) Stuart R.C., in an unpublished paper Farm Planning & Budgeting given at a 'Farms as a Business' Conference at Lincoln College.
New Zealand has had extension services of varying types since the 1890s when the Department of Agriculture set up experimental farms with the idea of making available to the farmers any significant information derived from scientific and management studies on the farms. The problem with this limited service was that information and new practices often took a long time to filter through to farmers, so in 1922 the first formalized approach to farm advisory work was begun. However, the advice given was more technical than managerial. It continued in this form until 1945 when the Rural Development Division was set up with the aims of giving more specialist advice where needed and of looking at the farm as a business. This service failed because of the lack of clearly defined objectives, the lack of co-operation from farmers and the lack of personnel. It wasn't until 1953 that the advisory service as it is today came into being when its aims were laid down under an Act of Parliament. The Farm Advisory Division was established

1. To give a sound technical and farm management service to farmers to enable them to obtain the highest continuing net income from their enterprises.

2. To be the ears and eyes of the Government on non-technical matters which may affect farming and farm production in districts.

3. To report to the appropriate research organisations the technical problems which may affect farming in districts.\(^{(5)}\)

There are over 100 farm advisory officers in the Department of Agriculture serving on an average 700 farmers each, throughout the country.

\(^{(5)}\) Scott R.H. Role of State Extension Services in 'N.Z. Agricultural Science' Jan. 1968 p.114
Each advisor has access to specialist information which can be provided by experts in various fields, e.g. drainage, agricultural engineering etc. To back the advisors there is the Agricultural Information Centre which was set up in 1966. This Centre gathers, collates and distributes much of the information for advisors, and research into information services and communication of information is going on continually. One system under construction at the moment involves classifying all farmers according to area, soil-type, type of farming etc. on a computer file, so that when information becomes available on a particular problem, or where a certain problem situation appears to be developing in a certain area, the farmers concerned can be provided with information immediately.

Department of Agriculture farm advisors give little intensive advice. They may have groups of five or six farmers who receive intensive advice on all matters of management for two or three years, but most advisory work is provided through field days where new techniques are demonstrated, discussion group programs, visits by groups to particular farms, and articles in journals and local newspapers. Their duties also include making survey reports for the Department and other minor duties which, it is considered,(6) greatly reduce the effectiveness of the advisors in fulfilling their main role - that of giving a sound farm management service to farmers.

There are other forms of extension services in New Zealand, including State Advances Corporation officers who are concerned with farmers

(6) Scott R.H. p.114
who are granted development loans, officers of stock and station agents
who in a few cases provide farm management advice, dairy company consulting
officers, and others. There are three further types of advisory officer
which will be considered in this text; the Dairy Board officers;
the Farm Improvement Club officers, and the private farm management
consultants.

The Dairy Board.

Work of the Dairy Board involves all aspects of dairying including
advice on the farm, control of herd testing and artificial breeding
services, research into processing and the marketing of all dairy produce.
The consulting officers, as the Dairy Board calls its advisors, are
expected to consult with successful farmers and then pass on to other
farmers those methods which have in practice proved successful. Further
duties include promoting interest in herd improvement among dairy farmers,
acting as organizers for widespread collection of material on dairy cattle
nutrition and disease problems, and provision of any necessary education
designed to help farmers make better management use of herd-testing returns
and other information supplied by Dairy Board officials. The number of
officers employed has increased from the original six in 1939 to twenty in
1968. It has largely been the active encouragement by these officers through
their personal contact with farmers and through articles in journals which
has resulted in artificial breeding becoming so common in the dairy industry.
Initial experiments proved so successful that the number of cows inseminated
has risen from 2,400 in 1950 to over 985,000 in 1967(7)

(7) N.Z.Dairy Board 7th Annual Report (1968) p.15
This is only one of the advanced techniques which this specialist type of extension service has successfully communicated to the dairy farmer. A Dairy Board official considers also that in spite of the complexity of the report, over 70% of the farmers who receive herd testing reports, understand and use them in the management of their dairy herd. This understanding is the result of the extensive educational program regarding their use carried out by the consulting officers.

Dairy Board consulting officers do not normally give an intensive whole-farm approach advisory service, this type of advice being left to other forms of advisory services. Dairy Board officers concentrate rather on their own specialist side of farming, although any advice on, say, a new herringbone cow-shed or pedigree cows, would naturally be given only after consideration of the general farm situation financially and physically.

Farm Improvement Clubs.

In 1949 members of the Federated Farmers requested the Department of Agriculture to provide an intensive service for some farmers where an advisor would be responsible for only fifty or so farms. When the Department of Agriculture maintained it was unable to do this a number of farmers in the Franklin district decided to form a club, and in 1952 the first Farm Improvement Club was formed. This movement has grown considerably and by 1967 there were thirty-five clubs employing sixty-three advisors, with over 3,000 farmers participating.

Rose, secretary of the N.Z. Farm Improvement Club Advisors Association, described the clubs.
Undoubtedly the strength, success and growth of the farm improvement club movement is that the basic concept of this advisory service is one of the whole farm approach, with the advisor acting as a farm management consultant on all financial, managerial and technical aspects of the entire business enterprise and on the most efficient methods to employ in the best utilisation of land, capital and labour. In general the advisor visits each property for about 7 - 8 half-days annually. \(^{(8)}\)

The advisory service provided by farm improvement clubs is an intensive one. The farmer is keen to receive the advisory help of the club officer, otherwise he wouldn't have joined the club, and the club officer usually has complete access to farm records, etc. The relationship between club officer and farmer has been described as a personal one, and some officers feel that to provide sound management advice on the farm as a unit necessitates knowledge of the aspirations, limitations and personality of the individual farmers as well as accounting and physical knowledge.

One of the considered advantages of the farm improvement club type of set-up is that the advisory officer is responsible to the club members. If his advice is wrong, then members are either likely to leave the club, or he will be asked to leave. It was suggested by a senior official of the Department of Agriculture that one possible drawback to advisory services operated by the State would be their lack of a sense of responsibility toward the farmers, something which is not likely to occur with farm improvement clubs.

Two disadvantages of farm improvement clubs are the advisors' lack of access to information on important scientific and technical advances

\(^{(8)}\) Rose E.G. Role of Farm Improvement Clubs in 'N.Z. Agricultural Science' January 1968 p.118
except through mass media, and the shortage of specialist officers who are needed to support general farm management analysis in particular situations. It is hoped that the information problem will be overcome when the Agricultural Information Centre allows the information gathered by Department of Agriculture advisors and specialists to be generally available to all advisory services as well as farmers.

Private Farm Management Consultants.

This is a relatively new field in the agricultural industry, but the growth of farm management consultancy firms has been almost as rapid as the growth of farm improvement clubs, in that from one firm in 1960 the number had risen to thirteen by 1967.

Ashworth, (9) in describing the role of farm management consultants said:

'The public consultant has one main motivating force, which is sufficient to ensure the maintenance of a high standard of service to his client, a high level of integrity and a sense of responsibility to his profession. This motive is profit - profit for himself and for his client, coupled with capital growth and social improvement.'

More than in any other form of advisory service, except maybe in some farm improvement clubs, this motive ensures a sound service. The farmer's welfare is the consultant's welfare. This motive, alone will keep the farm management consultants "on the ball". The basic approach to advisory work, as described by Ashworth, who was the first person in New Zealand to practice privately as a consultant, is a financial one, and statements of the financial position and the capital structure.

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(9) Ashworth V.A. Role of the Public Farm Management Consultant in 'N.Z. Agricultural Science' January 1968 p.121
of the farm are demanded before any farmer is served. This is done to
ensure that any recommendations while physically possible, are also
financially possible.

Where an intensive service is provided, a farm may receive as many
as twelve visits a year, and in most cases financial forecasting, usually
in co-operation with the farmer's other financial advisers, is involved.
Also in this service full use is made of specialist advice and information
from research units and universities. In some cases where intensive
service has been given, the consultant has not only provided advice on
technical matters but has also arranged more sound financial arrangements
for the farmer.

Other services provided by the farm management consultants include
consultancy work for non-farming organisations e.g. lawyers in charge of
an estate, surveys for boards and institutions, etc., supervisory work
which in many cases means managing the farm for estates, or as a receiver,
and finally extensive advisory services. This service is provided to
farmers who wish advice on specific problems, or farmers who no longer
need intensive advice, but wish an independent analysis of their farm at
periodic intervals.

Conclusion

Although extension services have operated in a situation of excess
demand in recent years, indicating a shortage in qualified farm advisory
officers, there remains a large number of farmers who are apathetic towards
advisory help. (10) The motivations and aspirations of farmers vary, but

are dependent to a large degree on age, health and family commitments. These goals often determine whether the farmer will seek farm management advice, and when a farmer actively seeks such advice he usually has formulated goals in his mind. Before proceeding with farm advisory work of any nature one of the main requirements is the knowledge of the farmer's goal in life.

To this, and a knowledge of the farm, physically and financially, the farm advisor brings his own skills, together with those of accountants, lawyers and other specialists. It is the practical realization of the farmer's objectives, and the most efficient means of achieving these which should be the dominating influence in the work of the farm advisor.

Farm advisory services in New Zealand whether State-controlled or privately operated will continue to grow and the need for them to provide specialist advice will become more evident as farming generally becomes more specialized and scientific. To be able to give sound advice, advisors will need not only the technical and scientific information available both within and outside management information systems, but also financial and managerial accounting information which accountants should provide.
CHAPTER II.

OBJECTIVES OF FARMERS.

Any farm management information system exists primarily to provide information for the physical and financial planning and control of the farm. Information from extension services is usually directed to these purposes and the accounting profession is rapidly realizing the role it has to play in this area.

However, behind any planning and control operations there must be an objective or objectives which the manager wishes to achieve. Planning presupposes an ultimate goal, and controlling requires both a goal and a plan against which to check progress. Therefore the system designer should be aware of management objectives before he designs the management information system. Also, since multiple objectives are often expressed, and since objectives vary between farms and may change over time, the information system should be flexible enough to incorporate them.

Do farmers have objectives? To answer this question it was decided to conduct a survey to determine whether farmers had objectives or not, and if so whether they were able to state them clearly. It was felt that since management teams in large industrial enterprises plan to achieve objectives which are defined by top executives, so too, farmers ought surely have objectives in some form before they decide on any plan of operations.

To question whether farmers have objectives may seem absurd, but it has been the author's experience when discussing this question with advisors, accountants, academics and laymen alike that many of them do indeed question this. Many too, while not questioning the fact that farmers do
have objectives often expressed the idea that a farmer would merely state his objective in farming as "a way of life". Others questioned the farmer's ability to be able to state his objectives as such.

The Survey.

This was a very limited study. A firm of public accountants in Northern King Country with several hundred farming clients and a firm of public farm management consultants with clients in most areas of the North Island were approached and they agreed to conduct a survey among their clientele.

To ensure that within these limitations the sample would be reasonably random the public accountants only interviewed those farmers who came into their offices during the survey period. Similarly the farm management consultants interviewed those clients they were due to visit during the corresponding survey period. This form of sampling ensured that there would be no pre-selection by any of the interviewers. In all a total of twenty farmers were interviewed, eleven by the farm management consultants and nine by the public accountants.

First the interviewer established:

(a) What type of farming was carried out (dairy, sheep, beef, mixed)
(b) how long the farmer had been on his present farm.
(c) whether development work was in progress,
(d) what type of ownership the farm had; whether it was freehold or leasehold,
(e) whether the farm was individually-owned, a partnership, a company or an estate.

Next the interviewer questioned the farmer about his objectives:

(1) In the short-term (i.e. in the next year).
(2) mid-term (i.e. in the next five years or so) and
(3) in the long-term (i.e. greater than five years).

Care was taken not to prompt the farmers. It was felt essential that the farmer describe his goals or objectives in his own words. The farmers interviewed were more than willing to answer the questions and in a number of cases the public accountants found it difficult to end the discussion, so keen were the farmers to talk about their goals.

As a result of the first part of the interview it was established that there were:

1. twelve dairy farms, two sheep and six mixed farms
2. sixteen freehold and four leasehold
3. twelve individually controlled, six partnerships, one company and one estate
4. nine were not being developed and eleven were still being developed.

In view of the very small sample these results should not in any way be taken to mean that these proportions hold for all New Zealand farms. Rather they serve only to show that there was a wide variety in the survey taken.

Table II shows the objectives of each farmer in the survey.
<table>
<thead>
<tr>
<th>TABLE II</th>
<th>SURVEY OF FARMING OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LONG TERM OBJECTIVES</strong></td>
<td>Farmer Number</td>
</tr>
<tr>
<td>Security for Self and Family</td>
<td>x x x</td>
</tr>
<tr>
<td>More Leisure</td>
<td>x</td>
</tr>
<tr>
<td>Bring Sons onto Farm</td>
<td>x x</td>
</tr>
<tr>
<td>Financial Stability</td>
<td>x</td>
</tr>
<tr>
<td>Be Debt Free</td>
<td>x</td>
</tr>
<tr>
<td>Increase Size of Farm</td>
<td>x x</td>
</tr>
<tr>
<td>Sell out completely</td>
<td>x x</td>
</tr>
<tr>
<td>Carry on as before</td>
<td>x x</td>
</tr>
<tr>
<td>No Long-term Objectives</td>
<td>x x</td>
</tr>
<tr>
<td><strong>TOTAL Long Term Objs.</strong></td>
<td>1 1 3 2 1 2 1 1 1 2 1 1 2 3 2 1 2</td>
</tr>
<tr>
<td><strong>MID-TERM OBJECTIVES</strong></td>
<td></td>
</tr>
<tr>
<td>Increase Production</td>
<td>x x</td>
</tr>
<tr>
<td>Increase Herd or Flock Size</td>
<td>x x</td>
</tr>
<tr>
<td>Develop More land</td>
<td>x x x x x x</td>
</tr>
<tr>
<td>Capital Improvements and Additions</td>
<td>x x x x x x</td>
</tr>
<tr>
<td>Financial Repayments</td>
<td>x x x x</td>
</tr>
<tr>
<td>More Leisure</td>
<td>x x</td>
</tr>
<tr>
<td>Family Education</td>
<td>x x</td>
</tr>
<tr>
<td>Change Type of Farming</td>
<td>x x</td>
</tr>
<tr>
<td>Retire</td>
<td>x x</td>
</tr>
<tr>
<td>Security for Self and Family</td>
<td>x x</td>
</tr>
<tr>
<td>Financial Stability</td>
<td>x x</td>
</tr>
<tr>
<td><strong>TOTAL Mid-Term Objs.</strong></td>
<td>2 1 3 2 1 1 1 1 1 1 1 1 2 2 1 2 3 2 3</td>
</tr>
<tr>
<td><strong>SHORT-TERM OBJECTIVES</strong></td>
<td></td>
</tr>
<tr>
<td>Increase Production</td>
<td>x x x x</td>
</tr>
<tr>
<td>Increase Herd or Flock Size</td>
<td>x x</td>
</tr>
<tr>
<td>Develop More Land</td>
<td>x x x</td>
</tr>
<tr>
<td>More Leisure</td>
<td>x x</td>
</tr>
<tr>
<td>Financial Stability</td>
<td>x x</td>
</tr>
<tr>
<td>Maximum Profit</td>
<td>x x</td>
</tr>
<tr>
<td>&quot;Buy Rotary Slasher&quot;</td>
<td>x x</td>
</tr>
<tr>
<td>Try new enterprises</td>
<td>x x</td>
</tr>
<tr>
<td>New Buildings</td>
<td>x x</td>
</tr>
<tr>
<td><strong>TOTAL Short-Term Objs.</strong></td>
<td>2 1 1 1 1 1 1 1 1 1 1 1 2 1 1 2 1 1 2 1 2 6</td>
</tr>
<tr>
<td><strong>TOTAL ALL OBJECTIVES</strong></td>
<td>5 3 7 5 5 4 3 2 3 4 5 3 4 5 3 5 5 6 5</td>
</tr>
</tbody>
</table>
Long-term Objectives.

