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THE USE OF A COMPUTER
FOR THE ANALYSIS AND EVALUATION
OF FARM DEVELOPMENT PLANS

by

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CHAPTER 1INTRODUCTION AND GUIDE TO THE THESISIntroduction - The Agricultural Development Conference

New Zealand's economy has always been heavily dependent upon the farming industry to provide export income. Foreign exchange has been required mainly to finance the import of raw materials for secondary industry which provides employment for much of New Zealand's labour force.

In the early 1960's the population was increasing rapidly. More export income was required to pay for additional raw materials needed for the expanding secondary industry labour force. It was apparent, however, that export income could be appreciably increased only by raising the volume of agricultural exports. This led to suggestions in 1963 that a conference be organised to inquire into further agricultural development. Following these suggestions, the Government that same year convened the Agricultural Development Conference¹ with the Order of Reference "to indicate what increases in the production of meat, wool and dairy produce were practicable and desirable over the next two, five and ten years and to recommend measures for achieving them".²

At its first meeting in October 1963, the Conference confirmed the setting up of a Targets Committee to advise on a tentative production programme for meat, wool and dairy produce. The Targets Committee recommended that the Conference indicate to Government its view that the target for livestock numbers should be tentatively set at 111 million ewe equivalents, to be

1. Hereinafter referred to as Conference.

2. "Report: Agricultural Development Conference 1963-64", Government Printer, Wellington, February 1966.

reached by the beginning of the 1972-73 farming season.³ This was an average compound rate of increase of 3.5 percent per annum from the base year, 1962-63. This recommendation by the Targets Committee was accepted by the Conference.

The Order of Reference of the Conference required it not only to indicate desirable production increases, but also to recommend measures for achieving them. To decide on the measures necessary to meet the production targets, the Conference established several Working Parties to advise on finance, taxation, farm costs, manpower, scale of farming, land valuation, noxious weeds, noxious animals and farm pests.

The public and interested organisations were invited to make submissions to each Working Party. Some Working Parties invited expert witnesses to address them. Each Working Party then considered the submissions and any evidence from expert witnesses before making recommendations to the Conference. The Conference was free either to accept, modify, or reject each Working Party's recommendations.

The Finance Working Party

In order to illustrate in greater detail the working of the Conference, the Terms of Reference, procedure and the recommendations of the Finance Working Party are examined.

The Terms of Reference of the Finance Working Party were:

- "1. To consider and report on sources and terms of finance to the farming industry:
 - (a) for seasonal expenditure

3. "Report of the Targets Committee of the Agricultural Development Conference", Government Printer, Wellington, March 1964, p.15.

- (b) for capital investment for
increasing production
- (c) for farm development.

2. To indicate whether (and, if so, what) changes are desirable to provide adequate finance on reasonable terms for attainment of the production targets and to assist its efficient utilisation."

The Working Party circulated a questionnaire on all aspects of agricultural finance to lending institutions in this field. A survey on farm finance undertaken by the Department of Agriculture was made available to the Working Party.

The Working Party initially considered the problem of the likely capital investment needed to yield the livestock targets. Three different methods were used:

- (1) Capital Output Ratios.

This method attempted to measure the marginal output for each additional \$1 of new farm investment. One major problem with the method was the inadequate statistics on farm investment.

- (2) Government Statistician's Estimates.

The Government Statistician estimated the capital investment on farms in recent years largely from changes in Government Valuations. However, the Government Statistician stated that the estimates could not be relied upon.

- (3) Farm Cost Approach.

In this approach, a direct estimate was made of the likely cost of increasing production on a ewe equivalent basis.

The belief of the Working Party was that -

"it is not possible to obtain precise figures of

the extra capital required and even if an agreed figure could be reached, it would still not be possible to ascertain what proportion could become available from farm incomes and what would need to be borrowed."

The Working Party concluded that its main objective was to ensure the availability of loan finance for suitable development projects.

The Working Party reviewed the sources of finance for farmers. Included in the review was a consideration of the availability and terms for seasonal, medium, and long term finance (the latter included development finance). The conclusion of the Working Party was that it did not appear likely that there would be any serious difficulty in the provision of adequate seasonal and medium term finance in the next decade.

In considering the problem of finance for farm development the Working Party attempted to define the necessary attributes of sound development finance. The Working Party felt that, assuming a development plan could not be financed out of income, these were:

- (1) The farmer must be assured that finance would always be made available to enable a sound development plan, once initiated, to be completed. Even if export prices should fall or a credit squeeze eventuate, the farmer must know that credit would not be restricted part way through the development plan.
- (2) The farmer should make the best use of technical advisory services to ensure that the development plan was technically sound and that capital would not be wasted.
- (3) The Working Party noted that during the initial phase of development, usually expenditure increased and income fell. They considered that special loan terms were required to assist farmers during this period and felt that initially interest only should be paid on a development loan. When development became profitable,

the loan should be repaid on a table mortgage basis.

- (4) The Working Party stressed the need, in lending, to consider the borrower's capacity to service his total debt. It was noted that a farmer may become discouraged, and the development plan might fail, if his financial obligations were too great. On the other hand, it was argued that in considering how much could safely be lent to a farmer, allowance should be made for the added capital value of the farm following development.
- (5) There should be no arbitrary upper limit on the amount which can be lent on any one property.

A consideration of the necessary attributes of sound development finance together with the review of existing lending policies for development, provided the basis for the Working Party's recommendations on development finance.

The Finance Working Party made 22 recommendations to the Conference. The general theme of the recommendations was that lending for farm development (principally by the State Advances Corporation and the Marginal Lands Board), be accorded first priority.

The Recommendations of The Conference

The Conference made a number of recommendations to the Government designed to encourage farm development to try to ensure that the livestock targets were reached. Since the conclusion of the Conference, Government has enacted legislation implementing many of these recommendations. In general terms, the implementation of the Conference recommendations affected farmers in two major ways. These were:

- (1) The supply of certain resources either essential for, or

likely to promote farm development, was increased. In particular the supply of finance, essential for farm development, was increased.⁵ The number of farm advisers⁶ was also increased. This action can be viewed as increasing the supply of a resource which would be likely to encourage farm development.

- (2) The introduction of various incentives, designed to raise the profitability of farm development. These generally took the form of reducing the farmer's taxation liability. Examples of incentives introduced include the Nil Standard Value Scheme for Livestock and the Special Depreciation allowance on new machinery.⁷

Outcome of The Conference

The implementation of the Conference recommendations stimulated interest in farm development amongst the farming community. On those farms where development was already taking place, the development process tended to accelerate. Where production was virtually static, farmers were encouraged to favourably consider some farm development.

Thus, following the Conference, significant numbers of farmers began to either consider some development or the acceleration of present development plans. This in turn led to increased demands on farm advisers for advice

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5. See "Report : Agricultural Development Conference", op. cit., p.319.
 6. The term farm adviser or adviser means farm management adviser in this thesis and includes Farm Advisory Officers of the Department of Agriculture, Farm Management Consultants and Dairy Board Consulting Officers.
 7. Details of the incentives can be found in "Farmers Tax Guide", Inland Revenue Department, Wellington, November 1969.

on all problems associated with development. In particular, farm advisers received many requests for advice on the budgeting and evaluation of development proposals.

Concurrently with the upsurge in demand for management advice on farm development, there existed a shortage of farm advisers capable of advising farmers on this problem.

Much of the work involved in the formulation and budgeting of development plans fell upon Farm Advisory Officers of the Department of Agriculture. The work was found to be time-consuming, especially the detailed budgeting. It was noted that in budgeting a development proposal, considerable time was often spent in relatively trivial calculations, for example, the calculation of taxable income to determine taxation liability. Furthermore, a farm adviser was required to make assumptions with regard to future prices. The difficulty in forecasting future prices was recognised, but whilst it was considered desirable to budget a development plan using a range of prices, time usually did not permit this.

The Department of Agriculture was aware of the role of the computer in reducing time-consuming trivial calculations. Consequently, in view of the increased demand for advice on development problems and the shortage of farm advisers, the Department considered it possible that a computer could be helpful to advisers working on farm development. Specifically it was suggested that the computer might:

- (1) be helpful in reducing the number of 'trivial' calculations performed by farm advisers in budgeting a proposed development plan.
- (2) enable farm advisers to examine the financial implications of variation in some of the 'crucial parameters' in a development plan. For example, rather than simply budgeting a development

plan for a sheep farm at one wool price, it was considered that by using the computer it should be possible to budget a development plan using a range of wool prices. This would enable the financial implications of variation in wool prices to be examined and accordingly assist the farmer in deciding whether to adopt or reject a development proposition.

In 1966, the Department of Agriculture decided to provide funds for research into the above two possibilities. The results of the investigation are reported in this thesis.

Guide To The Thesis

Chapters 2, 3 and 4 are introductory Chapters to the main body of the work which is presented in Chapters 5 and 6.

Chapter 2 is concerned with the nature and the tasks of management. In Chapter 3, budgeting as an aid to management is discussed while Chapter 4 reviews the problem of evaluating a farm development plan.

Chapter 5 describes a computer program that analyses and evaluates a development plan for a sheep farm. A flow diagram showing the logic of the program is given. An example is included in the Chapter of a development plan analysed by the program. The program input (information supplied by the adviser about the development plan) and output (the analysis and evaluation of the development plan), are shown.

Chapter 6 is similar in principle to Chapter 5. It describes a computer program that analyses and evaluates a development plan for a dairy farm. An example is also included in this Chapter.

Chapter 7 discusses the role of computers in Farm Management extension and research.

The summary and conclusions are presented in Chapter 8.

CHAPTER 2DEFINITION OF THE ROLE OF MANAGEMENTIntroduction

This chapter defines the nature and the tasks of management and includes some comments on the changing organisation and functions of management in agriculture. The increase and development of the managerial resources employed in agriculture is also discussed.

Nature of Management

Nielson in an article¹ concerned with the problem of improving the management resource in agriculture, lists eight processes in a model of the managerial process. These eight processes are:

- (1) The formulation of goals or objectives for the farm or unit.
- (2) Recognition and definition of a problem or recognition of an opportunity.
- (3) Obtaining information - observation of the relevant facts.
- (4) Specification of and analysis of the alternative courses of action.
- (5) Decision making - choosing an alternative which is the core of the management process.
- (6) Taking action - implementation of the alternative selected (assuming that the decision was to take action).
- (7) Bearing responsibility for the decision or action taken.
- (8) Evaluating the outcome.

1. Nielson, J., "Improved Managerial Processes for Farmers", Journal of Farm Economics, Vol. 44, 1961, p.1250.

Nielson stresses that these eight processes are all interrelated and that managers will not always consider all eight processes in decision making. Nor will they necessarily consider the eight processes in the sequence outlined above. They may omit one or more processes and they may return to one or more processes several times before arriving at a decision.

A farmer performs the function of management when carrying out the managerial process. The study of farm management is concerned with studying management problems on individual farms.

Discussion of The Managerial Process

The formulation of definite goals or objectives is important to managers because these give direction to the whole managerial process. In the absence of clear goals or objectives, management is likely to encounter increased difficulty in recognising problems within an existing management system, or recognising an opportunity existing outside a management system. Goals and objectives determine where management will search, and what management will envisage, as a problem or an opportunity.

Goal or objective formulation is sometimes a difficult phase in the managerial process. It is difficult in the sense that managers often possess multiple objectives which are sometimes conflicting, for example, the desire held by many managers for both increased leisure and income. It is often a necessary step for managers in decision making to reconcile conflicting goals and objectives.

Sometimes a manager's goals or objectives (objective function) can be adequately expressed in a simple quantitative form, for example, maximum profit. If all the alternative courses of action can also be expressed in terms of the objective function, then decision making - the selection of the best alternative - may be simplified.

If the objective function of the manager can be expressed in a quantitative form (together with the alternative courses of action) then an adviser can recommend the best course of action to a farmer.