Prior to the survey it was thought that while farmers objectives in the short and mid-term would be expressed in physical and financial terms, the long-term objectives would be more personal and non-economic. In answer to the question about long-term objectives:

(a) only two farmers gave answers that could be termed economic.

1. One young farmer expressed a desire to be "debt-free", his other long-term objectives being to own a larger property and to provide security for himself and his family as soon as possible.

2. The other farmer expressed "financial stability" as an objective coupled with the desire to educate his family and establish them on the farm.

(b) Eight of the remaining farmers gave family security and personal retirement security as the prime objectives.

(c) Of the two who wished to sell out one wanted to do so because of the low return being obtained on capital invested. His expressed desire was "to get the farm to a fine condition and sell". The other farmer who wished to sell out took over the farm from his father's estate fifteen years ago, but with a mortgage to cover a life interest in the estate. This restricted the surpluses available to develop the property, and now that there is no longer a life interest, he hopes to accelerate development, sell and invest his capital elsewhere.

(d) No long-term objectives were given in two instances.

One involved a widow whose objectives in the past had been to provide security for herself and family (who are now all married and settled) and did so by raising the production of the property, which is now in a sound financial position.
Her objective is to retire in the next 3 - 5 years.

The other farmer with no stated long-term objectives is a young man with no family, farming a well-developed dairy farm. His objectives in the next five years are to freehold his farm and buy an adjoining property. The combination of factors in this example of a well-developed property, financial stability and no immediate family are such that it appears there is no need to have objectives for any longer period at this stage.

The results of the question on long-term objectives show that 80% of the farmers interviewed had at least one long-term objective and with 75% of these, the main objective was self or family establishment and security on the farm.

Mid-term Objectives.

All the farmers interviewed had objectives covering the next five years. The objectives stated may be classified under the following:

1. To increase production (e.g., raise butterfat production from 40,000 to 50,000 lb), or to increase size of flock or herd, or to develop more land. Seven farmers named one, two or all three of these as objectives in this period. Three of these farmers have family security as their long-term objectives, two wish to bring their sons on to the farm and the other two are the farmers mentioned above who intend to sell out.

2. To make substantial financial repayments. Four farmers named this as their main mid-term objective, and in all four cases other objectives for this period were to make capital improvements by way of replacing building or plant. In two of these cases, the farmers' desire to repay existing mortgages is stimulated by their long-term desire to either buy a larger farm or increase the size of the present farm, and
another farmer who is much older hopes in the long-term to "enjoy by relaxation on holiday some of the fruits of a life time's hard work".

3. To make capital improvements or buy more land. Eight farmers gave one of these as a mid-term objective, and in all cases but two, the long-term objectives included self and family security, more leisure or a desire to hand the property over to one or more sons.

4. To have more leisure time. Both farmers who expressed this as a mid-term objective have been farming for over twenty years, they are on well-developed properties and they and their families are financially secure. Their long-term objectives include retirement.

5. Other mid-term objectives were:

   - provision for family education, from a farmer with five children.

   - change the type of farming, the reason given being to provide more leisure time.

   - financial stability from a young farmer who in the long-term wants to "obtain lifetime security at the youngest possible age" and

   - in the case of the widow already mentioned, retire.
Short-term Objectives.

There were fewer short-term objectives.

1. Fifteen of the farmers interviewed placed emphasis on:
   (a) A specific amount of further development (e.g., break in 20 acres, apply 6 cwt. of fertilizer per acre, etc.)
   (b) Increasing livestock numbers or
   (c) Increasing physical production.

   A feature of the farmers' statements was that they gave specific goals e.g., 42,000 lb of butterfat, or 500 lb of butterfat per acre, or get 100 yearlings, indicating a knowledge of the capabilities of the property. In ten out of fifteen instances, there was only one short-term objective.

2. One farmer stated his short-term objectives as "Buy a rotary slasher, otherwise nil". He is operating on a very small unit which is considered uneconomic, and his mid-term objective is to buy more land or a larger farm, so that he can achieve his long-term objective of providing for his three sons.

3. Three farmers highlighted financial stability or a move toward it as the major short-term objective. In one of these cases development work has just been completed and liquidity is poor at the moment, this farmer being one of those who hopes to sell out eventually. The other two farmers aim at family education and security as long-term objectives.

4. Two farmers, or 10% of the sample, named - "maximum profit" as an objective, and both of them indicated that this profit is really "maximum continuing profit", i.e. the continuing physical and financial stability of the farm would be taken into account when operations were planned.
The Objectives Reviewed.

1. Profit was seldom named as an objective, although both profits and satisfactory cash flows are implicit objectives if most mid-term and long-term objectives are to be achieved. Many of the short-term objectives could be achieved without a profit on the year's operations being made and it is conceivable that a loss would actually be expected if the objective is to be achieved.

2. There is a strong correlation between short-term and mid-term objectives, and between mid-term and long-term objectives, so that in almost every case a pattern of planning can be observed. The particular short-term objectives chosen are a step towards achievement of mid-term objectives, and the mid-term objectives are a step towards the achievement of long-term objectives. An example of this is the young farmer who wants to increase his production this year and "balance his income", with a view to being financially secure enough to increase his herd size (debt-free) to the maximum for the size of the farm, his long-term objectives being to increase the size of the farm to provide "a university education for the family", and to be wholly debt-free.

3. Such factors as the age of the farmer, the number and ages of his family, and the degree of development the farm has reached seem to influence the choice of objectives. This is seen for example in the farmer whose aims are (from the short-term to the long-term) to increase his capital so that he can buy another property large enough to put two sons on. Even after this acquisition this objective will continue. He stated that the new property would be largely undeveloped, because his capital situation prevents him from buying a developed property.
4. Long-term security of self and family appears to be a dominant factor in the selection of objectives. Although we cannot draw the conclusion from this limited study that this is a feature in the whole farming community, comments received from advisers, accountants and other farmers certainly strengthen the belief that this is typical. It is surely not unique to farming.

One interesting result of undertaking this survey has been a decision by the public accountancy firm involved to request a similar statement of objectives for the file of each farmer who is willing to divulge such information. It is their belief that such information, if reviewed annually in the presence of the farmer will be of significant benefit in discussing future plans for the farm.

A survey of a different nature, but one in which a question about objectives was included was carried out in 1964 under the auspices of the Lincoln College Agricultural Economics Research Unit.\(^{(1)}\) The results from the question about personal objectives when embarking on a development program showed that the age of the farmer and the age and size of his family did influence objectives, and that where there were three or more children, capital gain was the major objective.

**Summary.**

In spite of the limited nature of the survey, it is clear that it is over-generalising to suggest farming is merely "a way of life". Farmers

do indeed appear to have specific and varied objectives, and these do not necessarily include "paying as little in taxation as possible". Although farmers may not divide their objectives up formally into long-term, mid-term and short-term objectives, they have them firmly in mind and they would be willing to discuss them with any operator or designer of a farm management information system.

It appears the accountant's and advisor's task of deciding what information to give could usefully begin with a discussion with the farmer of his objectives. It is felt that this sort of preliminary discussion will make later discussion and advisory periods more productive, and will help the farmer both to organize his physical and financial resources in order to achieve his stated long-term objectives and to improve his planning methods. Once the accountant or advisor knows the farmer's long-term objectives, he will be able to guide the farmer in determining the short and mid-term objectives that lead to the achievement of the long-term objectives. He will also be enabled to produce reports which are truly relevant.
CHAPTER 5.

PRINCIPLES OF FARM MANAGEMENT.

The returns of a farming business for any given year can be the resultant of many different factors, some of which are not under the farmer's control. From one period to the next income may fluctuate because of weather variations or animal or crop diseases. Similarly, the economic factors which cause major price variations for both inputs to and output from farming are determined at national and international levels and are seldom influenced by the individual farmer.

However, in any given period, in any given area, with the same weather and other constraining factors, there are likely to be wide differences in costs, returns and net profits from farm to farm. For example, Cronin (1) showed that within the same soil type in an area, the production of butterfat per acre could vary as much as 120 lb or about $4.2 in gross income per acre.

What are those factors, apart from lack of incentive on the part of the farmer, that cause one farm to have lower costs and higher returns than another in the same area? They come under two broad headings, physical and economic.

(a) Physical factors include such influences as:

- selection of breeds of livestock or varieties of crops
- methods and degrees of disease and pest control
- soil quality and topography
- methods of cultivation, fertilizing and harvesting
- drainage and erosion control, etc.

(1) Cronin M.B. (1968) p.42
(b) Economic factors include the management operations and decisions involved in the successful running of the farm.

How does a farmer control or make best use of these factors? There appear to be no hard-and-fast rules to follow for success. Certainly some farmers have been successful because of a strong intuitive knowledge of farming, but a basic knowledge in the following three areas will assist any innate ability.

1. The farmer ought to be conversant with the proven practices and methods of the area in which the farm is located. There is no substitute for this practical knowledge and experience. Many people with little education or business experience or training, other than years of experience on their farms have been successful because of this factor. Yet this is not to say that they would not be even more successful if they also applied the other "rules" for success. They have learned by trial-and-error when and how to do things.

2. The farmer ought to know or have ready access to the scientific techniques of pasture, crop and livestock production which are applicable to the area. Many farmers have gained this "know-how" by trial-and-error, observation of others, and by experimentation. Others have relied on the advice of the extension specialists, specialists attached to lending firms and institutions, and still others have attended the agricultural colleges and then applied the scientific knowledge gained from this source.

In recent years many scientific developments in agriculture, principally from research organizations, have resulted in increased volumes of production and lower costs per unit or, in other cases, increased volume and quality of production which more than justify the increased costs. Examples in the
dairying industry have been the introduction of herring-bone cowsheds and artificial insemination.

3. The farmer ought to know and use the basic management principles in accordance with which common farm practices and scientific techniques should be applied. This includes the capacity to combine the practical experience, educational background and business knowledge in such a way as to take the greatest possible advantage of all factors in the management of the farm.

Major business activities which are important in the management of a farm are:

(a) determination of price trends
(b) selection and organization of enterprises\(^2\) to form an efficient farm unit
(c) Determination of operational methods for efficient production
(d) financing the business
(e) managing capital and income
(f) marketing of products.

Information from several sources is needed if these activities are to be applied in the management of the farm. To give some idea of these needs and their sources, a discussion of the above activities follows.

**Price Trends.**

Prices are almost totally beyond the control of the individual farmer, but they affect the profitability and continuing existence of farms. In New Zealand price trends affect the action and thinking of farmers

\(^2\) Enterprise in this context means an activity on the farm. For example, a farm may have the following enterprises - wheat, peas, fat lamb raising and beef cattle.
differently, according to the type of farming undertaken. For example a dairy farmer faced with an immediate drop in his minimum price for butterfat can do little about it in his production season, but a fat-lamb raiser faced with a fall in lamb prices may decide (providing other conditions are suitable) to hold on to his flock for several more months. Similarly a wool-grower faced with a fall in price per pound could elect to store the wool till a later date in that season, or even retain it until the next season.

More important, however, is the price level the farmer expects for his agricultural products in one, two to five years time. The gross return a farmer obtains depends on the prices for produce when it is sold, not on the prices prevailing when he commits his resources to the production of that output.

Because agricultural production is a biological process which is limited in its duration by the live-stock maturity cycles, or growing-season requirements, an insight to the trend in prices is of much more importance to the farmer than it is to those in the retailing and manufacturing industries. In such industries the production to selling cycle may be only a week or so, and the businesses can more readily make adjustments for future price trends, but in farming the stock is bought, the development commenced, the fertiliser applied, the seed sown and the labour utilised, sometimes several years before the product of the original investment is realized.

Unfortunately, in the agricultural industry, prices cannot be forecast with any degree of accuracy even for one season ahead, let alone five. There is so much uncertainty attached to the prospective prices
of primary produce both locally and overseas that to the author's knowledge no marketing organization is prepared to forecast prices for a number of years ahead.

- Meat price schedules are set weekly throughout the killing season

- Butterfat prices are set by the Price Fixation Authority at the beginning of the production season with allowance for a change of up to 5% once during the season

- Wool prices are those ruling at the auctions locally and overseas, with a guaranteed minimum set by the Wool Commission

- Wheat prices are set by the government every two or three years

- Barley prices are set yearly by a committee representing all interested parties, the price having changed only four times in the last nineteen years and

- Other cereal prices are more or less set on an open market basis.

Farmers must keep up with the information on short-term price ranges and trends, and such information is readily available from the various marketing boards, co-operatives or companies. At the outset, because future prices are unknown, the commitment of resources is so much a "stab-in-the-dark". However at the time of sale the farmer will need short-term price information to make the most of his opportunities.

If a farmer does consider adjusting the farm enterprises to take advantage of price changes in farm products, two important factors should be kept in mind:

(a) Any change should be within the framework of the physical and
economic possibilities of that farming area. Few enterprises are profitable unless they are adapted to the climate, soil, topography and economic conditions of the farm.

(b) There should be a reasonable assurance that the price changes causing the planned shift in the farming system are sufficiently permanent (relative to the production and marketing cycle) rather than temporary.

Selection of Enterprises.

The range of possible enterprises is to a certain extent bounded by the locality of the farm but nevertheless there are usually several enterprises which could be selected. The selection of enterprises depends on a number of factors including

(a) size and type of farm e.g. hill-country, plains, etc.
(b) productivity of the soil
(c) costs of establishing the enterprise
(d) probable prices of commodities produced
(e) climate factors
(f) amount of available labour, seasonal and permanent
(g) marketing opportunities and facilities.

The technique of linear-programming which is discussed in Chapter 7 is useful for evaluating these factors and determining the combination of enterprises. Whatever methods are used the evaluation must be efficient if any sound management decision is to be reached. Further discussion on the selection of enterprises is covered in the following section.

Combination of Enterprises.

Once the range of feasible enterprises has been determined, the farmer should seek to develop that combination of enterprises (and their
relative intensity) which will enable him to achieve the objectives he has set. Determining factors, which will vary in relative importance according to the system of farming and the specific facilities and resources (including financial resources) on the farm, include:

(a) Labour distribution. The ideal combination of enterprises may be those that demand enough work to keep the farm labour busy for each working day of the year, while allowing for use of temporary labour when available and economic. The main problems in utilization of labour lie in the competition between enterprises for peak labour needs. When selecting the enterprises, cognizance should be taken of these peak time needs and the likelihood and cost of hiring temporary labour for that time. Mechanization is an analogous problem. The farmer must decide to what extent existing machinery can be used, what new machinery is needed, or whether manual labour is as efficient and economic.

(b) Use of land. The major reason why the combination of enterprises on farms (even in the same farming region) is not exactly the same is the variation in soil, drainage conditions, topography and similar factors from farm to farm. The use of land should be adjusted according to the relative demands made by different pasture, crop and livestock enterprises. How many farmers, for example, have considered running more livestock all year round and buying in the feed when needed, rather than run fewer livestock and grow the feed? Such intensification of land use may be more profitable.

(c) By-products. To what extent can an enterprise be organized to use a by-product of another enterprise? For example after harvesting a crop, a farmer may run livestock through the cropping areas, this fodder
being in effect, a by-product of the crop. Such by-products afford an additional margin of profit.

(d) Maintenance of soil fertility. On most farms it is not profitable to purchase all the fertilizer that is needed to maintain soil fertility, so at least part of the natural fertility removed by various crop or livestock enterprises must be returned through good husbandry in the choice of enterprises and pasture management. A farmer should be careful in designing or altering paddock sizes, so that he has an adequate size and number for rotation of use. An over-emphasis on soil-building at the expense of income-producing enterprises, or vice versa, may not be profitable.

(e) Relative risks. A farm that includes income from more than one enterprise is less likely to be a failure in any one period than one which is highly specialised. The high number of poultry farms that went out of business in the early 1960s reflected the risk inherent in single-enterprise farms. Consideration should be given to the spreading of risks by the use of several important enterprises in providing the most desirable combination for the complete farm. However, if the comparative advantage of one enterprise is such that it is much more profitable than any other possibility, it is often preferable to take the risk rather than lose the income. A striking example of this is the analysis of the Lincoln College Town Milk Supply Farm. It was shown that if the farm was run as a factory-supply unit the profits would be similar to those obtained by running it as a town-supply unit. However if it was run as a mixed-cropping unit, the farm surplus would fall from $8,000 to $4,240(3). Clearly it was well worth while in this case to specialise in production.

(3) Farm Management Notes 18 (Mid 1965) Lincoln College Department of Farm Management and Rural Valuation.
(f) Distribution of Income. Other things being equal, a combination of enterprises resulting in relatively constant income each month throughout the year is preferable to one returning the gross income in one or two gross payments over that period. Budgeting is simpler, changes can be made more easily according to changes in returns, and interest charges on short-term finance are reduced. However, few enterprises have this desirable characteristic. Without resorting to external short-term finance the only way to overcome this is to have enterprises which bring in their returns at different times of the year.

On the combination and selection of enterprises then, in an area where there is one single enterprise which is more profitable than any other, the first step would be to expand this enterprise to the greatest possible extent in view of the resource constraints. This is the simple underlying principle of linear programming. After this development, other enterprises should be added to balance the farm business and provide greater efficiency.

Operational Methods.

The decisions on operational methods which a farmer must make both yearly and in the course of his daily activities involve a wide range of features relative to efficient and profitable methods of production for each individual enterprise. Determining the amount of fertilizer to apply per acre, what animal health steps to take to prevent diseases, etc., are economic as well as scientific decisions. Today, the farmer receives technical and scientific information of this nature through the newspapers.

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(1) There is extensive literature available on the Theory of the Firm, and it is felt that a detailed discussion is not warranted in this text.
and journals, by radio and television broadcasts, and through meetings with specialists and advisors, but decisions using this information must be made with consideration to all the economic and physical resources and constraints of the farm, i.e., they must be made within the framework of the total management information system. Further points to consider in decisions relating to operational methods are those which arise when prices of inputs change, or climatic conditions are out of the ordinary. Thereupon decisions must be made to alter the volume of inputs or operations in order to optimise resulting gains or losses. For example if pasture feed is more than plentiful because of favourable weather the farmer may decide to buy in more livestock if the prices are also favourable. Information to assess these gains or losses should be available as part of the accounting system within the management information system. Farmers are continually being faced with these sorts of decisions, and they have to determine the economic as well as the natural benefits of them, but it is considered by some advisors that too many of these day-to-day types of decision are made almost unconsciously by the farmer.

Financing the Farm Business.

A problem which most farmers face is that of securing and maintaining enough capital to meet long-term obligations, and keep current operations moving efficiently. The efficiency with which a farmer obtains credit cheaply, uses it wisely and meets his payments in an orderly manner is an

(5) The term "unconsciously" was used in this context by more than one advisor.
important factor in determining his financial success in the operation of the business. The general problems involving finance includes:

(a) An estimate of the amount of short-term credit needed for the production period, whether it be a growing season for crops of wool, a livestock fattening season, or a dairy season, until the revenue for the production comes to hand. This type of credit is needed to finance the family living expenses and/or the current production expenses during the farming year, especially on units where income isn't coming in at a constant rate.

(b) The determination of the funds needed for 'mid-term' capital requirements for such items as buildings and machinery, purchase of breeding stock, small-scale development programs such as pasture development etc.

(c) The amount of long-term credit of a mortgage nature necessary to finance the whole farm through change of ownership, long-term development, or consolidation, until it can be paid for by earnings over a period of years.

An almost exclusive problem of the industry is that farms are commonly refinanced every generation because they are largely family units. For this reason alone, farmers need to have adequate information when seeking finance. Credit problems involve the amount and source of finance, the terms of repayment compared with time and value of returns from the farm, and evaluation of interest rates. There are a large number of organizations, institutions and companies in New Zealand offering rural credit of different types, and the government openly encourages lending for this industry, but the farmers have to know of the different types of
credit needed, and available, the sources, costs and repayment provisions, and the most desirable methods of employing each type in financing the business.

Managing Capital and Income.

The operation of a farm business requires a relatively large capital investment, varying from area to area and among the various types of farming. In the early days of farming in New Zealand, the farmer had little capital to protect, little cash income to invest, and no income tax to pay. For example the average value of land and improvements covering all farms over ten acres in 1920 was approximately $9,000 dollars and by 1950 it had only risen to about $11,000 dollars. (6)

Today, however, the farmer faces a number of problems regarding capital and income. With the relaxation of restrictions on land prices in rural areas in 1951, land values have increased rapidly and in 1968 the average value of land and improvements per farm holding was approximately $62,000, and the greater degree of mechanisation and specialised breeding has meant large increases in capital for equipment and livestock. Gross farming income has risen from $439.6m in 1940 to $817.9m in 1968 as New Zealand has expanded its overseas markets through periods of rising prices and greater intensification on the farm, so that surplus income after personal needs is becoming more common, and since 1959 when the Income Tax

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(6) These figures and that following for 1968 are a very rough approximation derived from Table I (p.8) by the following formula - "Total capital value of land and improvements in counties" divided by number of holdings over ten acres". The capital value of land and improvements will obviously include not only 1-10 acre farms, but areas of urban development within counties as well, especially in more recent years. This serves to distort the statistics somewhat, but nevertheless the trend can be seen.
regulations were extended to include them, all farmers have had to be tax-conscious.

The skill with which the farmer handles these capital and income problems will have its effect on his returns in both the short and long-term. Where the farmer does not have this skill, which is often the case, he must seek the necessary financial and legal advice to protect his capital and income. To safeguard his capital a farmer should have adequate insurance cover for his buildings, equipment and stock and to protect his family and estate, where the private capital invested is substantial, life insurances or death duty stocks should be considered. In most cases there should be some sound form of estate planning.

The first place for most farmers to invest any surplus funds available, after personal management and labour contributions, should be in the farm business, in terms of paying off all debts, building up the size of the farm to provide a more economic and therefore saleable unit, and improving the land and buildings to increase production efficiency. The extent to which this is done will depend up the farmer's objectives and the return the farm is giving and can give on capital. In some cases where the farm is fully developed, or marginal returns on re-investment are not great, it pays to seek outside investments, and here again professional advice should be sought.

Income Tax legislation has become so complex in the last twenty years that few farmers are able to handle their own affairs in this field adequately. Because of the number and complexity of incentives, professional advice is needed, but a farmer should never fear his development or production to maximise his income tax avoidance; rather
tax planning should be made a part of overall planning.

Marketing of Farm Produce.

Marketing of their produce is regarded by many producers as something beyond their control, and to a certain extent with some products, this is true. Nevertheless farmers should have sufficient knowledge of marketing organizations available, and the skill of organizing and deciding their marketing practices. It is felt that for a discussion of marketing under New Zealand conditions, each product should be view separately. An understanding of these marketing practices is helpful not only to the farmer but also to the designer and operator of the farm management information system because information available from the various sources may affect the time and method of marketing. The produce covered will include the major export items, meat, wool and dairy produce, and wheat and barley to give some idea of the options open to farmers.

(a) Meat

The farmer has virtually an open door within the constraints of world and domestic prices, especially with lamb and mutton on the export side, and beef on the domestic market. Ways open for marketing include:

1. For beef, mutton and lamb the farmer can accept the schedule price which is set weekly according to current overseas prices by the meat exporting companies, this price being set to the farmer and received by him immediately the meat is processed. Here the companies carry the risk and therefore the gains or losses if the price on the overseas market alters between the time of processing and the time of sale, which can be several months.

2. Again for beef, mutton and lamb, the farmer can accept a price
per head on his property, which is negotiated with him at the time of sale, and here again there is no risk carried by the farmer.

3. Sell to a co-operative or company that offers "pool" arrangements, whereby the farmer is paid about 90% of the schedule price immediately, and at the end of the season, if the proceeds from sales in the "pool" are greater than that already paid to the farmer, a bonus is distributed on a per head sold basis. In this way he has most of his proceeds immediately and stands to gain or lose on the market price when the meat is sold. These pool arrangements are not offered for beef.

4. Sell on his own account through an export company whereby the farmer gets the price ruling at the time of sale overseas, although in most cases he receives an immediate advance from the company, and he is charged for processing and marketing costs. Here the farmer takes all risks on himself and stands to gain or lose the most from it. This is not usually done in the case of beef.

5. Sell on the domestic market where normal supply and demand forces apply. Over 50% of all beef is marketed in this way.

(b) Wool.

Most wool is either sold by the farmer himself, or by a stock and station agent on behalf of the farmer, at auctions held in various centres during the clipping season. The prices obtained are determined according to supply and demand, the risk in most cases being entirely on the farmer.

(c) Dairy Produce.

The dairy farmer has no control over the marketing of his produce, this function being organized by the Dairy Board, hence the farmer bears
no risk except to the extent that the price may be altered at the beginning of the season.

(d) Wheat.

This is similar to dairy produce, in that the Wheat Board is responsible for the marketing of all wheat harvested, the price a farmer gets being determined by the government at two-yearly intervals usually.

(e) Barley.

There are three ways of marketing barley:

1. Gain a contract, through a seed merchant, with a malting company for the crop, in which case there is little risk involved from a marketing point of view. This method accounts for 30% of the barley harvest.

2. Prior to sowing sign a contract with a seed-merchant, the price being set then. This again has little risk involved.

3. The farmer can grow on his own account and market wherever and however he wishes, in which case he takes all the risks. Other grains are grown and marketed on this basis or in a few cases as in 2 above.

With these markets that offer them, the choice among the several ways open to the farmer depends primarily on his willingness or ability to accept risk, the current state of feed on his property, the current economic situation, and his financial position. Some farmers just cannot afford to take any risks, others are virtually forced by circumstances to sell at a certain time in a certain way, but nevertheless, the opportunities for marketing are there, and the farmer should be aware of them.

Summary.

Farm management, in part, may be described as the application of
of business principles of agricultural economics to the applied sciences and agricultural production fields, from the point of view of the individual farmer. Admittedly the farmer has a right to make "a way of life" his objective in farming and this was perhaps sufficient in the days when the agricultural industry produced over 50% of New Zealand's export earnings, but with this percentage now decreasing each year (79% in 1967-68), farmers will have to improve their efficiency to justify the incentives accorded them. Because no two farms are exactly alike, and no two farmers have the same experience, education, desires and capital, the management problem in farming is still essentially an individual one. Thus, only general principles of farm management can be presented, and overall suggestions made as to the effective application of these principles. The final point of view is always that of the individual farmer.
CHAPTER 6

LONG RANGE PLANNING AND UNCERTAINTY IN FARMING.

The effects of the uncertainty which is characteristic of farming may be minimized by intelligent planning.

In the past planning by farmers tended to be haphazard. The farmer would determine sub-objectives and goals consonant with his main objective and devise ways and means of striving to achieve these targets. Because these plans were seldom expressed on paper they tended to be limited by the willingness and ability of the farmer to think ahead in concrete terms. As situations changed so too did his plans. Consideration of the manner in which changes in plans would help to achieve the objectives was essentially informal. Many of the older farmers spoken to in the course of empirical investigations agree that this somewhat unstructured process was the older form of their planning, and many still rely on it rather than use specific planning techniques such as budgetary analysis.

When budgeting was in its infancy, the chief argument raised against it was the uncertainties involved in farming. Today it has been proved that such planning is successful and helps in fact to reduce effects of uncertainty in the short-term.

Long-Range Planning.

However when the subject of longer term planning, i.e. longer than two years, was discussed with a leading professional businessman (who also owns a farm) he used the same argument against longer-term planning.