In general, however, management objectives cannot be expressed in a quantitative form. In these situations, an adviser cannot recommend the "best" course of action to a farmer. He can assist the farmer in the specification of the alternative courses of action open to him, but the farmer must decide for himself the best course of action.

All managers must necessarily be profit-motivated to some degree. A farm management adviser can assist a farmer by expressing the alternative courses of action open to the farmer, in terms of profit. The farmer can then decide on the "best" course of action considering the profits and the non-economic consequences of each course of action.

Problem recognition and definition has been discussed by Lee and Chastain.² The authors state that "a clearly defined problem is one of the pre-requisites for sound thinking and reasoning". The authors list the steps in problem definition as:

- (1) A difficulty is felt.
- (2) Knowledge and information relative to the felt difficulty is gathered, organised and observed.
- (3) Alternative definitions of the problem are recognised.
- (4) Alternative definitions are analysed in the light of observed information.
- (5) The problem is defined, a decision is made on a definition.
- (6) Responsibility for problem definition is accepted.

2. Lee, J.E., and E.D. Chastain, "The Role of Problem Recognition in Managerial Adjustments", *Journal of Farm Economics*, Vol. 42, 1960, p. 650.

When management has recognised and defined a problem or recognised an opportunity, then before a decision can be made, it is necessary to gather information. This process of gathering information is concerned with deciding what are the alternative courses of action management can take. It is the selection of the best course of action that is the "core" of the managerial process.

A management problem only arises if there is more than one feasible course of action. There is no management problem if there is only one possible course of action.

The real function of management is concerned with directing thinking towards ways in which management's goals may be attained. This is largely centred around setting goals, recognising problems or opportunities that prevent fulfilment of these goals, collecting information about each problem or opportunity, specifying the alternative courses of action and selecting the best alternative.

The Tasks of Management

The task of management is to apply the managerial process to the many decisions that the farm manager is required to make. The decisions that a farm manager has to make can be classified in several ways. Black et al.³ classify all decisions into two groups, those concerned with the organisation of the farm and those concerned with the operation of the farm. The decisions relating to organisation are long term or strategic decisions; the decisions concerned with the operation of the farm are short-term or tactical decisions.

3. See Black, John D., Marion Clauson, Charles R. Sayre, Walter W. Wilcox, "Farm Management Analysis", The Macmillan Company, New York, 1957, p.5.

The farm manager is concerned with both strategic and tactical management decisions. The first management problem however must be to resolve the strategic decisions. For a sheep farmer some strategic problems are the breed of sheep to run, whether or not to employ permanent labour, and the type of fencing to erect.

Tactical management problems are the short run management problems. Tactical management decisions are concerned with problems such as the quantity of fertiliser to apply, whether or not to vaccinate against a particular disease, and the choice between contract or casual shearers.

The tactical management problems may be conditional upon strategic management decisions. Thus, the strategic decision to run cattle rather than sheep on a farm will determine the nature of some tactical management problems.

Management is Primarily Concerned with Problems Arising Out of Risk and Uncertainty

If the future was known with certainty, that is, there was no uncertainty, management could formulate the perfect plan. If future prices, technology, climatic conditions etc., were known in advance, management could select the best plan for an indefinite period of time. Once this best plan had been chosen, management would no longer be required. It would be necessary only to implement this perfect plan.

The need for continuous management arises because of the need to adjust farm plans in accordance with changing technology, prices or even changing managerial objectives. Change implies that management needs to learn, to obtain and assess information about prospective technological changes and likely price movements. This learning process can, however, seldom lead to perfect knowledge on which the manager can base a decision. The reason

for this is that most farm management decisions are concerned with the future in some way and the future cannot be known with certainty.

Decisions which management must make with imperfect knowledge are said to involve risk and uncertainty.⁴ A decision where risk and uncertainty are present is one where the consequences of any particular action are not known with certainty when the decision must be made.

It is the problems arising out of risk and uncertainty (imperfect knowledge) with which management is primarily concerned. These problems concern both present and future technology, prices, personalities important to the farming business (e.g. the bank manager) and imperfect knowledge surrounding the economic and political environment in which the farmer must operate.

The Changing Organisation and Functions of Management in Agriculture

New Zealand's agriculture is dominated by the family farm where the owner is both the farm manager and the farm worker. Recently, however, public and private companies and large scale farms have become more important in New Zealand agriculture.⁵ This has been accompanied to some extent by changes in the organisation and functions of management.

In the company form of farming, it is not necessarily a pre-requisite for managerial responsibility, that a manager possess some minimum equity capital. This contrasts with the family farm where the farmer, in order to become a manager, must possess sufficient capital to buy the farm. Thus company farming may give more opportunities to manage farms to those individ-

4. For a distinction between risk and uncertainty see Knight, Frank H., "Risk, Uncertainty, and Profit", Cambridge, Mass., Houghton Mifflin and Company, The Riverside Press, 1921, pp.19-20.

5. Throughout this discussion the term "Company farm" will be used for public and private farming companies, together with large scale farms, unless specified otherwise.

uals with a flair for management, but possessing little capital.

Company farms tend to be larger in size than family farms. If company farming became widespread it would tend to reduce the number of farm managers in agriculture and perhaps tend to lead to more "efficient management" of the Nation's agricultural resources. The advent of company farming in agriculture may not however lower the total demand for managerial resources in agriculture. Company farms may use the services of advisers to a greater degree than do family farms.

Company farming (especially the large public farming company) may lead to a change in the organisation of management in the agricultural firm. In contrast with the family farm, company farming may see the management function being split amongst several people (directors, managing director, general manager). We can probably assume that not all managers possess ability in all aspects of management. Thus, it is possible to imagine improved managerial performance in the agricultural firm brought about by people in the management team being allocated that role to which they are most suited.

Improved managerial performance in company farming could presumably also come about because each member of the managerial team would become a specialist.

The introduction of company farming would demand that managers acquire new functions. In particular, the need to co-ordinate the activities of a management team would arise. Under the family farm, the manager merely needs to co-ordinate his own managerial activities.

Furthermore, company farming would make greater demands on some managerial skills than does family farming. Company farms with their comparatively large labour forces would require that farm managers become more proficient in the management of labour.

The general effect on management of the introduction of company farming

would be that the organisation and functions of management would more closely resemble that of the public industrial or commercial firm.

Developing and Increasing The Managerial Resources in Agriculture

The last decade has witnessed a development of the managerial resource in the agricultural firm, that is, an improvement of the managerial ability of farmers. There has also been a rapid increase in the availability of managerial resources external to the farm firm.

The increase in the managerial resources external to the farm firm has come about in several ways. First, there has been a shift in emphasis in the role of the Department of Agriculture from the provision of technical advice to management advice to farmers. The numbers of farm advisers, both in the Farm Advisory Division of the Department and the Dairy Board's Consulting Officer Service, has also increased.

New Zealand has also seen, in the years since 1960, the spectacular growth of both the Farm Improvement Club movement and private Farm Management Consultants.

The Farm Improvement Clubs each consist of about fifty farmers who employ a full time advisory officer. The adviser periodically visits each farm in the club, offering advice on many topics (e.g. technical, financial) and including management advice.

The private Farm Management Consultants are self employed. They also offer advice to farmers on a whole range of problems including management problems.

Advisers employed by the Farm Improvement Clubs, Dairy Board, Department of Agriculture or self employed Management Consultants, have nearly all received formal training in farm management. The management content of the undergraduate and diploma agricultural courses offered by the Universities

has been improved and increased. Nearly all new management advisers take either a diploma or a degree course in agriculture. Hence new advisers joining either the Dairy Board, Department of Agriculture, Farm Improvement Club or operating as a self employed Management Consultant, should be increasingly proficient as management advisers.

Some attempt has also been made to improve the managerial ability of people who are expected to manage the Nation's agricultural resources. Both Massey University and Lincoln College offer courses orientated towards management for students who anticipate becoming farm managers. The opportunity is thus available for prospective farm managers to receive some formal training in management before commencing work as farm managers.

There has been little attempt made to improve the managerial ability of those people actively working as farm managers, other than by some training prior to becoming farm managers. It is undoubtedly true however that the majority of the Nation's farmers have not received any formal training in management whatsoever.

One of the objectives of both the Dairy Board's Consulting Officer Service and the Department of Agriculture's Farm Advisory Division is to improve the managerial ability of farmers. However, because of the large number of farmers per adviser, progress in improving the managerial ability of farmers can only be slow. Perhaps the need exists to examine whether some formal management training programme should be offered to people actively engaged in management.

Summary

This chapter has discussed both the nature and the tasks of management. Some comments have also been made on the changing organisation and functions of management. Finally the question of increasing and developing the managerial resource in agriculture has been considered.

CHAPTER 3

BUDGETING AS AN AID TO MANAGEMENT

Introduction

The previous chapter reviewed the nature and the tasks of management. The purpose of this chapter is to discuss one of the traditional aids to management - budgeting. The chapter defines budgeting in general terms and discusses the different types of budgets commonly employed in agriculture.

Definition of Budgeting¹

Budgeting as used in farm management has two main functions:

- (1) To estimate and compare the profitability of farm plans or modifications to farm plans. The function of budgeting here is to aid management in decision making by indicating the likely economic implication of using resources in alternative ways.
- (2) To calculate the financial requirements of farm plans. Budgeting in this sense is used by management as an aid to decision making on problems relating to the financial requirements for alternative farm plans.

Management and Budgeting

Management has the problem, inter alia, of formulating plans which are both profitable and financially feasible. A financially feasible plan is one whose requirements for financial resources does not exceed the available

1. For a general reference on budgeting see Castle, Emery N., and Manning H. Becker, "Farm Business Management", The Macmillan Company, New York, 1962, Chapter 7.

supply. The financial resources available to a farmer include his equity capital and his access to borrowed capital (credit).

The process of budgeting in a farm situation is used as an aid to formulating a plan that fulfils the farmer's objectives or goals and is feasible in terms of its requirements for finance, and other resources. Budgeting assists management in decision making on the best use of the available resources.

Sometimes however, budgeting is used to help management to decide whether or not to acquire more resources. For example, a farmer may have to choose between two alternative development plans, one of which involves borrowing finance (acquiring additional resources). Budgets would be prepared showing the detailed financial and economic implications of each development plan which would assist management in deciding which was the better plan.

Limitations to Budgeting

Farm managers' goals or objectives are not normally bound up entirely with economic or financial considerations. The farm plan that maximises profits, for example, is unlikely to be the most acceptable plan to many farmers. In particular, a farmer's attitude to risk and uncertainty are important factors in deciding which is the best plan.

There are other factors which may also be important to the manager and which will influence the decision as to the best plan for the year. One of these factors is time. Even if a farmer's sole objective was simply profit maximisation, the farmer must still decide, over what time period profits are to be maximised. He also must decide how to "weight" profit at different points in time during the relevant time period.

The objective of profit maximisation furthermore cannot always be simply defined. It may include two components - cash profits and profits arising

from capital gains. The problem that arises in expressing profit as an aggregate is the "weight" to be attached to each profit component.

Farm managers cannot normally express their goals or objectives in quantitative terms because of the complex problem of expressing attitudes to risk and uncertainty and time, in numerical terms. Budgeting could only be used to determine the best farm plan if the goals or objectives of the farmer could be completely expressed in numerical terms. Because this is seldom possible, budgeting is only an aid (but a very important one) in the deciding on the best farm plan. Budgeting of feasible alternative plans indicates their likely profits. The farm manager then needs to subjectively assess alternative farm plans in relation to his non-quantifiable objectives. Thus budgeting by itself will not necessarily enable the optimum or best plan to be determined.

Current Working Budget

This budget is perhaps the most widely used and is certainly very important in agriculture. The current working budget is normally prepared at the beginning of the financial year and is simply an estimate of the financial implications of the plan for the coming financial year.

The current working budget is not generally used simply to determine the financial implications of a plan that management has already decided to adopt. Rather, the function of budgeting is usually to help in deciding upon the plan in the first instance. Thus it is often necessary, especially where resources are severely limited, to prepare several budgets (plans) before deciding on the plan for the year.