Long-term planning, termed in many cases development planning, is occurring, examples of which are those farmers working under the COFE program developed at Lincoln College by Mr. A. McArthur.
CORE stands for Computer Overdraft Prediction and Evaluation. The model or system has been taken over for use by the Department of Agriculture and at present there are more than twenty-five farms using it. The model incorporates overdraft prediction and evaluations, stock reconciliations and cost estimates. Mr. McArthur has since written a further model which, based on certain assumptions, assigns probabilities to the different levels of overdraft which may occur. To enable this financial plan to be drawn up by the computer model, a solid groundwork of physical planning is required, so that the program as a whole results in detailed plans not only for the whole period, but for each year within the time cycle.

Also one young farmer in the Piako county who has been using a three-year planning system (drawn up with his accountant’s help) has found it to be most successful especially in financial control over development work. He feels that by receiving such planning and other information he is much better prepared to face adverse circumstances.

The National Association of Accountants in the United States in its report on Long-range profit planning had this to say:

'The need for long-range profit planning is fundamentally attributable to the radical transformation in business conditions that has taken place in recent years. The fact that the rate of change has accelerated while in many respects, operations have become less flexible explains the increased emphasis on planning. By the means of planning, a company seeks to direct its course to avoid or minimise the unfavourable aspects of change and to take advantage of profitable opportunities.\(^{(1)}\)

This is equally applicable to farming in New Zealand. As costs have risen and as greater specialization is called for and becomes possible through new techniques operations have become less flexible.

The NAA Report\(^{(2)}\) went on to describe the factors which have created the need for long term planning. Some of these factors are particularly relevant to the New Zealand farming environment.

1. The growing scale and complexity of business operations. Farm units are becoming larger as greater scales of production and intensive use of machinery and labour inputs are needed to maintain an economic unit. Because of this, investment is greater and the need to protect this investment is greater. Longer-term planning helps to determine the protection needed and given, against the uncertainties which may arise.

2. Intensified competition and changes in competitive structures. New Zealand produce is facing more competition overseas now than it has ever done, and the marketing organisations have to work hard to maintain and expand their markets. While this side of the industry may be beyond the farmer’s control, he must make use of information the marketing organisations make available; for example, those who are able to, should consider at length the call by the Dairy Board and the Meat Board for more beef and dairy beef production. What are the long-term implications of such a change? What are the investment requirements? Will such a change be necessary in the next few years to ensure the continuing existence of the farms and the achievement of objectives? Answers to such questions require information and planning — long term planning.

\(^{(2)}\) National Association of Accountants Report No.42 pp13-15
3. The tendency for personnel to become a scarce resource, caused by the population drift to the cities and the rise of secondary industry. Labour is a scarce resource in farming. In 1953 17% of the labour force was engaged in farming, but by 1963 this percentage had decreased to 11.9%, the total number of males employed decreasing by over 10,000. Because of this farming has become more mechanized and the need to plan for replacement of machinery or use contractors is necessary.

4. The tendency for lead times to become longer. While there has been this tendency in industrial organizations, long lead times have always occurred in farming, so this is an ever-present factor which helps to make planning a necessary requirement in farm management.

5. Key decisions have long-term implications. In spite of uncertainties which may arise, the farmer must have some idea of the financial and physical implications of these decisions. There are many known cases where farmers have started development programs on a certain scale only to find after a few years that there is insufficient finance to continue all parts of the program. This has resulted, in many cases for example in a reversion to scrub of land broken in, and thus the effective loss of money spent on breaking in the land. Effective planning goes a long way towards overcoming this sort of situation.

"The obvious fact that planning for a distant future period involves a considerable degree of uncertainty, does not invalidate planning. The important contribution of business planning is not the accurate prediction of the future, but instead is the identification of a range of foreseeable alternative conditions and results, and the formulation of plans to meet them." (3)

(3) National Association of Accountants Report No. 42 p17
Long term planning involves many steps, which include

(a) Establish, if they do not already exist, goals and objectives to cover the planning period. The farm manager may have set his long term objectives, but for the purposes of a planning period of say five years he will need to set intermediate objectives.

(b) Collect all the relevant information possible. Much of this information will be the past experience and current knowledge of the farm business. Other information will be available to a large extent from advisors in different organizations and accountants.

(c) Outline the constraints that will prevail, the limits of production in certain enterprises, family limitations, etc.

(d) Search for alternative courses of action to achieve the objectives. That is, select the enterprises which could be practised, determine roughly the scales of production needed to achieve the goals e.g. number of breeding ewes needed. On most farms there will be a limited number of these alternatives, and the type of farming currently practised is usually considered first.

(e) Evaluate the alternative courses of action. This may be done by use of some of the managerial techniques outlined in Chapter 7. If linear programming is used and the model is carefully drawn up with regard to constraints and limitations, then one optimum plan will appear, but all plans must be tested to see that they are not only technically but also financially possible.

(f) Divide the plan into yearly intervals to see that it is technically and financially possible. In the years when it is intended to hold back natural increase from sale to increase the size of the flock or herd, is there enough finance to carry on normal farming operations in spite
of losing this source of revenue? Is it possible to alter the financial aspect of the plan through borrowing, etc., without upsetting the technical and physical side of the plan? This sort of process will result in the selection of one of the planned courses of action.

(g) Finally check the flexibility of the plan. To what extent can uncertainties be absorbed without needing a radical change in plan?

These steps are not the end. Once the plan or plans have been formulated they must be put into practice and they must be periodically reviewed. Ideally plans should be reviewed at least annually, and as soon after the end of the financial period as possible so that differences between planned and actual figures can be checked against the overall plan to see if any alterations are necessary. Annual budgeting greatly facilitates long-term planning of this nature.

Even if supplied with the raw information, few farm managers would be capable of formulating such long-term plans on their own. In some cases farm advisory services of the nature offered by the Farm Improvement Clubs, the private consultants and the Department of Agriculture would be helpful if not necessary and in most cases some sort of financial accounting service will be needed. It is felt that the management information system should be so designed that information for reviewing of plans will be a product of the general system and not as specific analysis external to the system. But the decisions must be the farmer’s.

How long a time period should these plans cover? The author is aware of no plans that cover a ten-year period, and the emphasis is usually on three or five year periods. The period covered will be determined by

- the state of the farm, whether it is new or old, fully developed
or only partially developed

- the financial situation, for example if there is a five year mortgage on the farm it would be wise to plan for those five years, but this will depend on the terms of the mortgage.

- the age of the farmer

- the family situation of the farmer, etc.

If the farmer is middle-aged and has a family, estate planning must be considered, to ensure not only that minimal death duties will be incurred (with regard to other objectives) but also that, if it is desired, as much of the farm is transferred to the dependants over a given planning period. There are many types of planning from a practical point of view, so it will not be elaborated on here.

The Nature of Uncertainty in Farming.

As was stated earlier one of the biggest arguments against long-term planning has been the inability of those in the farming industry to control certain factors - the uncertainties of farming. It has been stated also that long-term planning helps to minimize the effect of these uncertainties, but there are other ways to minimize their effect too.

Hedges (5) speaks of five kinds of uncertainty which farmers face in their decision-making process.

(1) Technical uncertainty. This is described as the lack of knowledge of future livestock and crop yields. In effect, what makes these uncertain are the physical and biological features of weather, disease etc. that cause crops to fail, or stock to lose weight or die. To minimize the

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effects of these uncertain factors farmers who cannot afford to take the risk on higher quality but more "fragile" crops and livestock may choose lower quality but harder varieties and species, for example a wheat grower may choose the higher producing, lower quality, but hardy Arawa wheat in favour of the higher quality Hilgendorf variety if his short term financial position is critical and a crop failure because of drought could ruin him.

2. Market or price uncertainty. Few farmers know in advance what price they will receive for their produce. Little more will be said about it in this section because prices and marketing have been fully discussed in the previous chapter, under the sections on price trends and marketing of farm produce. However there is one method of minimizing this type of uncertainty which has not been discussed. Vertical integration is a method by which the uncertainty is transferred to another party. Both Hedges\(^{(6)}\) and Castle and Becker\(^{(7)}\) describe it at length, and it has had a strong impact in some types of farming in the United States, especially the poultry breeding industry. Vertical integration in its simplest form involves a contract where a merchant or marketing organization guarantees a certain price for a product at a given time, usually with the proviso that the farmer purchases seed, feed, etc. from that merchant. Some of the contracts in the United States are quite strict in that they tend to reduce the number of decisions the farmer can make and they include clauses for penalties for poor management or bonuses for sound management. However there is always a minimum price, provided the produce is delivered. An example of this on

\(^{(6)}\) Hedges T.R. pp589-592.

the New Zealand scene is the contracts for malting barley, where the
malting companies supply the seed to the farmers who gain the contracts.
A minimum price is guaranteed, but the final price varies according to
final quality and yield.

3. Technological uncertainty. This type of uncertainty concerns
the scientific and technical advances which are made in the farming industry.
The farmer has little knowledge of new developments which might make the
machinery he has just purchased obsolete, or the breed of livestock he runs
less profitable than a new one. There have been great advances in the last
thirty years including the widespread use of artificial insemination,
development of new breeds of sheep, new seed varieties, new animal and
plant health systems and new types of machinery and buildings. This type
of uncertainty will affect the long-term plans and development more so than
the short-term period. The farmer will have committed large amounts of
capital on machinery, buildings, etc., so before he does so he will need to
consider possible future developments as far as he is able. This type of
uncertainty tends to have a lesser impact on the farming situation than
other types of uncertainty providing the farmer remains aware of current
technological developments.

4. Institutional uncertainty. This involves changes in laws and
regulations, pressure group action and other institutional forces which
affect the farming industry. Farmers are accorded numerous taxation
incentives and each year brings changes in these by addition, deletion and
modification. Some of these incentives materially affect the cost and
development structure of farms and almost invariably affect the tax-paid
profit. Other institutional action includes the shipping companies involved in wool, meat and dairy produce transport to overseas markets. Whenever there are changes in the shipping rates the costs are often passed on to the farmer in terms of direct charges or lower prices for produce. There is little that individual farmers can do about such group and governmental action except through their respective marketing organisations.

5. Human traits. This type of uncertainty involves the way individuals on the farm and related to it through business dealings act and react. Especially important here is the actions of farm labour. Many farmers with whom this problem was discussed were uncertain of their hired labour and others were reluctant to hire further labour. The major reasons given were the high turnover of labour and inability to get labour to stay on the farm for any length of time. These have caused some farmers to become more heavily mechanised than they need to be, and others have ceased further development work. One method of overcoming this problem is the use of agricultural contractors.

All these types of uncertainty can have serious impact on the structuring, intensity and type of farming practised, as well as on the income of the farm. The first two types of uncertainty tend to affect short-term decisions, although continued lack of attention to ways of minimizing their effects can have serious long-term implications. The other three types of uncertainty are important only for long-term decisions usually, and cognisance of them should be made when any long-term plans are being studied or formulated.

Hedges sums up uncertainty thus:

"The manager must make decisions, act upon them, and accept the
final financial responsibility, in spite of the many different causes of uncertainty. He rarely can expect to have complete and accurate information to support all decisions; he must use estimates and his best judgment as substitutes for the missing facts. To a considerable extent his success as a manager depends upon his skill in dealing with uncertainty.  

Summary.

Because long-term planning is in its infancy in the farming industry it is too early to show as yet that such planning will always be advantageous, but if experience in other industries and the few known cases in farming are anything to go by, then long-term planning will be successful not only in helping to minimize effects of uncertainty, or in controlling the farming operations, but also in compelling the farmer to relate the future more clearly and carefully to his own objectives.

Farming in general will continue to be plagued by uncertainty and can never be free from occasional disasters. However farmers can minimize the consequences by having current information on the state of the farm, by conceiving alternative plans that could be put into operation and by using scientific and managerial techniques. This current information and information for the use of the techniques must be available from within the farm management information system.

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(8) Hedges T.R. - p28,
CHAPTER 7.

MANAGERIAL TECHNIQUES IN FARMING.

Management in any business is concerned with planning, execution and control. Whereas in all but the smallest industrial enterprises different members of the management team may be responsible for different aspects of planning, execution and control, the farmer is actively engaged in all three. It would be ludicrous to plan the farm business without having the farmer, whose business it is, active in the formulation of plans; a point which should be borne in mind by accountants who may be tempted to construct a budget purely by extrapolation from the previous period's accounts. The farmer is the chief source of labour in most cases, it is he who puts the plans into operation. Control can only be obtained if there is a day-to-day knowledge of the farm situation and a proper feedback of information. No advisor, accountant, or any other person can be in a position to analyse the farm business unless the initial information of the current state of the farm comes from the farmer. It is the job of the advisor or accountant to analyse this input information and supply the farmer, the manager, with the necessary output information needed for the control of the farm business.

These planning and control functions require information in a form that can be used by the farmer, and those who offer physical or financial advice. The execution function is one that requires general farming skill, the know-how of the farmer in understanding plans and timely information of a technical nature.

There are a number of managerial techniques that are available and
being used in the planning and control functions. The more common planning techniques in use are:

1. Budgeting
2. Partial Budgeting
3. Parametric Budgeting
4. Gross Margins Analysis
5. Program Planning

All these techniques seek to maximize something, usually profit (in its various forms), gross margin, net margin or tax-paid profit. Most of the objectives are such that they can be expressed in terms of continuing net tax-paid profit, and the only way to incorporate other objectives is to define them as constraints in the use of the techniques. All these techniques, except linear-programming itself, are really a crude form of linear-programming.

1. Budgeting

'Planning is an accepted function in management of all business enterprises. Because its use in farming has too often been associated with the exercise of control imposed by an outside agency, farmers have tended to build up a prejudice against any form of financial planning.'

This statement has been especially true of budgeting in farming circles until the last few years. During the world depression of 1929-34 an Act of Parliament, the Mortgages and Lessees Rehabilitation Act, was passed which gave power to stay legal action against insolvent farmers, provided farming operations were conducted under a budget. The budget was required to be drawn up in consultation with the secured creditors, and it was operated in most cases by an officially appointed accountant. In many

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(1) N.Z. Society of Accountants, Farm Accounting in New Zealand 1966 p.75.
cases the farmer himself was not consulted at all when the budget was
drawn up. Most of these budgets failed to achieve what they were set up
for, and because most farmers felt little or no freedom to make their own
farming decisions, budgets tended to fall into disrepute.

Since that time most secured lenders have required some form of
budgeting by the farmer, but until recent years budgets have been regarded
as a necessary evil rather than an important voluntary operation of farm
management.

However in the 1960s, and especially since the Farm Accounting
Report of 1966, with the greater emphasis on farm management planning,
budgeting has taken on a new importance and is becoming more and more
common.