The current working budget is normally a cash budget. In drawing up the budget only cash income and cash expenditure are considered - an expense such as depreciation on fixed assets (plant and machinery) or non-cash income

arising as a result of increased stock numbers on hand at the end of the financial year as compared with the beginning of the financial year, are excluded from the budget. The budget, if it shows that the plan for the year will incur a cash deficit, shows the manager the credit and/or cash reserves required for the plan to be financially feasible.

Normally in formulating a plan some of the resources required and their availability, other than finance, are "unconsciously" considered. For example, a sheep farmer in formulating a plan is unlikely to explicitly consider his labour supply in terms of hours per week available. The farmer will usually know from experience whether a plan is feasible for the labour resource. The farmer will not always know whether a plan is financially feasible however. To answer this question, he needs to budget.

It can often be seen, in practice, how the determination of a plan's financial requirements can be very helpful to the farm manager. Thus, the situation has frequently arisen whereby a manager who has a well prepared budget has been able to borrow finance and implement a certain plan; the farmer who did not prepare a budget either had to alter his plan when he found it to be infeasible (at some point in the year) or attempt to borrow the necessary finance required under difficult conditions.

The current working budget can also be used to draw up a monthly cash flow, showing the balance between cash income and cash expenses for each month of the year. The farmer generally knows in which month income can be expected or expenditure will fall due. This enables management to calculate month by month the cumulative balance between cash income and cash expenditure, termed the cash flow profile. This can be very useful if a farmer is financing his seasonal expenditure through a trading bank or stock and station firm. Normally these institutions require a borrower's overdraft not to exceed a specified limit during the year. The farmer will

know his overdraft level at the commencement of the financial year and from his cash flow profile he can forecast the expected overdraft level for each month of the financial year which will indicate if the overdraft limit seems likely to be exceeded. If the overdraft limit is expected to be exceeded, either the lending institution must be approached with a view to raising the overdraft limit or the plan must be altered. If the farmer is operating in a difficult financial situation, then a current working budget is often essential so that the expected overdraft can be forecast for each month.

Perhaps the most important reason for a current working budget is simply that management is forced to draw up a tentative plan for the year. This is of value because management is likely to make improved decisions if more time is spent on thinking about the decisions that must be made. It needs to be stressed that it is seldom possible to draw up a plan at the beginning of the year to which management adheres rigidly. Rather the plan is a tentative one in which provisions must be made for coping with possible contingencies, for example, higher or lower prices than forecast. By drawing up a plan for the coming year, the manager has some idea "where he is going" during the year. In the absence of any plan for the year, the manager may tend to "drift" from one crisis to the next. The current working budget helps management in coping with the problem of adjusting the farm plan in changing circumstances.

The problem of evaluating the profitability of a farm plan is quite different to that of financing a farm plan. If a plan shows that a cash deficit is expected and that therefore credit is required and/or cash reserves then it cannot be construed that the plan is necessarily unprofitable. The current working budget may show that a cash deficit is expected for a given year when a farmer may be in the process of implementing a development plan which, although profitable is expected to produce a cash deficit in that

particular year. Thus although the plan for the year incurs a financial loss, it cannot be said to be unprofitable as it is part of a profitable farm development plan.

The Current Working Budget - Its Use in Unconstrained Financial Situations

Although the current working budget is essential for farmers with limited financial resources, preparation of the budget is also helpful for the farmer whose financial resources are adequate for any plan.

The budget (plan) is for example, useful in assisting management in general organisation. Thus once the budget is prepared, management can proceed to organise the year's activities. This may mean, for example, arranging for some casual labour to be employed. If management has a plan prepared for the year, then this is likely to be carried out more efficiently than if there is no plan. The manager will be aware of the requirement for some casual labour before the need actually arises and this will help him with the problem of obtaining suitable labour.

Comparative Budget

Another type of budget employed by farmers is the comparative budget. Comparative budgeting is used as an aid in the selection of a plan or modification to a plan from amongst a number of feasible alternatives. The use of the comparative budget contrasts with the use of the current working budget. The former is employed to evaluate the profitability of alternative courses of action; the latter is used to answer questions relating to requirements for financial resources.

Comparative budgets may be either "full" or "partial" budgets. Full comparative budgets are used where management is considering a major change to an existing organisation, for example, a change from sheep farming to

dairying. Because the proposed change in organisation is considerable, a full budget is drawn up to show the profitability of each proposal. In other situations, however, where a minor change to an existing farm organisation is proposed, a partial budget which simply shows the additional costs and additional returns that would result from the proposed change is sufficient.

Comparative budgeting can be used to determine the allocation of resources for profit maximisation if the number of production alternatives is few. In some situations, where there are a large number of production alternatives, mathematical procedures, such as linear programming may be employed to determine the resource allocation for profit maximisation.²

Parametric Budgeting

In both the current working budget and the comparative budget, single valued expectations for all variables are normally employed; that is, management assigns a single value to each variable in the budget. In agriculture however, there are certain variables that may be usefully treated as parameters, to which it is more useful to assign a range of values and calculate the budget for each value in the range. This is known as parametric budgeting. Variables which are often treated as parameters are product prices and production assumptions.

Parametric budgeting enables greater insight to be obtained into management problems. Thus, for example, a budget can be prepared for a sheep farm in which one wool price is assumed. Usually however the wool price

2. See Heady, E.O., and W.V. Candler, "Linear Programming Methods", Iowa State University Press, Ames, Iowa, 1958, for a practical description of linear programming.

is a major source of uncertainty in farming and it is preferable to calculate the budget over the range of expected wool prices. Management can then study the implications of different wool prices, and consider the appropriate action for each price.

Parametric budgeting may provide misleading information if not used very carefully. For example, a parametric budget calculated only for different wool prices may be misleading because changing wool prices cannot be considered in isolation. A change in wool price usually affects other prices also, for example stock prices. If parametric budgeting is to be of real value to management in gaining deeper insight into management problems, price relationships cannot be ignored. The limitations of parametric budgeting are discussed in detail in Chapter 5 of this thesis.

Budgeting - Farm Development

In a development situation management needs to formulate a development plan, calculate the finance required and make an evaluation of profitability as a basis for deciding whether to accept or reject the development plan.

Comparative budgeting can be used by management in development situations because of the large number of feasible alternatives and the need to select the best alternative. The alternatives that management needs to consider include such questions as the best stocking policy and the best method of development. Comparative budgeting is of assistance to management in these problems.

Comparative budgets can be used by management in formulating a broad development strategy. Given the development strategy to be followed, management then needs to formulate a detailed development plan. Budgets are required to determine the resources required and the financial feasibility. Finally, budgeting is required in order to evaluate the profitability of a development plan. This point is discussed in detail in the follow-

ing chapter.

Summary

Budgeting is an essential tool for management concerned with the problem of the profitability of alternative propositions or concerned with the problem of the financial resources required by alternative propositions. The preparation of a budget (plan) for the year is also of assistance to management in organisation, and decision making during the year.

CHAPTER 4THE EVALUATION OF A DEVELOPMENT PLANIntroduction

This chapter considers the problem of evaluating a development plan. Methods of evaluating the profitability of a development plan are then described and discussed. Finally the chapter concludes with some comments on ex poste and ex ante profitability evaluations of development plans.

The Problem of Evaluating a Development Plan

Before a development plan is adopted it must be assessed, often by several different people or organisations. For example a farmer, in considering a development plan, must decide if his goals or objectives will be fulfilled by the plan. A credit agency, proposing to lend money for the development plan, must also decide if its goals or objectives will be met by advancing credit to the farmer. The problem of evaluating a development plan refers to the problem of assessment of the plan, in terms of goal or objective fulfilment, by an interested party.

A development plan can, therefore, be evaluated from different viewpoints and it must be made clear from whose viewpoint an evaluation is to be undertaken. Those people and organisations interested in farm development, are often concerned with different aspects of a development plan. For example, a credit agency lending money for development, will wish to know the security that a farmer can offer. The farmer, however, is not directly interested in the problem of providing security for a lending agency.¹

1. This chapter is concerned with the farmer's problem in evaluating a development plan.

The Farmer's Problem in Evaluating a Development Plan

Farmers have many objectives or goals which they attempt to fulfil.

These can be broadly classified into two groups:

- (1) Economic.
- (2) Non-economic.

The farmer's problem in evaluating a development plan is to establish the degree to which the plan seems likely to fulfil his economic and non-economic objectives or goals.

Economic Objectives or Goals

Some possible economic objectives or goals that a farmer might envisage by implementing a development plan are:

- (1) To increase the sum of money available for personal drawings and perhaps off farm investment above the level expected to prevail in the absence of development.
- (2) To reduce the vulnerability of the farm business to falling prices. A farmer who has high fixed costs may fear that if product prices should fall there would be insufficient income available to meet his fixed commitments and also provide a reasonable sum of money for personal drawings.
- (3) To increase security by decreasing debt. Sometimes farmers attach considerable importance to being free from debt. In such cases farmers may implement a development plan simply to reduce, or preferably extinguish, indebtedness.
- (4) To enable a farmer to increase his equity by improving the productivity of his farm and thereby raising the value of the farm. The long-term objective might be to sell the existing farm and purchase a larger property.

In practice, farmers often have several economic objectives and a development plan needs to be evaluated in terms of the degree to which it seems likely to fulfil each objective. This is likely to be a complex task and furthermore, the economic objectives may conflict. For example, a farmer may wish to increase, in a short period of time, the net income for personal drawings. He may, however, be reluctant to increase indebtedness but it may be necessary to borrow money if development is to rapidly raise his net income. In this situation the farmer needs to consider the degree to which his desire to quickly increase net income is compatible with his aversion for increasing indebtedness. The problem of making a comparative evaluation among feasible alternative development plans is likely to be even more complex than evaluating a single development plan, assuming the farmer has multiple economic objectives.

Non-Economic Objectives or Goals

There may be important non-economic objectives to be considered in evaluating a development plan. For example, some farmers enjoy the challenge of farm development and obtain considerable personal satisfaction from implementing a successful development plan. Other farmers may be spurred on to develop by the prospect of becoming the owner of a "large" flock or herd in the belief that this increases their standing and prestige in the farming community. It is important, in evaluating a development plan, not to overlook the farmer's non-economic objectives.

The Role of a Farm Adviser in The Economic Evaluation of a Development Plan

In the economic evaluation of a development plan, an adviser can assist the farmer. He can, for example, estimate the present value of cash profits, the increase in the sum available for personal drawings after payback, or the

likely increase in market value of the assets after development.² If the farmer's criterion for an acceptable development plan is that the present value of profits be positive or that the market value of the assets after development should increase by a certain sum, then an adviser can evaluate a development plan and recommend its adoption or rejection by the farmer.

If, however, a farmer has several economic objectives, it is unlikely that he will be able to state explicitly the relative importance of each objective.³ Thus, although an adviser may evaluate a development plan in relation to each of the farmer's economic objectives, the decision as to whether to adopt or reject a development plan must invariably lie with the farmer. The adviser, furthermore, would usually be unable to evaluate a development plan in relation to a farmer's non-economic objectives.

The problem of evaluating a development plan is, therefore, an exceedingly complex one. It is, to a significant degree, a subjective problem. Farmers need to decide whether a given plan is acceptable and which of two (or more) acceptable development plans is preferred. Farmers make their decisions by evaluating development plans both subjectively and objectively and then ranking them on the basis of utility in a cardinal sense. The utility of a development plan may be thought of as a convenient way of expressing the extent to which the plan seems likely to fulfil the farmer's economic and non-economic objectives.

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2. These are all measures of the profitability of a development plan which are defined subsequently in this chapter.
 3. For example, a farmer may wish to increase both the value of the farm and the money available for personal drawings. It is unlikely that a farmer could state explicitly the relative importance he attaches to each objective.