Stedry(2) defines budgeting as:

1. A financial plan serving as a pattern for a control over
future operations;
2. Hence any estimate of future costs;
3. A systematic plan for the utilization of manpower material
and other resources.'

This definition of a budget implies that the type of budgets as
used in farming, the cash flow budget and the income budgets, are but the
end result of the budgeting phase. Indeed the Farm Accounting Report 1966
outline the following steps as 'essentials for a good budget:

1. A comprehensive plan of farming operations for the year or for
several years ahead.

(2) Stedry, A.C. Budgetary Control and Cost Behaviour. Award Winner
of the Ford Foundation Doctoral Dissertation Series,
Prentice Hall (1960).
2. A detailed set of livestock estimates in which the details given in the recommended accounts are clearly set out.

3. Estimates of yields and prices for all trading accounts such as wool, butterfat and cash crops.

4. A well-prepared set of accounts for the previous two or three years preferably with supporting "Cash Flow" and "What you are Worth" statements.

5. An estimate of amounts required by the farmer for personal living, life insurance, school fees and all other cash requirements which will not fall under expenditure headings in the farming estimates.

6. A set of forms with headings already available. (3)

The budget is an attempt to turn the plan and the information supplied into a forecast of cash flows and/or income and expenditure which arise from the implementation of the plan. Budgeting implies a thorough knowledge of the farm both financially and physically, and of the farmer, his family and his objectives. While the farmer is the chief source of information, it can be seen from the above essentials that unless the farmer is well educated in such matters, the accountant, or an advisor with financial and accounting knowledge, has an important part to play in budgeting. In fact it was stated by one senior advisor of the Department of Agriculture that they would prefer to leave this side of farm management to the accountant, if the accountants will take the responsibility for such an important area.

There are two main divisions of budgets:

- forecast budgeting, i.e. budgets for the next twelve-month or accounting period;
- development budgeting, i.e. for a two-to-five year planning period.

(3) Farm Accounting in New Zealand 1966 p 76.
The forecast budget is more common at this time, but it is felt that this type of budget will become more effective when it is tied in with development budgetary planning.

The forecast budget is usually written up in the form of either monthly cash flows or income and expenditure and trading accounts, on an annual basis. Both types of budgets have their advantages, the cash-flow in that the farm manager has some idea of his current financial position throughout the year, and the income-type budget in that the farmer can determine his taxation liability and his relative return on investment for the period.

Development budgeting was noted in only a few instances although the author found forecast budgeting common. All those encountered were drawn up for 3-5 years in the form of income and expenditure statements. The usual practice was to compile closely related yearly budgets for the whole development period and emphasis was placed on the physical rather than financial characteristics. For example, the stocking rate desired at the end of the planning period would be determined and the budgets would be so compiled as to achieve this rate. Once the final stocking rate was determined, each year was viewed separately and the amount of natural increase to retain and/or the number and types of stock to buy in would be decided. Once this part of the plan was completed other physical factors e.g. necessary land development, would be considered and incorporated into the budgets. Finally, financial aspects of these budgets would be considered and the budgets adjusted where necessary to ensure an overall balance between physical and financial characteristics. These plans greatly facilitated annual cash budgeting, and the annual review of the development budgets often resulted in alterations to plans of future years.
Stone\(^{(4)}\) in his discussion on budgeting outline a series of budgets for planning purposes. He describes the flow of information between them in the following diagram.

![Diagram of budget flow](image)

The time taken to gather the information and prepare such a comprehensive series of budgets when embarking on a development program would be well worthwhile, particularly if the fact that future circumstances are uncertain is acknowledged by incorporating probability estimates or showing "best-worst" possibilities.

There have been many papers given at conferences, many pamphlets prepared, and many sections in books devoted to this subject in the last ten years describing the techniques of budgeting and appraising the advantages and disadvantages. Each seems to outline a slightly different set of budgeting forms or a different set-out and emphasis in the budget.

\(^{(4)}\) Stone, J.A. *Accounting for Management in Agriculture* 1968 p 148.
It is felt that the rigidity with which any one system or type is followed will have to depend on the type of farming, and most important, the ability of the farm manager to comprehend the budget himself. While a certain degree of standardization should be maintained, not only within the one farm but also among farms, the budgets must be tailored to the objectives, the peculiarities and the knowledge of the farmer.

2. Partial Budgeting.

This is a term not generally used in accountancy. However in the farm-management field partial budgeting is widely advocated as an easy-to-use managerial technique. In accounting terminology this technique would be better known as marginal analysis or incremental analysis because

"the technique aims at comparing the increase in revenue and expenses resulting from any proposed course of action or change in practice." (5)

Castle and Becker (6) outline a system of analysis for partial budgeting. Their method has been adapted for this text to show the contribution margin more clearly as it is felt that this is more in line with accounting practice and the farmer's understanding.

Partial Budget Outline

1. Additional Receipts: Expected additional returns for products sold and services rendered as a result of the changes under consideration.

2. Less additional costs: Additional direct costs that would occur as a result of the change.

3. Net Returns from expected change

4. Reduced Receipts: Returns that will no longer be received after the change has been made.

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(5) Queensland Dept. of Primary Industries, Accounting and Planning for Farm Management 1966 p 104.
(6) Castle E., Becker M. p 134.
5. Lower Reduced costs: Estimates of costs which will no longer be incurred if the changes are made.

6. Net Returns foregone

7. Difference: The change in net income.

Partial budgeting analysis is appropriate as a technique when the proposed change is marginal in that no alteration is planned in the basic group of enterprises. Whereas in normal budgeting methods ("full budgeting") both fixed and variable costs likely to be incurred are included, in partial budgeting all or some of the fixed costs can be ignored, because management changes of the magnitude or kind for which partial budgeting is used often leave many of the costs unaltered. Should new resources have to be introduced, however, their cost must be incorporated in the budget; for example, if new equipment is needed, then indirect costs such as depreciation and maintenance must be included where possible, and if finance has to be sought for the equipment or other aspects of the change, then the interest charges should be included as expense items. In essence, then, the technique is the accountant's "differential cost study".

The information needed for the use of this technique is essentially the same as for whole farm budgeting, but less of it is used in the actual analysis. When determining returns and costs from the proposed changes difficulties may arise in estimating future yields and prices. Because conditions are apt to change so quickly in agriculture Stone suggests 'that the comparisons must include the least favourable expectations of price and yield'. (7) This would appear to be the typical conservatism of the accountant, used as a makeshift defence against uncertainty. Though some would tend to discount the usefulness of such a technique because of

this price and yield uncertainty, it must be remembered that under the same conditions whole farm budgeting suffers similarly, and its worth has already been proven as a managerial technique. The partial budget solution must always be tempered by knowledge of local conditions, and knowledge of significant resource limitations such as availability of finance, labour or contractors. A risk in partial budgeting is that of neglecting probable impacts on other enterprises, on soil fertility and other aspects of the farm as a whole. A course of action followed as a result of an incomplete partial budget analysis may result in reduced total profits, or a lesser degree of achievement of objectives.

The technique has two main uses.

It can be used in forward planning before a whole farm budget is drawn up at a time when the farm manager has a choice of enterprises or their degree of intensity in which case the partial budget may indicate which enterprises to concentrate on. The other opportunity for its use arises during current operations when the farm manager, because of conditions such as a drought or price failure, has to decide what to do with the enterprises to which he is currently committed. The consequences of the various courses of action open to him can be analysed simply in the form of partial budgets because most costs by this time will be sunk costs, and it will be the future costs and returns under each alternative which will be the deciding factors in the final decisions. This sort of situation emphasises the importance of timely information from the farm management information system.

2. Parametric Budgeting.

The term 'parametric budgeting' appears to be peculiar to farm management analysis, the actual mechanics of it being similar to cost-volume-profit analysis.
A parametric budget has been described as a refinement of a conventional budget, expressed in the form of an equation containing parameters and constants which expresses profit from a unit (i.e. per farm, per acre, per stock unit). While cost-volume-profit analysis is usually carried out on a per product or whole firm basis, the use of parametric budgeting has been largely to determine per unit margins e.g. gross margin per stock unit or gross margin per acre. Apart from this the assumptions and limitations are similar to cost-volume-profit analysis - it would be a simple matter to multiply the per unit return by the volume to achieve total returns.

The purpose of parametric budgeting is to explore the effects of changing parameters on the end results or budget results. When a budget is drawn up the farm manager has to make certain assumptions about prices, costs and yields. As has been pointed out before, all these coefficients are liable to vary according to the economic and physical climate, so parametric budgeting serves to indicate what effect various changes in these parameters will have on returns.

Stone(8) suggests that

'if his considered highest and lowest point in the range of yields and prices available to him is substituted for those on which the budget is based, his considered worst and best position can be ascertained'.

Parametric budgeting in effect can offer a series of budgets for the same production plan so that the farm manager can compare the likely range in net incomes for a particular plan, or compare alternative plans on the basis of widely differing assumptions.

An example of a parametric budget follows.

Consider a high-country sheep station producing wool and wethers.

1. Gross margin of wool per head.

\[ P = (W_p - 0.02W - 0.5) \]

where parameters
- \( P \) = Gross revenue per head (\( \mathcal{F} \))
- \( W \) = pounds wool per head (e.g., 12 lbs)
- \( p \) = price of wool cents per pound (e.g., 30c)

and constants are \( \mathcal{F}0.02 \) = selling costs per pound of wool;
and \( \mathcal{F}0.5 \) = variable costs per head, including depreciation;

therefore

\[ P = (12 \times 0.30 - 0.02 \times 12 - 0.5) \]
\[ = 3.36 - 0.5 \]
\[ = \mathcal{F}2.86 \text{ gross margin per stock unit} \]

By entering different values for the parameters the sensitivity of the proceeds from wool to changes in the price can be analysed and presented in a graphical form if desired.

2. Gross margin of wool per acre or Total Wool Revenue

An extra constant (overhead costs, \( \mathcal{F}2,000 \)) is introduced.

Extra parameters
- \( S \) = total number of wethers (e.g., 2500)
- \( P \) = profit before tax

Therefore

\[ P = (W_p - 0.02W - 0.5) S - \mathcal{F}2,000 \]
\[ = \mathcal{F}(2.36) \times 2500 - \mathcal{F}2,000 \]
\[ = \mathcal{F}5150 \text{ Total Wool Profit before tax} \]

To get the wool per acre margin simply divide by the total acreage. Alternatively, this could have been included as a constant in the equation.

By altering the parameters, the gross margin per acre can be expressed graphically according to different stocking rates.

There are many different equations which can be drawn up according to the type and degree of analysis desired. The following are among the uses of the technique:

(a) Explore the effect on the budget of input-output coefficient changes, when they are not certain, e.g., wool-weights, or crop yields.
(b) Study the effective costs and relative benefits of a new farming technique.

(c) Test the profitability of different policies under different conditions.

(d) Evolve the consequences of changes in fixed factors (the constants) which vary over time.

(e) Enable an immediate assessment of the sensitivity of a given program to changes in parameters.

The information requirements of this technique are the same as for budgeting, but further analysis is usually required to obtain the per unit figures and to refine the equations. Because it is more flexible than partial budgeting, its major use will be where risks are greater or where parameters cannot be determined with a high degree of accuracy.

Parametric budgeting will not be as time-consuming as it may seem because in any particular plan the number of parameters of importance is usually small and once the original budget is set up and the equations defined, one may readily solve for the various values of interest.

4. Gross Margins Analysis

While in the long-term all costs are variable, at any one moment of time or production period there are a large number of costs which remain fixed, for example, mortgage repayments and interest, land tax, insurance, rates, depreciation, etc., and drawings to a certain degree. These are expenses which the farm manager has to meet each period, and his planning for production has to allow for them to be covered, if he is going to stay in business. In the short-run then, while the farm manager can ignore these costs as they affect each enterprise, he should plan to have these
enterprises on his farm in relation to land, labour and capital resources available, which will contribute most to meet these fixed costs. Gross margins analysis is a technique used to program that combination and intensity of enterprises according to the given constraints on land, labour and capital, by analysing the gross return (i.e., gross revenue less direct costs) per unit (usually per acre) which tends to maximize the gross income for the farm for the period under review.

The assumed objective in gross margins analysis is to generate the greatest margin over and above direct costs to meet the fixed costs of production and profits. The basic technique is to list the activities available in terms of gross margin per unit, and devote as much of the resources as possible to those with the highest gross margins. The similarity with linear programming will be noted.

The information requirements are similar to those for budgeting, but more specifically the following should be known:

(a) A list of feasible activities given the specific resources and fixed cost structure.

(b) Average levels of expected performance i.e., yields and prices.

(c) The level of fixed costs.

(d) The unit for basis of comparison e.g., acre, man-hour etc.

The NZEI publication outlines the four basic steps in gross margins analysis.

First, by means of budgets, estimate gross margins for all livestock and crop enterprises or rotations which are possible on the particular property with the existing facilities.

Second, adjust gross margins so that all enterprises are being compared over the same period.

Third, determine what factors limit the expansion of a particular
enterprise.

Fourth, formulate the farm plan by selecting as great an area of the most profitable enterprise as possible; that is until some factor such as suitability of land or the availability of labour becomes limiting. Then include as many acres of the second most profitable enterprise as possible and so on until land or other limiting factors have been used up. (9)

The major uses of gross margins analysis may be summarized -

1. To explore the effect of changes in yields or prices on the total gross margin of the farm.

2. To assess the technical and economic efficiency by comparing all gross margins and perhaps comparing these with others achieved in the district under similar conditions.

3. To assess or make marginal changes in existing plans. This is perhaps the major application for the technique e.g. analysing the advantage or otherwise of taking ten acres out of pasture and into cropping.

Limiting factors include -

1. Availability of physical and financial resources e.g. a certain type of soil or crop; land availability and the time factor involved - a crop of rape takes one year to grow to harvest, whereas wheat takes about half that time; labour availability and demands, and seasonal peaks; demands for working capital under certain programs.

2. Institutional factors such as the contract limits available for growing malting barley.

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(9) Queensland Department of Primary Industries 1966 p.118.
5. Psychological, personal and other managerial factors.

Stewart(10) for example shows that a higher gross margin is achieved in a certain area by breeding replacements to a flock rather than purchasing two-year ewes, but few farmers in that area actually do this because there are other managerial factors that are considered more important.