The Economic Evaluation of a Development Plan

This section discusses the concepts of profit from a development plan. It then goes on to describe and discuss some of the criteria that are used to measure the profitability of development.⁴

Profits⁵ from farm development may accrue either as cash profits or capital gains. These two forms of profit are not mutually exclusive because, in general, a development plan which increases cash profits also results in capital gains.

It has been noted by Cartwright⁶ that the utility of these two forms of profits is likely to be quite different. Increased cash profits are immediately available for investment or consumption. The profits arising from capital gains are not directly available to a farmer until the farm is sold and the profits are realised. The farmer may, however, use any capital gains as security in order to borrow capital for investment or consumption. In this way, capital gains may be utilised immediately they accrue; however, to some farmers this would be unacceptable.

Marginal Analysis and The Definition of Development Cash Profits

The measurement of the profitability of a development plan requires a marginal analysis, in which profits in the absence of development, are compared with total profits arising as a consequence of development. Development cash profits may be defined as the profits that would not have accrued if development had not taken place.⁷ That is, development cash profits in

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4. The terms "economic evaluation of a development plan" and "measuring the profitability of a development plan" are used interchangeably in the thesis.
 5. Profit refers to the excess of income over expenditure. Profit is a difference measure - the difference between the value of the resources transformed into product and the value of the product produced.
 6. See Cartwright, R.W., "The Potential For Increased Production on Sheep Farms in Wairoa County", Discussion Paper No. 49, Department of Agricultural Economics and Farm Management, Massey University, August 1967, p.42.
 7. See R.W. Cartwright, op. cit., p.143.

the i th year of development are defined as follows:

Additional cash income (V_i) in the i th year is given by

$$V_i = A_i - A_o \quad (1)$$

Additional cash expenditure (C_i) in the i th year is given by

$$C_i = E_i - E_o \quad (2)$$

where

A_i = Total cash income in the i th year of development

A_o = Total cash income in the base year

E_i = Total cash expenditure in the i th year of development

E_o = Total cash expenditure in the base year

Then, in the i th year, development cash profits are defined as

$$V_i - C_i \quad (3)$$

The Concept of a Base Year

The definition of development cash profits requires that cash profits be estimated for a base year. It is assumed that in the absence of development base year cash profits would be received indefinitely. In estimating base year cash profits, management must consider the level of production immediately prior to the commencement of development. The budget drawn up to establish base year cash profits should reflect the level of production expected if the productivity of the existing farm improvements were to be maintained. The budget must be a balanced one in the sense that it could be continued indefinitely with annual production and annual inputs required to maintain that production, both constant. One of the features of this base year budget is, therefore, a static stock reconciliation.

In practice, some difficulty is often experienced in drawing up the base year budget. The reason is that often little is known about the annual inputs required to maintain production indefinitely at a static level because

farm production seldom remains static for more than a brief period of time.

Furthermore, "errors" in the base year budget may lead to "errors" in the calculated value of development cash profits for every year in the development plan. If the base year budget is in error this implies that either A_0 , the base year cash income, or E_0 , the base year cash expenditure or both, are in error. Because both these variables are encountered each year in evaluating development cash profits for that year, any errors in their measurement can mean that development cash profits are measured incorrectly for every year of the development plan. Thus management needs to think very carefully in deciding the equilibrium input and output levels when drawing up the base year budget.

Definition of Cash Income

The total cash income in the i th year of development (A_i) and the total cash income in the base year (A_0) refer to the total value of sales of farm produce in year i and the base year respectively.

Definition of Base Year Cash Expenditure

The total cash expenditure in the base year includes all cash costs such as the normal items of farm expenditure required to maintain base year carrying capacity - repairs and maintenance, fertiliser, fencing and stock purchases, together with life insurance premiums, annual charges on any mortgages (principal and interest payments), interest on any current account overdraft, and taxation. Normally, the base year cash income will exceed the base year cash expenditure - the difference is termed personal drawings or base year cash profit and is the annual sum available to the farmer to spend on personal consumption. By defining personal drawings in this manner, that is, as a residual, the base year cash income equals the base year cash expenditure plus personal drawings.

If the farmer has a trading bank or stock and station agency current account which is overdrawn at the commencement of development, then for the base year budget interest is charged on this overdraft, which it is assumed is never repaid. That is, in calculating the base year cash profit (personal drawings), an allowance is made for the payment of interest on any overdraft at the commencement of development, which is assumed to remain indefinitely at this level. The interest payment on this overdraft is thus a fixed cost for every year of the development plan.

The farmer's trading bank or stock and station agency account may conversely be in credit at the commencement of development. In these circumstances, the base year cash profit is calculated so that the bank credit level would remain indefinitely at the same level as it is at the commencement of development.

Although it is assumed that in the absence of any development, base year cash profits continue indefinitely at some constant level, they may vary from year to year. If, for example, a farmer is encumbered with a table mortgage at the commencement of development, then because interest is a deductible item of expenditure for taxation whilst the principal repayment is not deductible, the taxable income changes each year as the table mortgage is repaid and so therefore do tax payments. Thus even if no development takes place, the base year cash expenditure changes each year as the table mortgage is repaid. In these circumstances, the base year cash profit also changes each year.⁸

8. This problem can, however, be overcome by defining a moving base year, that is, a base year which changes from year to year.

Definition of Cash Expenditure in Year "i" of Development

The total cash expenditure in the *i*th year of development is the sum of the normal farm expenditure on stock purchases, repairs, fertiliser, purchases of plant and machinery, and development expenditure for that year, together with life insurance premiums, interest on the overdraft level at the commencement of development, interest and principal charges on any mortgages, and taxation. Interest is also payable on the development overdraft (if any). The concept of the development overdraft is defined subsequently in this chapter.

The Concept of a Post Development Year

In evaluating the profitability of development, it is necessary to estimate profits for the post development period, when production is assumed to be stable.⁹ The budget for the post development year shows the expected production and the annual inputs necessary to maintain that production indefinitely. The budget is, in principle, identical to the base year budget.

The Post Development Budget-Replacement of Capital Assets

During development, certain assets may be purchased which at some future point in time must be replaced. Assets falling into this category include buildings, plant and machinery, yards and fences. These assets cannot be repaired indefinitely.

The post development budget must be a balanced one in the sense that the inputs and outputs are in equilibrium. It should therefore include an

9. In general, production during development rises from a base year level to a new and higher level at which it tends to stabilise. The period of increasing production is termed the development period. This is followed by the post development period, when production is assumed to be stable.

allowance for the replacement of those assets that depreciate over time. For example, the post development budget should include a sufficiently large sum to enable additional fences erected during the development plan, to be repaired and replaced.¹⁰

Development Overdraft

If in the first year of development, the total cash expenditure exceeds the total cash income, then the balance must be borrowed. For the purpose of evaluating the profitability of development, it is convenient to assume that money is borrowed by way of an "unlimited overdraft facility" which is repaid from cash profits generated by the development plan. This "unlimited overdraft facility" is termed the development overdraft and interest is payable on it.

Personal Drawings and The Development Overdraft

For the most meaningful measure of the profitability of a development plan, personal drawings in each year of the development plan should be set at the same level as they were in the base year. If this is done, then the development plan is self-contained in the sense that all financial resources required by the plan must either be borrowed or be provided out of

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10. The annual payment required to replace a depreciating asset is the annuity whose future value equals the expected replacement cost of the asset. The annual payment (annuity) is equal to:

$$A = \frac{Sn \cdot r}{((1+r)^n - 1)}$$

where r = rate of interest
 A = annuity
 Sn = replacement cost of the asset
 n = the life of the asset (years).

profits generated by the development plan. If, on the other hand, personal drawings during development are allowed to fall below the base year level (this lowers the development overdraft) then the development plan is, in effect, receiving financial resources for which no charge is made. Nor are these resources required to be repaid. Conversely if personal drawings are allowed to rise above the base year level (this has the effect of increasing the development overdraft) then the development plan is, in effect, being charged with the cost of resources to enable the farmer's living standards to be increased above the base year level.¹¹ Thus, included in the cash expenditure for each year of the development plan, should be a sum for personal drawings, this sum to be equal to the base year personal drawings.

The level of the development overdraft at any point during the development plan is thus a measure of the loan required by the development plan at that point in time if all financial resources for the plan must be either borrowed or be provided out of development cash profits generated by the development plan. When the development overdraft is zero development cash profits have "repaid" the loan.

The Development Overdraft Profile of a Typical Development Plan

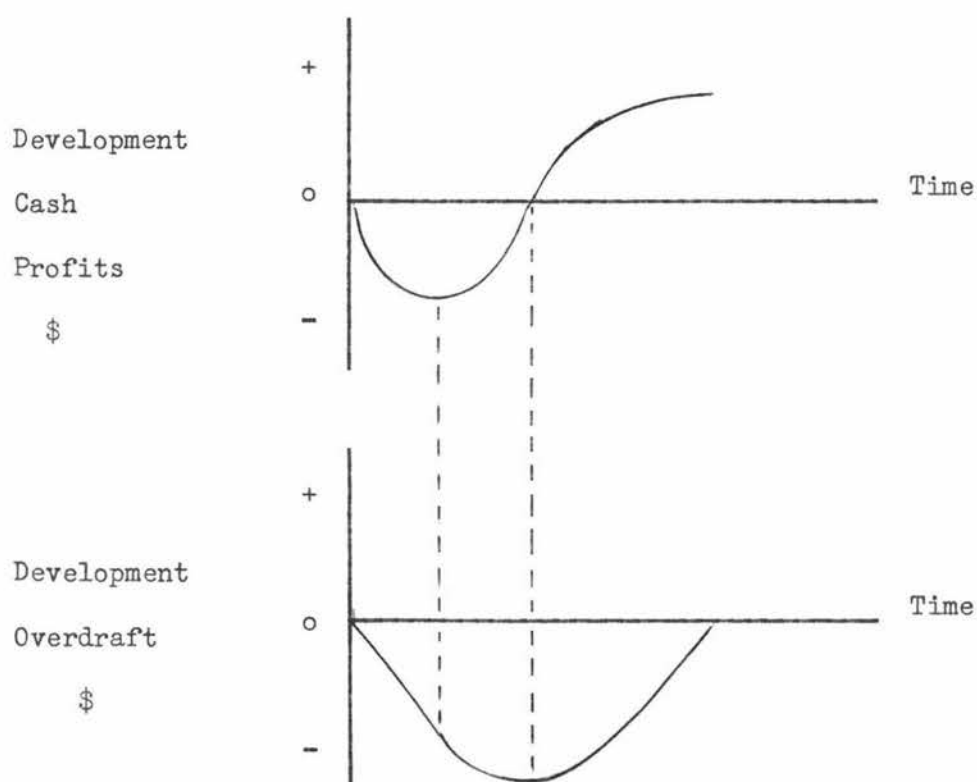
In most development plans, the development overdraft rises in the initial phase of development as the cash profits are negative and then falls as positive cash profits are used to "repay" the development overdraft.

Figure 4.1 illustrates the typical pattern of increasingly negative development cash profits (necessitating borrowing) giving rise to a development overdraft which increases at an increasing rate. This is followed by

11. The development plan is being charged for the cost of resources to enable the farmer to maintain a higher living standard than he could obtain in the absence of any development.

a period where development cash profits become increasingly less negative. The development overdraft continues to increase, but at a decreasing rate. Finally, positive development cash profits permit the development overdraft to be repaid. Payback is reached when the development overdraft reaches zero.

Figure 4.1 : Development Cash Profits and The Development Overdraft Profile



Relationship Between The Development Overdraft and The Projected Actual Overdraft

The development overdraft profile will not necessarily be the same as the actual overdraft profile expected for a development plan. Farmers often lower personal drawings during development below the base year level, and furthermore, borrowed finance for farm development is seldom provided as an "unlimited overdraft" facility. Thus, only rarely will the development overdraft profile, used in the evaluation of a plan, correspond to the

projected actual overdraft profile. However, this latter profile is of interest to the farmer in examining the financial feasibility of a development plan.

The Concept of a New Equilibrium Year

The new equilibrium year is the first year of the development plan in which both development cash profits and production have reached their maximum. This will either be the first year after payback or the first year of the post development period.¹²

Time and Farm Development - The Present Value of Cash Profits from a Development Plan

A development plan may take several years to complete. In evaluating the plan, it is convenient to express the stream of development cash profits over time, in the form of an equivalent lump sum at the beginning of development. This involves discounting the stream of profits.

If we assume that development extends over n years, and that the cash profits expected in the n th year continue in perpetuity at this level, then if profits are assumed to occur at the end of each year, the expression for the present value of development cash profits for years 1 to $n - 1$, is given by

$$\begin{aligned} & \frac{V_1 - C_1}{1+r} + \frac{V_2 - C_2}{(1+r)^2} + \dots + \frac{V_{n-1} - C_{n-1}}{(1+r)^{n-1}} \\ & = \sum_{i=1}^{n-1} \frac{V_i - C_i}{(1+r)^i} \end{aligned} \quad (4)$$

where r = the interest rate expressed as a decimal, and V_i and C_i have the same interpretation as before.

12. Payback may occur before or after the commencement of the post development period. If payback occurs before the first year of the post development period, new equilibrium will occur in the first year of the post development period. If payback occurs after the beginning of the post development period, new equilibrium is the first year after payback. The new equilibrium development cash profit is the additional sum available to the farmer for personal drawings.

The present value at the beginning of the nth year of the stream of development cash profits commencing at the end of year n which are assumed to occur in perpetuity, is as follows where "a" is the annual value of these profits.

$$\begin{aligned} & \frac{a}{1+r} + \frac{a}{(1+r)^2} + \frac{a}{(1+r)^3} + \dots \\ & = \frac{a}{r} \end{aligned} \quad (5)$$

The present value of this stream of cash profits is given by

$$\frac{a}{r} \cdot \frac{1}{(1+r)^{n-1}}$$

Thus the present value of the total stream of development cash profits is given by

$$PV = \sum_{i=1}^{n-1} \frac{V_i - C_i}{(1+r)^i} + \frac{a}{r} \cdot \frac{1}{(1+r)^{n-1}} \quad (6)$$

where PV is the present value.

The present value expresses the stream of development cash profits as an equivalent lump sum at the commencement of development.

Although normally in determining the present value, profits in perpetuity are considered, it is a simple task to calculate the present value of development cash profits for any finite time period. This is necessary when a farmer with a short planning horizon attaches no value to profits occurring beyond some point in time.

The Interest Rate Used for Discounting The Stream of Development Cash Profits

The need to discount future cash profits arises when capital has an opportunity cost. Under these circumstances, a future sum of money has less value than the same sum of money now. The latter permits either consumption at an earlier point in time (and individuals place a preference on present consumption as against future consumption) or it permits the investment

of this sum (and hence the earning of interest) at an earlier point in time.

The question arises in relation to farm development as to the appropriate rate of interest to use in discounting future cash profits. There are two choices:

- (1) A market rate of interest.
- (2) An internal interest rate.

The market rate of interest is the rate of interest payable on borrowed capital. Chisholm¹³ states that the market rate of interest is determined by two factors.

- (1) The time productivity of capital as a factor of production and,
- (2) The time preference for capital as a factor of consumption.

The time productivity of capital as a factor of production is determined by its rate of growth. The greater the economy's anticipated marginal rate of growth, the higher will be the demand for investment capital which is reflected in the market interest rate.

The time preference for capital for consumption reflects a preference for present consumption over future consumption. Thus a marginal quantity of present consumption will normally only be foregone for a greater resultant future consumption.

The market rate of interest in the economy represents the interaction of time productivity and time preference for capital. In a perfect capital market, the market interest rate is equal to the cost of capital. Furthermore, this same market interest rate is equal to the "opportunity cost of capital",

13. Chisholm, A.H., "An Economic Comparison of Forestry and Agriculture", Discussion Paper No. 30, Department of Agricultural Economics and Farm Management, Massey University, September 1963, p.12.

the income that is foregone by a farmer if he does not invest his capital outside his farm.

The market for capital seldom fulfils the criteria of a perfect capital market. Farmers normally pay more for borrowed capital than they receive on capital invested outside the farm.

The internal interest rate is defined as the interest rate that could be earned on the most profitable investment other than the investment possibility being considered.

In evaluating a development plan, a decision must be made as to what is the appropriate rate of interest to use in discounting future cash profits. Generally a market rate of interest is used because of the difficulty in defining the internal interest rate.

Discounting for Investment or Consumption

When discounting the positive stream of development cash profits to determine the present value, the question of the appropriate interest rate for discounting can be raised in another context. In discounting a future sum of money, the equivalent sum of money is found which if invested now at compound interest, would "grow" to be equal to that future sum. This is discounting in an "investment" sense. Income, however, is not only used for investment purposes but also for consumption purposes. It can be argued that from a consumption point of view, possibly future cash profits should be discounted at a different interest rate from that used for discounting from an investment viewpoint. In this context it can be noted that while a suitable rate of interest for discounting from an investment viewpoint might be, say, somewhere between five and eight percent, this might be too low for discounting from a consumption viewpoint. Evidence for this statement comes from the observation that people pay much higher interest rates than five to eight percent on hire purchase agreements in order to obtain present consumption as against future consumption.

Inflation and The Appropriate Interest Rate

If currency inflation is important to the farmer, and he wishes to evaluate the present value of development cash profits in constant money terms, then, given that the expected inflation rate is $r_1\%$, the present value, in constant money terms, of cash profits in any year, may be found approximately by discounting by the factor:¹³

$$\frac{1}{(1+(r_2-r_1))^i}$$

where r_1 = the rate of inflation expressed as a decimal

r_2 = the normal interest rate expressed as a decimal

i = the number of years

Discounting, Compounding and Taxation

A problem in discounting or compounding a sum of money is that it is difficult to adequately consider the complex problem of taxation which arises because interest received may be assessable for taxation.¹⁴ For example, the present value of \$11,000, due at the end of 11 years, is approximately \$5,500 at a six percent interest rate in the absence of any taxation on interest. Expressed in an alternative way, \$5,500 compounded annually at six percent for 11 years has future value of approximately \$11,000, in the absence of any taxation on interest. However, the presence of progressive taxation on interest earnings makes the calculation of present and future values, a time consuming task. For example, assume we wish to calculate the future

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13. See "Farming as a Business", Cost Benefit Handbook, Volume Two, Compounding and Discounting Tables, Farm Economics Section, Department of Agriculture, 1968, p.35.
14. In the current financial year (1969/70), any interest received above \$100 is assessable for taxation. See "Farmers Tax Guide", Inland Revenue Department, Wellington, November 1969.

value of a \$5,500 investment on which compound interest is received annually at six percent for 11 years and assuming progressive taxation on interest. As the interest is the last increment of income, and is taxable at progressively higher rates, the real future value of the investment can only be found by a detailed year by year analysis, calculating the interest received, taxation payable and adding the residual to the principal sum on which interest will be received in the following year. This is a much more tedious task than required for the customary computation of future and present values which ignore taxation on interest.

Summary of The Criterion of Present Value of Development Cash Profits as a Measure of The Profitability of a Development Plan

The criterion of present value of development cash profits not only permits a statement to be made as to whether a development plan is profitable, but also permits comparison among development plans. The present value criterion enables development plans to be ranked in order of profitability. This is important because management is sometimes more concerned with ranking alternative plans in their order of profitability than with attempting to make precise statements about absolute profits.

The criterion of present value of development cash profits does explicitly consider time in evaluating the profitability of a development plan. Some criteria used to evaluate profitability, ignore time completely. Failure to consider time explicitly will not be unsatisfactory if either the development plan is quite short (say two to three years) or the farmer's objectives in development are such that discounting for time is inappropriate. In practice, discounting profits is inappropriate for some farmers and furthermore some development plans do extend over only two or three years and, provided that the interest rate is low, it is not necessary to discount future profits to evaluate the profitability of a development plan.

A difficulty that does arise with the use of the present value concept is that it is not a concept which is readily understood by farmers. Farmers in estimating profits from a development plan, think in terms of a development plan requiring "capital" and contributing to profits. The most popular farmer method of evaluation is to examine the ratio of added profits to capital. Farmers find it difficult to visualise an aggregation of added profits and added capital being expressed as a single sum as in the present value criterion.

Other Economic Criteria Used to Evaluate Development Plans - The Internal Rate of Return

This criterion is frequently used to evaluate the profitability of a development plan. The internal rate of return of a development plan is defined as that interest rate at which the present value of the negative development cash profits is equal to the present value of the positive development cash profits or, in other words, that interest rate at which the net present value is zero. Algebraically, the internal rate of return is that interest rate at which

$$0 = \frac{V_1 - C_1}{1+r} + \frac{V_2 - C_2}{(1+r)^2} + \dots + \frac{V_{n-1} - C_{n-1}}{(1+r)^{n-1}} + \frac{a}{r} \cdot \frac{1}{(1+r)^{n-1}} \quad (7)$$

The limitations of the internal rate of return have been extensively discussed in the literature.¹⁵ Briefly the main weaknesses of this criterion in evaluating development plans are:

- (1) It is possible for there to be more than one interest rate for which the net present value is zero and thus there exists the possibility of multiple solutions.

In practice multiple solutions do not arise very frequently

15. See for example Baumol, William J., "Economic Theory and Operations Analysis", Prentice Hall, Englewood Cliffs, New Jersey, 1965, pp. 440-445.

because usually in farm development a stream of negative development cash profits is followed by a stream of positive development cash profits. In these circumstances there will only be one interest rate at which the net present value is zero. Multiple solutions will only exist if the stream of development cash profits changes in sign more than once.¹⁶ It is difficult to argue that any one particular interest rate is the internal rate of return, when multiple solutions exist.

- (2) A further problem may arise in comparing two feasible alternative development plans. It can be shown¹⁷ that sometimes the development plan that has the higher internal rate of return may have a lower present value when development cash profits are discounted at the interest rate that reflects the opportunity cost of capital. That is, if management wishes to know which of two development plans has the higher present value and the discount rate is to reflect the opportunity cost of capital, then the internal rate of return may rank development plans in the incorrect order.
- (3) The internal rate of return criterion implies that the opportunity cost of capital is that interest rate given by the internal rate of return. That is, if the internal rate of return is 25 percent for a development plan, this implies that an interest rate of 25 percent is paid on any negative cash profits and an interest rate of 25 percent is received on positive cash profits generated by the develop-

16. If development cash profits change in sign from negative to positive and then become negative again before finally becoming positive, multiple solutions may exist.

17. See Baumol, William J., op. cit.

ment plan. This is not relevant information because management needs to know the present value of a development plan at an interest rate which reflects the opportunity cost of capital - which may or may not be the internal rate of return. The internal rate of return provides a "break even" rate of interest for a development plan. The rate of interest is the price for capital and hence the internal rate of return is the break even price for capital. The internal rate of return is only one of the break even prices that could be determined, at which the present value of development cash profits is zero. It is difficult to see the value in finding the break even price for capital - there is much more uncertainty attached to product prices than there is to the price of capital and hence it is of more value to establish break even values for product prices using a market rate of interest for capital.

- (4) The internal rate of return criterion is not readily understood by farmers. This further restricts the usefulness of the criterion in the field.

The conclusion is that the internal rate of return criterion has some important limitations as a method of evaluating a development plan. It needs to be used with caution if used to compare alternative development plans.

Payback Period

This is another criterion used to measure the profitability of a development plan. The uses and limitations of the payback period have been extensively discussed in the literature and will only be briefly reviewed here.¹⁸

18. See Baumol, William J., op. cit., pp. 438-439.

Some weaknesses of the payback period as a criterion of profitability are:

- (1) No account is taken of the time value of money.
- (2) No account is taken of cash profits occurring beyond the payback point.