Garrett sums up gross margins thus:

'A good method worth attempting but results from it require careful inspection and the application of common sense before being used in actual farm programmes. Probably its greatest value arises from the fact that it can provide a logical basis for selection of enterprises for alternative budgeting and so does not rely on the great accumulation of wisdom and experience necessary for achieving good results in this field using the instructive process. This is most important because farm managers have to begin managing without this wisdom and only acquire it over the years.'(11)

5. Programme Planning

Programmes planning is a technique which lies between gross margins analysis and linear programming in its degree of sophistication. In fact it has been described as a "poor man's linear programme". It is similar to gross margins analysis in that it aims to maximise total gross margins, but it assumes that there is more than one limiting resource.

The basic information requirements to undertake programme planning are -

1. A list of activities or enterprises by gross margins.

(10) Stewart J.D. Farm Management Notes No. 7 (1968) Lincoln College Department of Farm Management Mimeo Notes p. 33.

2. A list of limiting resources and other constraints.

3. A calculation of the requirement of each activity for its resource, i.e., input-output relationship.

Having these, the general procedure is to select the activities or enterprises on the basis of return to the most limiting factor, first assuming land is, until a complete plan is built up. The plan is built up by choosing the activities giving the highest return to land up to the limit of known restrictions, then working down the hierarchy of gross margins until one of the resources is exhausted. Having done this attempt to utilize resources not fully exhausted by selecting enterprises that give the highest return per unit of the resource that has been exhausted. Continue this process until the gross margin is maximized.

The following is a worked example.

Given the following alternative activities, resource availability, resource requirements and the constraints of good husbandry, the aim is to determine the plan which maximizes profit.

(a) Resource constraint.

Land 300 acres  
Capital $3,000  
January-February labour is 300 hours, these being the critical months for labour.

(b) Characteristics of alternative activities.

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Per Acre Gross Margin</th>
<th>Per Acre Capital Reg'nt</th>
<th>Jan-Feb. Labour Reg'nt. hrs. per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peas</td>
<td>50</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Potatoes</td>
<td>68</td>
<td>250</td>
<td>1</td>
</tr>
<tr>
<td>Wheat</td>
<td>64</td>
<td>44</td>
<td>2</td>
</tr>
<tr>
<td>Barley</td>
<td>40</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Specialist White Clover</td>
<td>70</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Specialist Ryegrass</td>
<td>30</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Ewe flock - 2 year ewes</td>
<td>9</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>Ewe flock - breed replacements</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ewe flock</td>
<td>9</td>
<td>3</td>
<td>0.5</td>
</tr>
</tbody>
</table>
(c) Other constraints.

140 hours of labour must be set aside for overhead work.

- Maximum specialist White Clover: 30 acres
- Minimum Ewe Flock: 30 acres
- Maximum Potatoes: 6 acres
- Maximum white straw crop: 30 acres

Selection of enterprise based on return per acre:

<table>
<thead>
<tr>
<th></th>
<th>Acres</th>
<th>Gross Margin per acre</th>
<th>Capital per acre</th>
<th>Labour Unit</th>
<th>Labour Unit</th>
<th>Capital Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Clover</td>
<td>30</td>
<td>70</td>
<td>13</td>
<td>390</td>
<td>5</td>
<td>150</td>
</tr>
<tr>
<td>Potatoes</td>
<td>6</td>
<td>68</td>
<td>250</td>
<td>1,500</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Wheat</td>
<td>80</td>
<td>64</td>
<td>14</td>
<td>1,120</td>
<td>2</td>
<td>150</td>
</tr>
<tr>
<td>Peas</td>
<td>184</td>
<td>50</td>
<td>16</td>
<td>2,944</td>
<td>4</td>
<td>736</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>300</strong></td>
<td><strong>5,954</strong></td>
<td><strong>16,588</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This gives maximum use of land, but both capital and labour are over-utilized. Because capital is over-utilized more than labour rearrange the program to reduce capital requirements.

Returns to capital of enterprises are:

- Ewe flock - breed: £10.00
- White Clover: £5.38
- Wheat: £4.36
- Barley: £4.00
- Peas: £3.12
- Ryegrass: £3.00
- 2 wethers replacement: £3.00
- 2 year Ewes: £2.25
- Potatoes: £0.27

Retaining the program maximized to land as much as possible, substitute at the margin for the enterprise with the lowest return to capital. Remove potatoes and replace with 2 year ewes - 6 acres

Capital saved = capital required for potatoes - capital for 2 year ewes.

\[ \text{Capital saved} = 6 \times (250 - 4) \]
\[ = 614.76 \]
bringing total capital required down to £4,478, which is still £1,478 over-allocated. Remove 2-year ewes and replace with 2-tooth rep. ewes
Capital saved = 6 (4-3)
= 6
bringing over-allocation of capital down to £1,472.

Remove 2-tooth rep. ewes and replace with ryegrass - 6 acres
Capital saved = 6 (5-10)
= -£6.2

bringing over-allocation of capital up to £1,514. Remove ryegrass and replace with peas - 6 acres.
Capital saved = 6 (10-16)
= -£36

bringing over-allocation of capital to £1,550. Wheat and white-clover are already at their maximum use, so replace peas with breeding-ewes.
Capital saved = £16-1
= £15 per acre.

Acreage to use = 1550
= 10.4 acres to the next integer.

Partial Solution.

<table>
<thead>
<tr>
<th>Acreage</th>
<th>Gross Margin per acre</th>
<th>Capital per acre</th>
<th>Labour units</th>
<th>Labour per acre</th>
<th>Gross Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>White clover</td>
<td>30</td>
<td>70</td>
<td>13</td>
<td>390</td>
<td>5</td>
</tr>
<tr>
<td>Wheat</td>
<td>30</td>
<td>61</td>
<td>14</td>
<td>1,120</td>
<td>2</td>
</tr>
<tr>
<td>Peas</td>
<td>36</td>
<td>60</td>
<td>16</td>
<td>1,376</td>
<td>4</td>
</tr>
<tr>
<td>Breeding-ewes</td>
<td>10.4</td>
<td>10</td>
<td>1</td>
<td>10.4</td>
<td>1</td>
</tr>
</tbody>
</table>

Total:
- Acreage: 360
- Gross Margin per acre: 2,390
- Labour hours: 758
- Gross Margin: 12,320

Both land and capital are now maximized, but labour is over-allocated by 98 hours. Now maximize to labour also.
Potatoes £60.00 gross margin/labour hour
Wheat 30.00
Barley 20.00
2 year Ewes 18.00
2 tooth replacement Ewes 18.00
White Clover 14.00
Peas 12.50
Breed Ewes 10.00
Rye grass 10.00

Of the enterprises used breeding ewes have the lowest return to labour so substitute peas, the next enterprise.

Hours saved = 10.4 (1-1.4)
= 3.12

By introducing 10.4 acres of peas excess hours are increased to 4.10.

White clover is at maximum already so replace peas with 2 tooth replacement Ewes.

Hours saved = 4 - 0.5
= 3.5

Substitute \( \frac{4.10}{3.5} \) acres of 2 tooth replacement Ewes for peas
i.e. 118 acres.

Solution is:

<table>
<thead>
<tr>
<th>Acreage</th>
<th>Gross Capital</th>
<th>Capital</th>
<th>Labour unit</th>
<th>Capital</th>
<th>Labour</th>
<th>Gross Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>per acre</td>
<td>per acre</td>
<td></td>
<td>per acre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Clover</td>
<td>30</td>
<td>70</td>
<td>13</td>
<td>390</td>
<td>5</td>
<td>150</td>
</tr>
<tr>
<td>Wheat</td>
<td>80</td>
<td>61</td>
<td>14</td>
<td>1,120</td>
<td>2</td>
<td>160</td>
</tr>
<tr>
<td>Peas</td>
<td>72</td>
<td>50</td>
<td>16</td>
<td>1,152</td>
<td>4</td>
<td>288</td>
</tr>
<tr>
<td>2 tooth replacements</td>
<td>118</td>
<td>9</td>
<td>3</td>
<td>3,54</td>
<td>0.5</td>
<td>59</td>
</tr>
<tr>
<td>300</td>
<td>3,016</td>
<td>657</td>
<td>11,612</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

However, this programme exceeds the capital constraint by £16, so remove one acre of peas (which removes £16 of capital) and the gross margin is £11,592 with full utilization of land and capital, and 3 labour hours to spare.
The information needed for such a problem is provided by the farmer himself, advisory organizations and accountants, and in any farm management information system such information should be readily available.

Programme planning has the following advantages -

1. It roughly complies with maximization theory in that it builds up plans according to decreasing marginal utility.

2. It indicates the effect of increasing the supply of a limiting resource.

3. It is superior to gross margins where there are several limiting resources.

4. It can be used to see if changes in the fixed cost structure are warranted.

5. It indicates the cost involved when a farmer insists on a specific enterprise.

As with all techniques, programme planning has its limitations and these include:

1. It is more time consuming than the previously described techniques because of the greater requirement of detail. However, this requirement for detail may be an advantage in some cases because it necessitates more intensive analysis of the farm and its problems.

2. It, like linear-programming, assumes linear relationships.

3. It raises real problems in handling intermediate activities, for example growing hay which will be kept for winter feed - how is this valued and included in the programmes?

4. It can be tedious because it is an iterative process.

Programme planning would be an appropriate technique to use where use of resources is critical and there is no access to a more sophisticated
and more accurate technique like linear-programming. For most farms, however, one of the more general techniques described above is usually adequate.


It is doubted whether any accountant in New Zealand has yet used linear programming for planning a farm business, but in the agricultural research field a considerable fund of experience has been built up in the last ten years in the use of this technique for farm planning. Its main use to date has been in investigational work, where it enables the determination of the optimum point of production and it has largely superseded the techniques of comparative budgeting and programme planning as an agricultural economist's tool. The principal advantage over budgeting is that it allows more alternatives to be tested with a given amount of work.

Mattessich has defined linear programming as

'A mathematical technique for determining the most desirable or most profitable course of action for a situation where a number of variables are involved, where many possible courses of action are available, and where the problem can be expressed in linear terms.' (12)

It is a technique for optimizing or maximizing an objective function subject to certain constraints, the objective function being expressed usually as profit maximization or cost minimization. While such an objective

function may not cover all the farmer's objectives, these can be formulated as linear constraints, along with the other physical and financial constraints, and included in the model. 'For example... if he wishes to have a minimum of leisure time over a certain period, the model can be suitably constrained'. (13)

The chief requirement for setting up a linear programming model is a full understanding of the problem or farm being analysed. This requires sorting out and analysing maximums or minimums of all possible activities, deriving the gross margins for these activities, tabulating the constraints upon the objective function and the expression of these constraints as linear equations and finally determination of the input-output coefficients, i.e. how much input will it take to produce one unit of each possible output or activity.

The advantages of linear programming over other methods include:

1. It gives an optimum rather than a "better" combination available under the other techniques described. It is considered that this optimum may be somewhat of a hallucination because time-lags, structural restrictions and management and human peculiarities will determine the rate at which progress is made from point A to the new optimum point B, by which time the optimum is most likely to have changed because of the dynamic nature of the farming industry. However, this criticism may be levelled at any technique and linear programming serves to give a better idea of the direction to follow.

2. It enables the evaluation at any one time of many different activities and constraints, the number of such factors being very limited in other techniques discussed.

3. It enables the critical input-output coefficients to be parameterized more easily than in other techniques.

4. Once the initial table or model is constructed the algorithm is purely mechanical; even the addition or substitution of new constraints, and input-output coefficients is mechanical once they are determined.

5. The model provides supplementary information on stability, in that the marginal value of each product and marginal costs are determined thus indicating which limiting resource should be increased first, if possible, and for which activity it should be used.

The chief disadvantage of the technique is the time and cost involved in constructing the model, and it is this reason, probably more than any other, that has served to discourage the use of linear programming in extension work in New Zealand. Because the work after the model is constructed is mechanical, computers are ideal for its development - in fact all but the simplest models would not be practical to calculate by manual methods.

General linear programming models have been constructed for computers and may be run at a reasonable cost.

Disadvantages include:

1. Unless the input information is accurate, and unless the model is properly constructed, some nonsensical answers can be given. However, the body of experience in the agricultural colleges in the use of the technique already would serve to lessen the likelihood of this happening.

2. Problems of linearity. While this assumption is adequate as far
as product prices go because of the generally perfect competition nature of farming, other factors do not present linear functions, e.g. one man can milk twenty cows, and the same man can milk fifty cows.

3. Linear programming is not easily understood by the farmer. As a disadvantage this can be overcome simply by restating the results of the model in a form that the farm manager can understand.

4. A disadvantage in the use of linear programming is the difficulty of obtaining accurate input data.

'Unfortunately information on labour inputs for various stock and crop activities on farms is extremely difficult to obtain. Ideally, this information should be obtained from the particular property being programmed because of the variation in labour efficiency between farms.' (14)

Many models, for this reason, have excluded labour requirements, and the results are correspondingly dangerous to apply until studied from the point of view of labour practicability.

5. Linear programming permits only one objective function to be considered at once, usually maximum expected profit. As was pointed out before, this one objective does not take account of the farmer's other objectives. To overcome this restriction Powell and Hardaker (15) advocate that the income objective function be converted:

'into a minimum income constraint and optimize some other objective...'

By varying the minimum income level parametrically, a set of solutions is

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obtained. This method has the advantage that all solutions lie within the range of acceptable solutions.

While the use of linear programming so far has been confined to research work in the agricultural colleges, it is felt that its use by extension and advisory services will become more important in the next decade. The factors limiting its use at the present time are
- the lack of access to computers
- the lack of model computer programs
- the lack of accurate input data and
- the lack of knowledge of the technique's existence by farmers and accountants.

However, it is felt that New Zealand will soon see its use when farm management laboratories like those in many United States universities, and those which are being developed at the universities of Western Australia and New England in Australia are established here. Because such laboratories provide and collect information from the farm manager on a regular basis, the lack of accurate input information restriction is partly overcome, as are other limitations.

Finally let it be said that linear programming should not be used for the sake of using a sophisticated technique, because there will be many problems in farm management where, although linear programming could be used, a far less rigorous technique such as gross margins analysis or partial budgeting will be sufficient. The cost of the information must be matched with its worth.

Summary of Planning Techniques

The above are but some of the planning techniques available for farm
planning. There are more sophisticated techniques such as Monte Carlo programming and Simulation which are being used in research work to a certain extent in the United States, the United Kingdom and Australia. These more sophisticated techniques require more computer space and more variables and accurate input data. Stewart (16) however has summed the techniques up thus,

'Remember that any method of farm management analysis is only as good as the data which is available, and no amount of mathematical sophistication will give useful solutions from inadequate data. Indeed the inadequacy and uncertainty of farm production data severely limits accurate farm management analysis of any kind, from budgeting to the more sophisticated refinements of linear programming.'

THE CONTROL FUNCTION

Control of the farm business implies not only the day-to-day decisions needed to meet the changing circumstances of farming, but also the checking of progress with the current farm plan. Inevitably, if there is a comprehensive system of operation planning with readily-understood plans in the hands of the farmer, the major aspects of control will be seeing that progress is made towards the achievement of the planned goals, or to consider a change in plans because of some unexpected factor arising in the course of the production cycle. The farmer is the controller in most farming enterprises, it is he who makes the decisions according to the circumstances prevailing and it is he who takes the consequences. Control for the farm manager means control over physical features, control over finance and control over costs. All of these are somewhat interrelated.

There are several techniques available and in use for control purposes, the chief ones being the techniques previously described as planning.

(16) Stewart J.D. Developments in Farm Management Analysis. Canterbury Chamber of Commerce Ags Bull. No 397 (1962)
techniques. As was indicated above, for effective control there must first of all be a plan and the very fact that planning takes place helps fulfil the control function in a number of ways including:

(a) the process of gathering information to enable planning to take place often highlights inadequacies in the keeping of records, and for effective control, adequate records must be kept.

(b) the plans, if properly compiled offer a measure for checking current operations i.e., are the current results similar to the planned results to date, and if not, why not?

Control of physical factors on the farm, while a very important management function, gains very little help from accounting. Nevertheless, information for this type of control is very important and the farm manager has a number of sources available to him. The Department of Agriculture, for example, through its advisory and its Agricultural Information Centre has a number of pamphlets etc., outlining solutions to such problems as pest-control, disease-control etc. The agricultural colleges and the various research units throughout the country keep the farm manager as up-to-date as he wishes to be, on all the latest research into increasing efficiency of land, labour and livestock, reducing risk of and combating diseases, and so on. There are a number of radio and television programmes weekly, and numerous journals, as well as personal advice available for the benefit of the farm manager in the field of management.

The accounting role in the area of physical control is in the analysis of results, the preparing of statements showing such things as output per acre, or per unit of livestock, or per hundredweight of fertiliser, etc. Providing the farm manager supplies the correct information, these
ratios can be helpful in analysing the efficiency of the physical factors, the factor-factor and factor-product relationships.

Financial control is an area which the farmer is usually not qualified to completely handle himself. It implies not only control over current finances but also control over long-term use of finance. The techniques used are mainly those of budgeting both on a monthly and developmental basis, and capital expenditure analysis. As an example, The State Advances Corporation, when considering an application for a development loan usually calculate budgets for each year until the break-even year, i.e. until there is no longer a loss on operations. This gives them an idea, expressed in cash flow terms, of when the farmer will be able to meet principal repayments. It also gives an indication of the relative profitability of the proposed development. Financial control is important if only for the reason that expenses are incurred and have to be paid for in a large number of cases long before the income is received. There has been considerable emphasis in recent years on the idea of cash-flow type budgets to assist financial control during the year, so that costs of temporary finance can be minimized.

With cost control the same techniques apply, for the costs of the next period are usually fairly well known at the planning stage. In the short-run, a substantial proportion of costs tend to be rigid, and if they do change the farm manager does not usually have much control over them. The only way to overcome increased costs on some occasions is to avoid them altogether e.g. if prices of drench rice the farmer has three choices; to incur the extra cost, to cut down on the quantity used, or to cut it out altogether. What the farm manager really needs in these circumstances
is cost-benefit analysis. He needs to be able to determine the probable reduction in gross output which would occur if he cuts down on some expense item like fertiliser or animal health. If the reduction exceeds the cost then obviously it is better to incur the cost. Cost-benefit studies have been carried out on various resources, especially fertilizers, and most farmers are aware of the benefits in output terms, but the real need for this type of analysis is when prices are fluctuating. Is the extra cost going to be worthwhile? The farm manager may know that by applying a certain amount of extra fertiliser he will get a certain percentage more feed, or by drenching his flock he will get a greater percentage of meat-weight, but does he know at what price of the inputs, the benefits are less than the cost?

This sort of analysis requires past figures for the same farm or figures from farms of a similar type in soil context, drainage, enterprises and so on. The problems involved in obtaining this type of data are the same as those in obtaining the output per unit of input figures needed for linear programming studies. A step in the right direction towards obtaining this sort of information was begun in the 1940s in the United Kingdom under the term of comparative analysis, but it got out of hand and became almost an end in itself. On the output side they designed a "systems" index which reflected the intensity of the farming system and a "livestock" or "crop-yield" index to reflect the efficiency of factor control. On the input side they designed standards for labour and machinery inputs per £100 of output, etc.

These figures were used however, not for cost-benefit analysis but for analysing farm efficiency. By building up samples of farms of similar
types in similar areas, and taking the top ten or twenty-five per cent, the analysts hoped to determine the efficiency with which each farm was run, in its use and intensity of resources and in farm management ability. There are many deficiencies and pitfalls in the use of standards in this way and because such a use became widely criticised by farm management experts in New Zealand and Australia, e.g. Candler and Sargent, the whole technique, including the derivation of standards tended to be criticised and cast aside in these countries.

The use of standards of some sort however is essential to the control function. There must be something to compare results with - even budgets are a form of standard. However it is felt that for accurate farm efficiency analysis and cost benefit analysis, there must be more adequate standards especially of input-output relationships.

Advisors and analysts in this country do have standards which they use in their work, but they are seldom derived as a result of some analytical system. They are what Candler and Sargent call 'subjective Standards' and their view is that

'there is no evidence that the manipulation of farm records has ever produced a farm standard which is of more use than the subjective standards which an advisory officer is bound to establish as a result of his day to day contact with the farming community. A farm advisory officer ought to know the usual rotations in his district, the usual fertilizer levels, the usual yields and the usual complement of labour.'

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(17) Candler W. & Sargent D. *Farm Standards and the Theory of Production* 
It is not at all clear that any averaging of farm records can add to this knowledge.\(^1\)\(^2\)

The sort of standards thus envisaged would be something like these:
- butterfat per cow at least 300 lbs
- fertilizer per acre minimum of six cwt
- full utilization of August grass

for a Taranaki dairy farm with high production. These are termed crucial ratios for that type of farming, but are they sufficient? Blagburn\(^3\)
in his rejoinder to Candler and Sargent thinks not.

'It is... a little surprising to find that ... they regard the so-called "subjective standards", established by advisory officers through their day to day contact with farmers, as of equal value with those obtained by farm economists. These advisory officers' standards are not of course "subjective". There can be no inner knowledge on such matters as crop yields, milk yields or labour requirements. These standards are, in fact, pseudo-objective standards resulting from casual and often highly inaccurate observations of an unorganized nature, and it is astonishing that they should be regarded by statisticians as of equal value to those based on reasonable accurate records, assembled and analysed in an organized manner.\(^4\)

In theory there is no substitute for accurate standards but there are distinct problems associated with them.

1. Derivation of standards will require standardization of accounts and classification of expense and income items, especially for inter-farm comparisons. A big step in this direction has been the widespread adoption of some of the recommendations of the N.Z. Society of Accountants\(^5\) in its latest report.

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\(^1\) Candler W. & Sargent D. p 289.


\(^3\) Farm Accounting in New Zealand 1966.
2. The standards for an individual farm derived from past farm records must be checked to see that allowance is made for unusual circumstances that may have arisen in years considered.

3. Perhaps the chief limitation is the cost of preparation, maintenance and use of standards. The person advising the use of standards must first have some idea of their potential benefit to the farm manager, and then decide whether the cost is justified.

4. Very few, if any, farms are exactly alike. When analysing inter-farm efficiency, farms must be carefully grouped by soil-type, drainage, degree of mechanisation, type of farming, etc., if the standards are to be meaningful. This raises the question of how far an analyst should go in comparing farms according to standards. It may be possible in the future to use sophisticated mathematical techniques to bring similar farms down to a common base by applying indices weighted according to the dissimilar factors involved.

5. Care must be taken when using the standards that not too much emphasis is placed on them when deciding why production has varied. There may be a logical explanation like a flood or inability to hire labour when it was required. Standards could be weighted to show the degree to which adversities or unusually favourable conditions are well managed.

6. Standards should be used only as indicators of weakness not as targets themselves.

Because there are problems associated with standards the use of "subjective standards", as they are called will continue, and they may well be the start of an evolutionary process which results in more formal standards in years to come.

The functions of planning and controlling in the farm business may
use these and other techniques which undoubtedly will increase the effectiveness of such functions, but these techniques must not be allowed to become ends in themselves.

'The purpose of farm management advice is to assist the farmer to run his farm successfully as a business, though business success is not necessarily the only thing in which the farmer may be interested. Too much emphasis on other motives may, however, result in very little or no financial return whatever being made.'(21)

It is the use of the information derived from these techniques, applied with a sound knowledge of the farm manager's ability, and the farming situation, which will determine whether the planning and control functions are satisfactorily performed.

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(21) H.M.S.O. The Farm As a Business London 1958, p.3.
CHAPTER 9.

ACCOUNTING SYSTEMS FOR FARM MANAGEMENT NEEDS.

'Accounts form the basic records of any business including the farm business, and if we are interested in business efficiency, we must have access to well-presented and comprehensive accounts to obtain the information required to assist us in diagnosing and analysing the strengths and weaknesses of the enterprise.' (1)

When thinking of accounts and management information systems for farmers, one has to remember the differences between the farm organization and the large industrial organization. Large industrial organizations usually have systems whereby information is being produced by subordinates at every production level and in every section from storage to clerical activities. Information so produced, on predetermined forms and usually in at least duplicate, has distinctive flow paths, with controls on the passage and accuracy of the information being maintained at different levels. Each item of information in a well-designed system is produced for a specific managerial purpose. Information of this nature, and that from other sources, is periodically collated and analysed by a central accounting section which uses it to prepare appropriately timed reports for management's planning, controlling and decision-making activities.

However in the farming organization, little if any internal information in the form of time-cards, job-sheets, stock-sheets, etc. is produced. Information to the accounting system in farming comes from the farmer himself, sometimes from memory and sometimes from prepared forms, cheque-buts, etc.

- from outside organizations in the form of invoices, statements, etc.

- sometimes from advisory organizations.

Most of the information is produced off the farm, and it is collated, given structure and analysed by an accounting organization which usually serves many farmers.

In the large industrial organization the sole task of the accounting department is to control the information and give managerial and financial reports to management at specific times. The accountant for a farming organization is responsible to many other organizations at the same time, numbers of which require their reports at the one time. No two large industrial firms have exactly the same sort of information, because different management teams have different ideas of information flow and needs. Farmers, too, have different needs and desires as regards information. Because the farm accountant serves many farmers he tends to have one basic system for preparing accounts, and reporting to the farmer, the system varying only between different types of farming and different forms of organization, e.g. estates, companies, partnerships. Much has been written about accounting reports thus processed and about the lack of imagination and ability on the part of the accountant to provide more meaningful accounts, and there are many systems described in various texts and in operation today which allow for flexibility in the system to meet personal requirements of farmers while maintaining a degree of standardization in presentation of accounts as desired by external bodies.

Farm management information is the concern of a number of groups of people, and any management accounting system for farming must meet the
needs of each of these groups as far as is able. The groups are:

1. The farmer, who needs his accounting data not only for end of year assessments, but for the everyday management of his business. Allowing for any legal requirements, all farm management accounting must centre round the farmer's needs first.

2. The Advisory people, whether they are in private firms, farm improvement clubs, dairy companies or government bodies. They need accurate and timely information so that they can advise their farmer clients.

3. Agricultural Research people, in the Agricultural Colleges, governmental agencies, Agricultural Research Units and in the Producer Boards. These people require information that is standard in presentation so that as little alteration as possible is required before the information coming from many different sources can be analysed.

4. Lastly, the farm accountant both in his capacity as producer of the information and in his capacity as user. He needs an accounting system which is economical while still supplying the farmer, and through the farmer the other groups, with adequate information by way of reports, professional advice and explanation.

One of the problems with farm accounting has been the inapplicability of its reports to the needs of the farmer and other interested parties. A much-voiced, but fair criticism of the reports and systems has been that they are prepared to tax purposes. It was the introduction of taxation which first made farmers turn to accountants for reports and accounts. To overcome this problem it is felt that the types of accounting themselves should be reviewed. There are essentially two main types of accounting,
financial and managerial. Massie\(^{(2)}\) in defining the terms had this to say.

'Financial accounting involves an orderly process by which the business transactions of a firm are recorded, classified and summarized in a manner prescribed by a body of principles. The ultimate objective is to present the financial condition of a firm so that a variety of interested parties can make evaluations about the firm.

Managerial accounting, on the other hand is not concerned with a variety of parties; rather attention is focused on the operating manager. The principles and assumptions that underlie financial information limit the usefulness of this type of information for management purposes. Managerial accounting techniques must be flexible and "tailor-made" to the individual firm.'

Because the cost of preparing financial and managerial accounts separately is prohibitive to the farmer, accountants have to integrate these two aspects of accounting without losing any desirable characteristics of the separate systems. By using a code and classification of accounts similar to that outlined by the New Zealand Society of Accountants,\(^{(3)}\) accountants should be able to meet requirements of interested parties in the preparation of financial accounts. For managerial accounting, however, the emphasis is more on frequent and timely reports compiled in such a way as to be meaningful to the farmer.

To this end it is felt that while manual and mechanized accounting methods will be adequate in some cases, computers for accounting for farmers will have an increasingly important role to play in ensuring timely and standardized accounts, not only for managerial purposes but also for financial purposes.

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\(^{(3)}\) *Farm Accounting in New Zealand* pp114-124.
Computerized Farm Accounting

There are a number of computerized farm accounting systems in various stages of planning and operation in the United States, Australia and New Zealand.

Michigan State University has been operating an electronic mail-in farm record system called TELFARM since January 1964. The farmers, numbering 1270 in 1965, mail in to the university regular monthly, quarterly and annual input which is coded and processed and returned in the form of reports and summaries. All participants are enrolled by county agents i.e. advisory officers, on behalf of the University. Depending on his needs and desires and on the amount and type of information sent in, the farmer may receive:

(a) quarterly and annual financial reports
(b) a detailed depreciation schedule
(c) other pertinent reports e.g., enterprise accounts, and analyses of family drawings accounts.
(d) farm business analysis report, which compares the farm with other similar farms in the system, strengths and weaknesses being highlighted.
(e) the equivalent of our Wages Reconciliation Statement
(f) Income Tax Statement.