The payback period does not directly measure the profitability of a development plan.¹⁹ The importance of the payback period to farmers in considering development plans and investment proposals generally lies in the fact that farming is characterised by uncertainty. If the future was known with certainty, then a criterion such as the present value of development cash profits could adequately evaluate a development plan. Because of uncertainty however, managers may prefer a development plan with a short payback period to a development plan which has a higher present value of development cash profits, but a longer payback period.

Weingarter²⁰ discusses the reasons for the popularity of the payback period as a method for appraising investment proposals. He notes that the payback period has been dismissed as misleading and worthless by most writers on capital budgeting at the same time that businessmen continue to utilise the concept. The author argues that the reasons for the popularity of the payback period need to be known before it is possible to develop superior alternatives.

Increase in Personal Drawings After Payback

A measure of the profitability of a development plan is the increase in the sum of money available for personal drawings after payback, as compared

19. The payback period can, however, provide an indirect measure of profitability. Thus given a uniform stream of receipts (this is not a typical development situation) the reciprocal of the payback period is the internal rate of return for a project of infinite life, or a good approximation to this rate for a long-lived project. See Weingarter, Martin H., "Some New Views on the Payback Period and Capital Budgeting Decisions", *Journal of Management Science*, Vol.15, No. 12, August 1969.

20. See Martin H. Weingarter, op. cit.

with the base year personal drawings.

It can be shown empirically that a development plan for which the present value of profits is positive permits higher personal drawings after payback than in the base year. It is not a sufficient condition, however, for a plan to have a positive present value of cash profits, that it enables personal drawings to be raised above the base year level, after payback. It can be shown that a development plan may enable personal drawings after payback to be increased above the base year level, yet the present value of the development plan may still be negative.²¹

As a criterion for evaluating the profitability of development, the increase in personal drawings possible after payback provides a measure of profitability that is readily understood by farmers and this, together with the length of the payback period, helps farmers in deciding whether to adopt or reject a development plan. The criterion does not explicitly incorporate an allowance for time, but farmers can subjectively discount the extra personal drawings because the payback period is known.

Return on Investment

This criterion was originally suggested by Candler.²² Algebraically, the return on investment is defined as:

$$R = \frac{r \cdot PV}{P} \times \frac{100}{1} \quad (8)$$

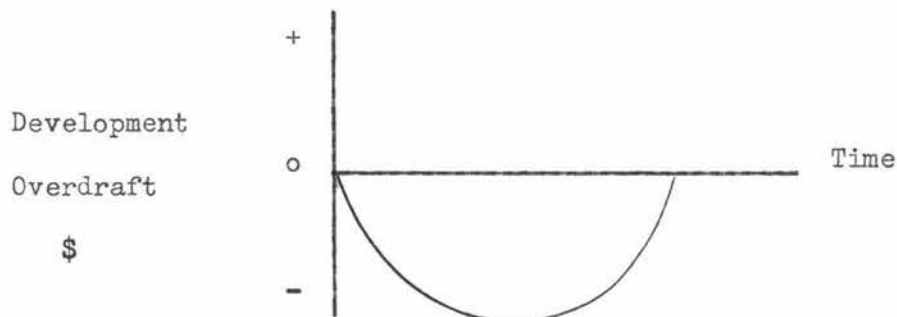
where R = Return on investment.

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21. See Cartwright, R.W., "The Impact of Taxation on the Profitability of Farm Development in New Zealand", Discussion Paper No. 46, Department of Agricultural Economics and Farm Management, Massey University, June 1967.
22. Candler, W.V., "Incentives for Increased Output of Farm Products", Proceedings of the Lincoln College Farmers' Conference, 1964.

- r = The interest rate expressed as a decimal.
- PV = The present value of development cash profits.
- P = The present value of the sum of money required to avoid borrowing, or, in other words, the sum of money required so that no development overdraft is required.

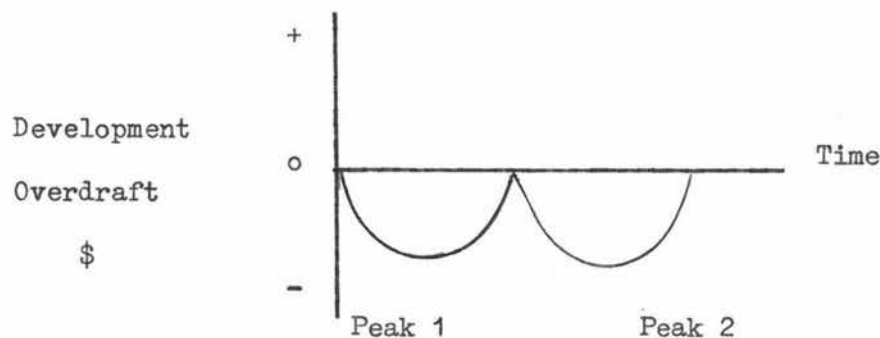
If the development overdraft profile is as shown in figure 4.2 with one peak, then a sum on hand at the commencement of the development plan, equal to the present value of the maximum overdraft, would avoid the need to borrow.

Figure 4.2 : A Typical Development Overdraft Profile



If, however, the development overdraft profile is as shown in figure 4.3, the sum required at the commencement of the development plan to avoid borrowing is not necessarily equal to the present value of the maximum overdraft.

Figure 4.3 : An Atypical Development Overdraft Profile



"Peak 2" may have a higher absolute value (disregarding the negative sign) than "Peak 1", but nevertheless a smaller sum may be required at the

commencement of development to avoid borrowing at "Peak 2" than at "Peak 1". In any case, the divisor is always the sum required at the commencement of development in order to avoid borrowing. In practice, as discussed previously, the sum required initially to avoid borrowing when interest is taxable, will be quite different from that required when interest is not taxable.

The numerator in the return on investment criterion is simply the present value of cash profits expressed as a constant annual sum or annuity.

The criterion, return on investment, cannot be used to rank alternative development plans on the basis of absolute profits because a "high" return on investment may be the result of low absolute profits and "low" investment. If the investment is zero, the measure is undefined.

Return on Capital

This criterion has also been extensively discussed in the literature. It suffers from several limitations as a method of evaluating the profitability of development. These limitations are:

- (1) Most "return on capital" criteria ignore time, that is, they assume that management is indifferent to the time required to complete a development plan, or that the discount rate, for the particular plan, is zero.
- (2) The criterion cannot be used to rank alternative development plans on the basis of absolute profits because a plan may have a high return on capital, but very low absolute profits. In considering a development plan, management is usually interested in the likely increase in absolute profits.
- (3) In calculating return on capital, it is necessary to classify all expenditure items as capital items or maintenance items. The maintenance items in each year are then charged against income for

that year in estimating profit. The difficulty with this procedure is that the value for return on capital is dependent on the classification of expenditure items. It is often difficult to distinguish between maintenance items and capital items - thus the classification must of necessity be rather arbitrary and hence the value for return on capital may depend upon the person doing the computation. It is feasible for several people to establish different values for return on capital, although each is given the same set of data.

- (4) Seldom in calculating the return on capital is cognisance taken of the fact that because many items of "capital" expenditure are deductible for taxation, the true cost of a capital item of expenditure will be less than the price paid for the item by the farmer. For these reasons, return on capital as a method of evaluating a development plan, has largely been discarded.

The methods of evaluation discussed up to this point have all been concerned with the evaluation of cash profits in some way, from a development plan. As mentioned earlier in this chapter, management is sometimes interested not in the cash profits from development, but in the capital gain arising from farm development. In general, a development plan that increases cash profits, will also lead to capital gains. In some circumstances, however, a profitable development plan may lead to no capital gains. This can occur in remote areas where although a farm may be developed profitably, to increase cash profits, the remote location does not lead to an increase in the market value of the assets.

Measurement of Capital Gains

To measure capital gains at any point in time, a comparison must be made between the market value of the assets in the absence of development,

the market value of the assets at that stage of development, and the level of the development overdraft at that same point in time. The capital gain from a development plan may be measured as:

$$P = A_i - B_i - OD_i$$

where P = Capital gain.

A_i = Market value of the assets at the end of year i .

B_i = Market value of the assets at the end of year i (if no development were to take place).

OD_i = Development overdraft level at the end of year i .

The market value of the assets after implementing a development plan can be most conveniently estimated by calculating the value of the assets now if the farm was fully developed. It is not usually a sound practice to try and estimate the future market value of the developed farm, as this depends upon future economic conditions, which are difficult to anticipate.

Uncertainty and The Evaluation of a Development Plan

The chapter has discussed the problem of evaluating a development plan assuming no uncertainty.

The farmer's economic environment, however, is often clouded by uncertainty and this factor needs to be considered in measuring the profitability of a development plan. Two possible ways of doing this are by parametric profitability evaluations and by simulation.²³ Both appear useful as ways of providing a guide to the impact of uncertainty, thus showing the significance of imperfect knowledge.

23. Chapters 5 and 6 describe computer programs designed to perform parametric profitability evaluations of development plans. See Carrington, A.S., "Profitability Estimates For Investment Projects", Discussion Paper No. 13, New Zealand Institute of Economic Research, Wellington, 1967, p.15 for a discussion on the use of simulation as a means of dealing with uncertainty in appraising investment proposals.

Ex Ante and Ex Poste Profitability Evaluations of Development Plans

There are two approaches to the problem of measuring the profitability of a development plan. The first approach is the forward budgeting or ex ante approach in which the problem is to learn if a development plan is likely to be profitable. In this approach, management evolves a development plan, budgets each year of the plan and then evaluates it. The prices used together with the technical coefficients (for example, the extra fertiliser required to enable carrying capacity to be increased), are based on the best estimates that management can obtain.

In contrast to the ex ante analysis, the ex poste analysis is concerned with measuring the profitability of a completed development plan. This approach is concerned with answering the question - "was this development plan profitable?" The normal reason for asking this question is to ascertain whether or not this historical development plan would be profitable if implemented at today's costs and prices. Thus, the ex poste analysis is usually concerned with the problem of answering the question - is development profitable at current costs and prices?

It is seldom helpful to determine if a farmer has increased his profits by a development plan. This is of historical interest only. It is only if it seemed likely to be helpful in deciding future action that a farmer would attempt an economic evaluation of a completed development plan. The need for this seldom arises in practice.

In the ex poste analysis standard costs and prices are used to evaluate a development plan where the relationship between inputs and outputs is known. This is in contrast to the ex ante analysis where management must try and anticipate the technical relationship between inputs and outputs. In practice, however, although in the ex poste evaluation the technical relationship is known, this does not eliminate uncertainty surrounding the implementation

of that same development plan on other farms. This is an important problem because ex poste evaluations are usually conducted in order to be able to advise other farmers whether a certain method of development is profitable. However, the technical relationship between inputs and outputs is dependent upon, inter alia, the quality and quantity of fixed resources, for example, land and management which vary from farmer to farmer. Thus the problem still arises as to whether the technical relationship found by an ex poste analysis on one farm, will apply on other farms.

A further problem that often arises in ex poste evaluations is brought about by the farmers' failure to keep detailed records relating to income and expenditure. For example, whilst the total expenditure on fertiliser in previous years can usually be found, it is seldom possible to obtain the amount spent on each type of fertiliser in any one year. Under these circumstances, the current cost of the same fertiliser programme must be determined by reference to an index of movement in average fertiliser prices over the time period involved.

A limitation to the usefulness of ex poste evaluations arises from changing technology. This is an important feature of agriculture. Where technology is changing rapidly, there is sometimes little information of value to be obtained from an ex poste evaluation if new developers would use a different technology.

Summary

The problem of evaluating a development plan has been discussed. A number of different criteria used to evaluate development plans have been described and discussed. Finally, a comparison has been made between ex poste and ex ante evaluations.

CHAPTER 5

A COMPUTER PROGRAM FOR THE ANALYSIS OF A SHEEP FARM DEVELOPMENT PLAN

Introduction

This chapter describes a computer program¹ which will perform a financial analysis and economic evaluation of a development plan² for a sheep farm. Included in the chapter is a summary of the information required by the program (program input), that is, the information that must be provided by a farm adviser who wants a development plan analysed. The chapter also includes a summary of the information produced by the program (program output), that is, the financial analysis and economic evaluation of the development plan. Finally an example of a development plan analysed by the program, together with a simple flow diagram of the logic of the program, is given.³

Definition of a Development Plan

A development plan has been defined by Cartwright⁴ as

"A time schedule of resource inputs and outputs together with information on how the inputs are to be transformed into outputs".

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1. Throughout the thesis, in order to avoid confusion between the terms computer program and development programme, the term development plan is used. Henceforth "program" refers only to "computer program".
 2. Development plan refers in this chapter to a development proposal, i.e. a possible development plan which the farmer must decide whether to adopt, reject, or modify.
 3. See Sanderson, K.T., and A.T.G. McArthur, "Computer Methods for Development Budgets", Agricultural Economics Research Unit, Lincoln College, Research Report No. 45, 1967, for examples of computer programs which will calculate the financial requirements of development plans for sheep and dairy farms.
 4. See Cartwright, R.W., "The Potential For Increased Production on Sheep Farms In Wairoa County", Discussion Paper No. 49, Department of Agricultural Economics and Farm Management, Massey University, August 1967, p.136.

For the purposes of this thesis, the time period involved in a development plan is assumed to be at least one year.

Basic Principles of The Program

The program depends on two basic principles. The first principle is that the adviser is required to evolve a development plan which is feasible for all resources other than finance. That is, the adviser must formulate a development plan, whose requirements for all resources, other than finance, can be met by the farmer. The program determines the financial resources required if the development plan is to be adopted and evaluates the profitability of the plan.

If the program shows that the development plan is profitable and the farmer is willing and able to obtain the required financial resources, then the plan can be implemented. If conversely the plan is either unprofitable or the farmer unwilling or unable to obtain the necessary financial resources, then the plan must either be modified or rejected and a new plan evolved. This new or modified plan can then be analysed.

The second basic principle of the program is that the adviser must define a development plan which involves increasing stock numbers over some period of time. The program caters for breeding ewes and non-breeding cattle.⁵

The adviser must consider the resources, other than finance, necessary to make the increase in stock numbers feasible. The principal resources required will include the seed and fertiliser required to produce additional feed, more subdivision, and increased supplementary feed facilities, for example, haybarn capacity.

5. Throughout the thesis "ewes" means breeding ewes, and "cattle" means non-breeding cattle.

Other resources which may be required include additional labour, perhaps increased shearing shed capacity, further sets of yards, motorised transport and improvements to the water supply.

The adviser must consider, year by year, the requirements of the plan for the above inputs to make the projected increase in livestock numbers feasible. Alternatively, the livestock numbers must be increased at a rate within the capacity of the above resources, for example, the available labour.

The development plan may also require increased managerial skills. The managerial capacity of the farmer may be a crucial factor in deciding firstly, if the farm can be developed and secondly, in influencing decisions on such matters as the rate of development.

Information The Adviser Must Provide About The Development Plan

The information that an adviser must provide about a development plan that he wants analysed and evaluated can be grouped, broadly, into four categories:

- (1) Information assumed to be constant in all years of the development plan.⁶
- (2) Information relating to the base year.
- (3) Information relating to each year of physical development.⁷
- (4) Information relating to the post development year.

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6. "All years of the development plan" or "the development plan" includes the base year, each year of physical development and the post development year.
 7. "Each year of physical development" refers to years other than the base and post development years of the development plan. The expression is synonymous with "Each year of development" or "Each year of the physical development plan".

Information Assumed to be Constant In All Years of The Development Plan

A number of items are assumed to be constant in all years of the development plan. These items include the following.⁸

- (1) Death rates in all classes of stock (lambs, ewes, hoggets and cattle).
- (2) Wool production per lamb and per ram, shorn.
- (3) The expected wool price.
- (4) "Fixed costs" such as rates, insurance premiums (excluding life insurance), rent and interest on flat mortgages.
- (5) "Variable" per animal costs such as the variable per ewe costs and the cost of shearing. These costs are assumed to be constant, per animal, in all years of the development plan.
- (6) Prices (both buying and selling) for all classes of stock.
- (7) The number of rams required per 100 ewes put to the ram.
- (8) The number of times the ewes are shorn each year.
- (9) The value of the special taxation exemptions for calculating the income tax liability.
- (10) The value of the life insurance premiums which are deductible for taxation.

Information Relating to The Base Year of The Development Plan

Information about the base year is required by the program so that a base year budget can be derived. This budget is necessary in order to measure the profitability of the development plan.⁹

8. These items are all defined explicitly in Appendix A.

9. The rationale for a base year budget in evaluating the profitability of a development plan has been discussed in Chapter 4.

The adviser, for the base year, is required to estimate the total number of ewes that should be run on the farm if no development takes place but assuming the base year productivity of the farm is maintained.¹⁰

The adviser must also specify the "normal" culling policy for sheep of each age, if the base year ewe numbers are carried.¹¹ The culling policy for ewe lambs, and for ewes ranging in age from two-tooth to six years old, must be given by the adviser. The culling policy for each age class is expressed as a percentage and must be 100 percent in the year that stock are finally sold. Thus, for example, in the normal ewe flock, ewes are cast for age at five years, that is, 100 percent of the four year old ewes,¹² on hand at the beginning of the year, are culled at the end of the year.¹³

The principal feature of the base year is a static stock reconciliation. The program, given the total number of ewes carried in this year, together with the culling policy for sheep of each age, calculates the number of two-tooth ewes required annually to maintain total ewe numbers at the base year level.¹⁴ No culling rate is required for ewe hoggets as it is assumed in the program that surplus ewe hoggets (i.e., hoggets over and above the minimum number required to maintain constant ewe numbers), will be sold as two-

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10. This statement implies that existing fences, machinery and pasture productivity, etc., are maintained.
 11. If the base year ewe numbers are carried, the farmer would usually have a "normal" or "average" culling policy of say casting ewes for age at five years and perhaps culling a certain percentage of the sheep within each age class. Culled stock is sold.
 12. The program requires the adviser to specify the percentage of the ewes of each age, on hand at the beginning of the year, that must be sold at the end of the year.
 13. All sheep sales are assumed to take place towards the end of the financial year which is assumed to run from the 1st July to the 30th June. "Year" always means financial year.
 14. Other replacement policies can be considered, e.g. the purchase of five year or six year ewes.

tooths. From the static stock reconciliation, the number of ewes of each age to be sold is found. It is assumed in the program that all the wether lambs are sold as lambs.

The adviser must also specify the total number of cattle that should be carried if the productivity of the farm is maintained, but not improved.¹⁵ The program calculates the number of cattle to be purchased annually to maintain constant cattle numbers given the culling policy for each age group.¹⁶

The ages at which cattle may be purchased are as follows:

- (1) Weaner - approximately nine months of age.
- (2) Yearling (approximately 12 to 18 months of age).
- (3) Two years to two and a half years old.
- (4) Three years to three and a half years old.

For the base year, the adviser specifies not only the total number of cattle that should be carried but also the normal purchasing age. This is one of the four age groups given above.

The ages at which cattle may be sold are as follows:

- (1) Yearling to eighteen months.
- (2) Two years to two and a half years old.
- (3) Three years to three and a half years old.
- (4) Four years to four and a half years old.

If the adviser gives the percentage of the cattle in each age group¹⁷ to be sold, the total number of cattle carried and the purchasing age, the

15. The cattle enterprise can be excluded.

16. Only dry (i.e. non-breeding) cattle policies are considered in the program because of the limited storage capacity of the computer at the time the program was written.

17. The age groups are rising, one year, two year old, three year old, and four year old cattle. The adviser specifies for each age, the percentage of the number on hand at the 1st July, to be sold between the months of July and June.

program can then calculate the number of cattle to purchase annually to maintain constant cattle numbers.

Static stock reconciliations for both sheep and cattle enable the number of cattle and sheep sold and purchased in the base year to be determined. From this the value of stock sales and purchases are calculated.

The adviser is required to estimate the major items of expenditure for the base year. The annual expenditure on wages, fertiliser, seeds, vehicle expenses, fodder, repairs and maintenance, fuel and oil, car expenses, weed and pest control¹⁸ to maintain the base year stock numbers indefinitely, must be stated. The program calculates directly certain items of expenditure, for example, shearing costs and taxation.

The information provided by the adviser about the base year enables the program to calculate the income and expenditure and thus base year cash profit. The program output for the base year includes the cattle and sheep reconciliations and a summary of the income and expenditure.

Information Relating to Each Year of Physical Development

The numbers of sheep and cattle in each age class at the beginning of development, must be given by the adviser.¹⁹

For each year of development, the adviser must indicate a "target" for total stock numbers, both for ewes and cattle, required to be on hand at the

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18. Each of these expenditure items is defined explicitly in Appendix A.
 19. The adviser must state the number in each of the following stock classes on hand at the commencement of development:
- (1) Killers.
 - (2) Ewe Hoggets.
 - (3) Ewes ranging in age from two-tooth to seven years old.
 - (4) Rams ranging in age from two-tooth to four years old.
 - (5) Rising, one year, two year, three year and four year old cattle.

end (30th June) of that particular year. Furthermore for both ewes and cattle the culling policy must also be specified for stock of all ages.

The minimum percentage of the sheep in each age class (including ewe hoggets and ewe lambs) that must be culled at the end of each year, must be stated by the adviser.²⁰ The program, given the initial sheep numbers on hand at the beginning of development and the proportion of the sheep of each age that must be culled, then compares the total ewe numbers remaining with the target for ewe numbers for the end of the first year. If the ewe numbers remaining are less than²¹ the target for ewe numbers, the program permits the shortfall to be met by purchasing ewes of any one of the following ages:

- (1) two-tooth,
- (2) five year old,
- or (3) six year old,

if the policy of purchasing ewes is acceptable to the farmer.

If conversely the total number of ewes remaining after culling is expected to exceed the target number, then provision is made in the program for higher than the minimum culling for five, six and seven year old ewes, and two-tooth ewes, so that eventually expected ewe numbers at the end of the first year of development are equal to the target for ewe numbers for this year.

In certain circumstances the target for ewe numbers at the end of the

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20. The adviser specifies, for example, the minimum proportion of two-tooth ewes, on hand at the beginning of the year, that must be culled at the end of the year, i.e., as four-tooth ewes. The need normally to cull some two-tooth ewes arises because of failure to conceive, poor constitution, etc. Similarly the adviser specifies the minimum proportion of ewe hoggets on hand at the beginning of the year that must be culled as two-tooths, i.e. not suitable for retention in the ewe flock. The minimum culling proportion for ewe lambs refers to those that the farmer wishes to sell before winter, i.e. before they are one year old. The farmer, of course, may not wish to cull any ewe lambs or ewe hoggets, etc.
21. After including the two-tooths entering the flock.

first year might not be attainable. This situation could arise where the adviser indicated that the farmer is not prepared to purchase ewes. If this happens a message is printed indicating a shortfall between projected and target ewe numbers. The program has been designed so that the analysis will continue for subsequent years of development, even if there should be a shortfall every year between projected and target ewe numbers.

It should be noted that this situation will not necessarily arise should a policy of purchasing ewes be unacceptable to the farmer. If the farmer is not prepared to buy ewes, both the expected lambing percentage of the flock and the desired rate of increase in total ewe numbers will be important in determining whether projected total ewe numbers are less than the target in any year. If, however, there is a shortfall between projected and target ewe numbers it would usually be desirable for the adviser to modify the development and, in particular, to re-schedule the development expenditure because, ceterus paribus, this would always improve the profitability of the development plan.²²

The basis of the sheep reconciliation, explained with respect to the first year of development, is followed for each subsequent year of development. Thus the principle involved is that the expected total ewe numbers, after culling, are compared every year with a target for total ewe numbers for that year. Adjustments are made to the expected ewe numbers by either planning the purchase of additional ewes or increasing the number of five,

22. The expenditure during development on items such as fertiliser, fencing, etc., will have been planned in relation to the rate of increase in target ewe numbers. If the rate of increase in ewe numbers will be less than the target rate of increase, presumably some expenditure on these items can be deferred. This will improve the profitability of the development plan, other things being equal.

six and seven year old ewes and two-tooths culled, above the minimum culling levels²³ so that projected and target ewe numbers are always equal.