All summary reports are optional. A survey taken in 1966 revealed

1. Dairy farmers especially were eager to use the system because they had had experience with computer print-outs through herd-testing reports, as do New Zealand dairy farmers.

(4) Michigan State University What Do Farmers Think of TELFARM? (Ag. Econ. Report No. 38 1966)
2. Farmers participating in the program adopted twice as many improved farm practices as those who did not participate.

3. Over 90% of the participants revealed that they used the periodic reports to see how well the farm was doing, and over 70% revealed that they consulted the reports when problems occurred and for deciding the best course of action.

4. Farmers who participated in the program, when compared with farmers who did not, increased the value of farm production by $225203 more each year; and increased net farm earnings $70803 annually.

The system is successful because not only is the information timely, and in a form the farmers can understand, but the reports are sufficiently flexible in type and content to accommodate many different desires, and there is an extensive advisory and educational programme run in conjunction with it.

The University of Western Australia (5) has since early 1967 been running what is called a Farm Management Service Laboratory, starting with 452 farmers. This laboratory was set up to provide three services, which together would cover most management information needs of farmers. These services were described as

(a) A managerial information service which is designed to help the farmer to understand his farm business fully; to evaluate past performance; to control current operations; to plan ahead; and to improve his credit-worthiness. This service in the form of computer print-outs prepared from input data direct from the farmer is aimed at satisfying the needs of not only the farmer, but the accountant, farm advisor or consultant.

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(5) Maudlin B. Schapero, and Trevor D., The Farm Management Service Laboratory of Western Australia in 'Farm Policy' Vol. 7 No. 2 (1967).
and creditors.

(b) A seminar service, which is designed to show how to use the managerial information service and further to provide information on, and how to use, results of current research into farm management.

(c) A planning and problem-solving service which seeks to use computer techniques to speed up the processing of plans and budgets and comparative statements.

They offer a wide variety of statements, some monthly, others quarterly and most annually, ranging from the monthly Cash Flow statements to annual Assets and Liabilities statements and summary comparisons between farms for consultants. The farmer, though he may elect to receive statements less frequently, is advised to send his input information in monthly, so that it can be processed on a regular basis.

The accounts and summaries are designed for the farmer in that they largely ignore traditional accounting set-out and terms. For the benefit of any accountant who may be receiving the summaries there is a tax-year listing of operations, and to further reduce the paper-work for the farmer there is a listing of the statistics that must be supplied to local agricultural authorities annually.

The Seminar service keeps the farmer up to date on latest technical developments, an essential part of any farm management system. The Planning and problem-solving service aims firstly to prepare long-term plans for the farm, usually by means of a linear-programming model. From this point other types of planning problems will be tackled to extend the scope of linear-programming. Models for problems such as livestock and plant replacement will also be developed, the aim being to make as full use as possible of the information the farmer initially sends in each period.
The Laboratory maintains a complete record of all figures which have been provided by the farmer and copies of all print-outs are kept, supplying a wealth of information for any possible future planning or problem-solving operations.

Not satisfied with a static system, the administrators of the system intend to review the needs of farmers, management consultants or advisors, and accountants periodically and make alterations to input collection forms, computer programs and print-outs, where necessary.

The Farm Management Laboratory system thus offered by the University of Western Australia, if it fulfills all it says it will, provides a totally integrated management information system for farmers and their associates. The accountant will still be part of the management team in that the farmer will need him for financial and taxation services and advice, but it is conceivable that even this sort of advice may eventually come through the Seminar Service. Management accounting information is provided through the various summary reports and through the monthly cash flow statements, and financial accounting information is provided also through some of the summary reports. Scientific and technical information is available through some summaries and through the Seminar Service, and planning information is provided through the third service, the Planning and problem solving service.

It is felt that this sort of laboratory system offering similar services designed for the New Zealand farming environment is needed in this country. Among the advances that have been made in this direction are two different approaches, one by Mr. W. Payne of Massey University, and the other as a joint project from the Farm Management Department of Lincoln
College and the Department of Accountancy at the University of Canterbury.

The system at Massey University is unlike the systems previously described in that it does not rely on regular monthly or quarterly inputs of information. Rather it produces all statements once a year, some as a projection of the coming year, and others as financial and management information for the year just completed. The programs as set up are designed to inform farmers of the advantages of receiving accounts raised for management, and not tax purposes. Many farmers who participate in the system still receive their taxation accounts as prepared by the accountant, but they also receive the computerized management accounts. To produce the end-of-period accounts the university receives data input forms which are at this stage being made up by the accountants. The information includes that from which an accountant would normally draft the taxation accounts, plus other pertinent data. This information is processed and the following accounts are supplied to the farmer and his accountant.

1. A Profit and Loss Statement. This is unlike a normal profit and loss statement in that it shows in detail, changes in livestock over the period, details of farm produce sales and only a brief summary of expenses. Fair market value is used for livestock values because it is thought to be of greater managerial significance than standard value. Taxation incentive items are not included, and an imputed charge for labour is made so that the net return to capital and management is obtained.

2. An Analysis of Expenses, which shows expenses in detail giving comparisons with the previous year, the percentage of the example to gross profit and the cost per lb of butterfat or whatever is the chief source of revenue.

4. A Statistical Report showing numerous management ratios, percentages, etc.

This part of the system is essentially a computerized modification of Guise's (6) system for standardized accounts for managerial analysis, with a statistical report added. The Massey system is not as sophisticated as others described mainly because there is a lack of adequate computer facilities and staff to operate a sophisticated process, and information from financial accounts is used because in the words of Guise

'Since they provide the only information available on individual farm financial performance, they must of necessity provide the starting point of the analysis, though extensive adjustments to them will be necessary before relevant information can be obtained.' (7)

Information to this part of the system may come partly from another source, and that is the projected cash flow print-outs provided at the beginning of each year. The farmer or his accountant, or both, fill out a number of forms to show planned expenditure and income during the year in monthly terms, plus a stock reconciliation. These are processed and the farmer receives a predicted working capital statement showing capital income and capital and revenue expenditure separately on a monthly and cumulative basis, plus various other projected figures including expected tax, total exemptions and a graph showing the working capital profile for the year. If the farmer uses his working capital statement monthly and

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(7) Guise J.W.B., p. 15.
and updates the projected figures with actual figures he will have, at the end of the period, much of the information required for the managerial analysis programmes.

As a system designed to interest farmers in managerial analysis it will only be successful if farmers are shown how to use the reports provided, and as a result, they do use them for planning, controlling and analysing their business operations. The next step would then be to design a system which provides more periodic and timely information, which will enable more detailed planning for longer periods and closer control over current operations.

The joint project of Lincoln College and the Dept. of Accountancy at the University of Canterbury which in 1964 began pilot operations with only eight farmers seeks, on the other hand, not to use the financial statements as a starting point, but to integrate financial and management accounting systems into one complete system, as Michigan State University and the University of Western Australia have done. The joint project is very similar to these overseas systems, but care has been taken to design it for New Zealand conditions.

Carrington described several fundamental issues on which the system organization would depend, in their order of priority. These included

(a) Deciding upon the nature and frequency of the information output which would be necessary to meet the demands of the farmer for both financial and farm management advice, as well as serving special interests such as those of research workers...

(b) Preparing an analysis of the data input needed to provide for the desired output, including consideration of the most simple and reliable means of initial recording.

(c) Devising a code of accounts which would be comprehensive and flexible without becoming unduly elaborate...
(d) Agreeing upon the most effective allocation of functions among
the participants i.e., the farmer, the farm management advisors and the
Department of Accountancy, (simulating the role of the farmer's accountants).
(e) Setting what form of equipment should be employed.
(f) Selecting the size and composition of the sample of farmers to
be included.

Using these issues as guides to planning, an accounting system was
designed, and beginning June 1966 a further pilot scheme of ninety farmers
was commenced. Each farmer obtained the agreement of his accountant and
was associated with one of twenty farm advisors. The farmers filled out
carefully designed forms on a monthly basis and these were sent to the
university where they were edited and processed. The resulting cash flow
statements etc. were sent to the farmers, the accountants and the advisors.

The project was successful except that there was a lack of available
labour and finance at the processing end to edit and collate the input data.
Consequently, though all parties were pleased with results in terms of
type of information supplied, the project was suspended.

However in 1969, with a thorough revision of the input and output
requirements, the project has been updated and re-written, keeping in mind
the issues described above, with the following specific system objectives.

(a) provide monthly (or bi-monthly, quarterly - even annual)
management information.
(b) provide less frequent (e.g., quarterly or annually) financial
and taxation information.
(c) provide this information in a cheap and flexible manner

(8) Carrington A.S. The University, The Profession and Farm Accounting,
Research Unpublished Seminar paper University of
Canterbury p.4.
(9) Those in the team preparing the project included Prof. J.D. Stewart and
Mr. M.W. Taylor for the Dept. of Farm Management at Lincoln College, and
Messrs. B.J. Clarke and C. R. Osborne for the Dept. of Accountancy at the
University of Canterbury.
(d) serve to integrate and co-ordinate the functions of the farm manager, the farm management consultant and the public accountants (or other financial advisor) by providing them with statements which are accepted common measure of the farm entity and its activities.\(^{(10)}\)

Further emphasis has been placed on the following

1. Budgeting, in that all participants will be encouraged to submit budgets for each financial period so that the periodic cash-flow statements will be more useful and meaningful.

2. Efforts have been made to reduce the detail of information given to farmers, because in the previous version the statements were too bulky to be assimilated monthly. However the system is flexible and farmers will be able to get more detailed statements when required.

3. Enterprise accounting, in that it is considered sound managerial accounting practice to determine returns and expenses by enterprises where possible. To this end, and to extend the usefulness of the system to as many types of farmer as possible, a total of seventeen enterprise have been included. Even the cash-flow statements show returns and expenses by enterprise.

4. Wherever possible, from a management and system economy point of view, efforts have been made to ensure farmers have as wide a choice of detail, enterprises and number of reports as possible.

The Statements produced include

(a) Changes in Working Capital or Cash Flow Statement, produced when the farmer sends in data, whether monthly or quarterly etc.

(b) A brief Cash Profile Statement which shows the actual and projected overall monthly movements in cash, during the financial period.

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\(^{(10)}\) Clarke B.J., in a memorandum to Lincoln College, February 1969.
(c) Enterprise Trading Accounts which may be produced on request and which will be automatically printed towards the end of the farming year.
(d) Farm Working Account in a simplified form.
(e) Appropriation or Drawings Account, where necessary, again simplified so that it will be easily understood by all parties.
(f) Balance Sheet.
(g) A "Where Your Profit Went to", or Source and Disposition of Funds Statements, to show in summary form how the profit was used.
(h) A Budget Summary, to be printed on request to facilitate budget revisions, which can be included at any stage of the financial period.

As the system progresses in operation periodic reviews will be made and it is envisaged that new statements may be included, for example, a statistical report similar to the one produced on the Massey system. However before being added to the system any reports must justify their usefulness, and the system must be considered the best source from which they should be produced.

This system is sound in that it gives farmers information that they can understand and use at regular intervals, it gives advisors adequate financial and some physical information from which analyses can be made, and it gives accountants accurately prepared accounts very quickly after the end of the financial period, from which taxation reports and future financial advice can be produced. Prime characteristics of the system are its foundation on sound accounting techniques and its superior accounting presentation.

This joint project, providing it stimulates management planning and controlling on the part of the farmers with any necessary advice from other parties, and providing the whole service can be extended to include such planning devices as linear-programming models as part of the system, will
Conclusion

Farm records are of little value unless they are analysed, interpreted and used in decision-making by the farmer. To make farm records valuable requires a farm management information system which supplies to the farmer records in such a form that they can be analysed and interpreted by him. The reports and records must stimulate decision-making, they must highlight problem areas on the farm or at least serve to confirm the suspicions the farmer already has as to problem areas. Only when the reports are timely and only when the farmer has been educated as to their use, will they be of any benefit to him. Rather than design an information system which is academically sound, or ideal on paper, organizations involved in supplying information to farmers would surely be better off when they first look to the needs of the farmer, to the farming situation, its peculiarities and limitations as to information flow, and then design a system which provides information which will aid the farmer in his drive towards achieving his own objectives, in controlling current operations, in minimizing effects, uncertainty, and in planning physical and financial operations.

The systems mentioned above have to varying degrees achieved these aims, and it remains, in New Zealand at least, to implement these systems on a large scale, and then review them to analyse their effectiveness in improving farm management.
CONCLUSION.

Every institution requires methods for making decisions, ways of
co-ordinating activities of the undertaking, ways of communicating
information and ideas, and ways for evaluating the success of an enterprise
in meeting its objectives. Every institution requires management. Some
managers are effective, others weak; but management, good or bad, is
universal and of great importance.\(^1\)

To be effective, management must have information - information which
is timely, uncluttered with superfluities, in a form and language that the
manager can understand, and of a type which will help the manager determine
and achieve his objectives.

This thesis has ranged widely over many aspects of the environment
of farm management information systems and inevitably many topics have been
given only a cursory treatment. It has been suggested that there is a
general lack of appreciation by farmers, accountants and advisors of the
problems involved in integrating the needs and abilities of the three parties
into a total management information system. It is hoped that the contents
of this work may assist chartered accountants in particular in designing
reporting systems for the benefit of this vital sector of our economy.

Chartered accountants serving farmers have for many years struggled
with the difficulties of producing accounts for farmers as soon after the
end of the financial year as possible. Many accountants, though they have
been aware that more timely and meaningful accounts should be given to
farmers, have been unable to do so because of a lack of skilled staff and the
amount of work involved when hundreds of clients have the same financial
balance date. The author feels that computerized farm accounting systems

\(^1\) Haynes, W., & Massie, J. *Management, Analysis, Concepts and Cases*
similar to the one operated jointly by Lincoln College and the Dept. of Accountancy at the University of Canterbury, will eventually alleviate many of the problems accountants face, and they will then be able to spend more time advising their clients.

Further studies in depth should be made on:

- objectives, for example, studies of the degree to which the regulations of government and other external organizations can influence a farmer's choice of objectives

- decision-making criteria and the effects of current scientific and accounting information on decision-making processes

- capital budgeting, especially in the areas of land development, and the economics of owning equipment rather than use contractors

- marginal costing, with regard to size of enterprises and stock-carrying capacities and

- means by which information, both accounting and scientific, can be communicated to the farmer at a time when it is most useful to him.

Farmers on the other hand need to become aware of the usefulness of management information, the sources from which it is available, and the techniques of interpreting it. Farming may remain "a way of life", but in today's complex society, with increasing costs and standards of living, it must also be a business - all businesses require management - and all management requires relevant information.
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