Similar principles, to those already explained for the sheep enterprise, apply to the cattle enterprise. The adviser must give the number of cattle of each age on hand at the beginning of development. The culling policy²⁴ for each age group is also specified. For example in the first year of development this might be that 50 percent of the rising one year cattle, on hand at the 1st July, are to be sold between the months of July and June, and 100 percent of the rising two year old cattle, on hand at 1st July, are to be sold in the 12 months between July and June, etc.

The adviser also specifies a target for the total number of cattle for the end of the first year of development, together with the age at which cattle are to be purchased in this year.²⁵

The program determines the number of cattle to sell in the first year of development from the culling policy for this year and then compares the total number of cattle remaining with the target for cattle numbers for the first year of development. If a shortfall exists between projected and target cattle numbers, the difference is made up by purchasing cattle of the nominated purchasing age. The program also makes provision for the situation where projected cattle numbers exceed the target for the first year, in which case the surplus are "sold off"²⁶ until the expected cattle numbers

23. The minimum culling levels are constant for each year of development. See Appendix A for details of adjustments to ewe numbers where the expected total exceeds the target.

24. Culling policy with reference to the cattle policy refers to the selling policy. The ages at which cattle may be sold are the same as those given previously for the base year.

25. The ages at which cattle may be purchased are the same as those given previously for the base year.

26. See Appendix A for details of adjustments made by the program when the anticipated total cattle numbers exceed the target for total cattle numbers.

are equal to the target for cattle numbers.

The program allows both the purchasing age and the culling policy to be changed in each year of development. The program simply determines the number of cattle to be sold in each year from the culling policy for that year. If a shortfall exists between projected and target cattle numbers for any year, the balance is made up by the purchase of cattle of the nominated purchasing age for that particular year.

Thus for both the sheep and cattle stock reconciliations the principle is that the adviser must specify, for each year of development, a target number for both total ewes and cattle. The program calculates the number of ewes and cattle to be sold or purchased to equate projected stock numbers with the targets for each class of stock.

Information Relating to The Post Development Year of The Development Plan

The adviser is required to estimate the number of ewes and cattle the farm should carry when development is completed. Information on the post development year is required so that the program can calculate a post development budget, necessary in evaluating the profitability of the development plan. This budget is identical in principle to that already described for the base year.

The program simply calculates the number of two-tooth replacement ewes required each year to maintain constant ewe numbers, and the number of cattle to purchase annually so that cattle numbers remain constant at the post development level. From the static stock reconciliations, the numbers of stock to sell and purchase, and the value of stock sales and purchases, are calculated.

The adviser must give the annual expenditure necessary on wages, fertiliser, vehicle expenses, fuel and oil, car expenses, fodder, repairs and main-

tenance, weed and pest control in order to maintain indefinitely the post development carrying capacity.

Income in Each Year of Development

From the stock reconciliations, the program calculates the value of cattle, sheep and lamb sales and the costs of purchasing rams, cattle and breeding ewes.

The program also calculates wool production²⁷ and income for each year of development. Wool is produced from each of the following classes of stock.

- (1) Rams
- (2) Lambs
- (3) Ewes
- (4) Hoggets
- (5) Killers

For both rams and lambs, the wool production per head is constant for each year of development. In calculating the wool production from rams each year, the program multiplies the number of rams on hand, at the end of each year, by the expected wool production per ram. Thus it is assumed that any rams purchased (say in January) are shorn in the year of purchase. This assumption accords with normal practice. For the estimation of wool production from the lambs, the adviser is required to state the percentage of both ewe and wether lambs shorn.

The wool production per head from ewes and hoggets may be changed in every year of development. Furthermore, the program provides for once or twice a year shearing policies, and for the two-tooth ewes to be shorn just

27. The method of calculating the wool production in each year of development is identical to that used in the base and post development years.

prior to tugging.

It is assumed in the program that all ewes and hoggets are shorn at the normal times of say between October and December. If the two-tooth ewes are shorn prior to mating, and the ewes, other than the two-tooths, are shorn again, (that is, sometime in the months of say March, April or May), then this information must be indicated on the input form. Allowances are made for deaths in calculating the numbers of sheep shorn.²⁸

It is also assumed that half the killers are shorn each year. The wool production from a killer is assumed to be the same as that from a hogget.

From the total wool production, the wool income and cost of woolpacks is found.

The program also allows an adviser to include in each (or any) year of development, cash income (assessable for taxation) from any source such as rent, cash crops, hay, etc.

Expenditure in Each Year of Development

The adviser must estimate the major items of expenditure for each year of development. These include:

- (1) General development expenditure.
- (2) Fertiliser and lime.
- (3) Wages.
- (4) Seeds.
- (5) Contract cultivation.
- (6) Vehicle expenses, fuel and oil, and car expenses.
- (7) Fodder.

28. For details see Appendix A.

- (8) Repairs and maintenance.
- (9) Weed and pest control.
- (10) Personal drawings.

The expenditure²⁹ on the above items, can be estimated in advance because it will be related to stock numbers (except for personal drawings). Thus, for example, the rate at which stock numbers are to be built up at will depend upon general development expenditure, fertiliser, wages and fodder. Expenditure on these items is concerned with providing feed for stock or providing labour for the care of stock.

The inclusion of personal drawings as a variable for each year of the development allows the farmer to include the minimum sum required, which may change between years, and thus reduce the need to borrow finance.

The program calculates directly the expenditure for each year of development on items such as shearing costs, woolpacks, total variable costs associated with lambs, ewes, hoggets and the number of rams to purchase.³⁰

The adviser must state the balance outstanding, total annual charges and interest rate on any mortgages existing at the commencement of development. From this, the program calculates interest and principal charges for each year of development.

The program will calculate the depreciation that a farmer can claim as a deduction against taxable income. The adviser must provide details of the value and depreciation allowance on the various items of plant, machinery

29. The expenditure to be included under each of the above 10 items is defined in Appendix A.

30. It is assumed in the program that rams are retained for mating for four years. Given the initial ram numbers, together with the number of rams required per 100 ewes mated, the program calculates the number of rams to purchase each year.

and buildings owned at the commencement of development. From this, the program can calculate the depreciation deduction for each year of development. The program permits the purchase of additional plant and machinery or the erection of any buildings during development. The program will also calculate the annual depreciation allowance on these items.³¹

The adviser is required to indicate the bank overdraft or credit level at the commencement of development.

If the gross cash income expected from the first year of development is less than the total cash expenditure,³² then the resulting cash deficit is assumed to be financed from cash reserves in the bank (if any). If there is no cash or insufficient cash for this, then it is assumed in the program that the cash deficit is financed by bank borrowing, creating either a bank overdraft or an increased bank overdraft. Interest is charged on the bank overdraft, but it is assumed that interest is not earned if the bank account is in credit.

The program for each year of development calculates the cash surplus or deficit expected. Cash surpluses are assumed to be used to reduce the bank overdraft level or to bring the bank account into credit. Cash deficits are assumed to be financed by cash reserves at the bank (if any). If there are no cash reserves, cash deficits are assumed to be financed by borrowing from the bank.

Financing Development By Table Mortgage

Farmers often finance development by raising a table mortgage. Usually

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31. The program, in calculating the depreciation allowance on additional plant, machinery or buildings, ignores "Special" and "Initial" depreciation allowances.
 32. Taxation is included in the total cash expenditure and is calculated in the normal way.

the money is borrowed on a "current account" basis, with interest only, payable on the outstanding balance. At some point during development, the current account liability is converted to a table mortgage and repayment of principal commences.

The program caters for this type of financial arrangement. The point in time when the current account liability should be converted to a table mortgage can, however, only be decided once the adviser has inspected the program output from the "initial run".³³

Once the adviser has decided this point, he should then complete the necessary details about the new mortgage (year it will be taken up, amount, total annual charges, interest rate). The program will then be "run again" and the cash flow re-estimated.

Program Output For Each Year of Development

The program, for each year of development, provides the following output.³⁴

- (1) A sheep reconciliation.
- (2) A cattle reconciliation.
- (3) A budget and production summary.
- (4) A parametric financial analysis.

The Stock Reconciliations, Budget and Production Summary

The sheep reconciliation shows the number of killers, ewe hoggets, rams, and ewes in each age class ranging from two-tooth to seven year old, on hand

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33. The program output includes a statement of the expected overdraft level at the end of each year of development. From this the adviser can see when development is sufficiently profitable to begin repaying the borrowed money.
 34. The program output is shown in detail in the case study where the program is used to analyse a development plan. This is found towards the end of this chapter.

at the beginning and end of each year. Also shown are the number of purchases and sales in each of the above classes. The cattle reconciliation shows, for each age class, the number on hand at the beginning and end of the year, the number purchased and sold.

The budget and production summary includes information on income, cash expenditure, wool production, cash flow (cash surplus or deficit), bank overdraft or credit level, total indebtedness and additional indebtedness as compared with the indebtedness at the beginning of development.

The Parametric Financial Analysis

The program provides the adviser with information on the cash flow and the bank overdraft or credit level, under different price and/or production assumptions. The adviser specifies a change in percentage terms, for both the expected wool production and the expected wool price. The bank overdraft or credit level and cash flow are then recalculated using new values for wool production and/or wool price. Thus for example the adviser may indicate a change of 10 percent for wool price and 10 percent for wool production. For each year of development, the cash flow and the bank overdraft or credit level are re-evaluated, at a wool price which varies from 90 percent to 110 percent of that expected, and at a total wool production which varies from 90 percent to 110 percent of that expected.

The parametric financial analysis provides financial information for each blank "cell" in table 5.1 below. (It is assumed that the adviser wanted the cash flow and the bank overdraft or credit level calculated for a 10 percent deviation from the expected wool price, and a 10 percent deviation from the expected wool production).³⁵

35. The expected wool price is the wool price nominated by the adviser. The expected wool production is simply the total of the fleece weight for each class of stock multiplied by the number to shear.

TABLE 5.1
Parametric Financial Analysis

Wool Price Wool Production	10% Less Than Expected	Expected	10% More Than Expected
10% Less Than Expected			
Expected		X	X
10% More Than Expected		X	X

The program shows the sensitivity of cash flow and the bank overdraft or credit level to variation in wool price and/or wool production because the author believes that these are two variables to which considerable uncertainty is attached in sheep farm development. Accordingly it is important for farmers to have some indication of the implications for cash flow etc., if their forecasts of these variables are incorrect.

Farmers in budgeting a development plan are faced with uncertainty in two ways when attempting to forecast a variable such as the price of wool; long run uncertainty and short run uncertainty.

Some farmers are concerned with the problem of forecasting a wool price that is "correct" in the long run,³⁶ that is, the average actual wool price

36. This applies especially to those farmers who are well established and financially secure.

received corresponding closely to the forecast wool price. These farmers are concerned with the problem of long run uncertainty. The deviation in any one year between the actual wool price and the forecast wool price is of relatively less importance than any deviation between the long run average wool price received and the long run predicted wool price.

Other farmers, especially those with low equity or who are newly established, are more concerned with short run wool price uncertainty. These farmers may be concerned that a lower than projected wool price may coincide with a year in which a substantial cash deficit is anticipated and this could pose very difficult liquidity problems for them.

The program output provides information to farmers concerned with short run uncertainty. The program shows the financial implications of change in the wool production and/or wool price, from that expected, for each year. However, the program does not provide information on the cash flow or bank overdraft/credit level if both the wool production and the wool price are higher than expected. It is felt that this information, whilst not unimportant to a farmer, is of lesser importance to him than the financial implication of wool production and wool prices being worse than expected, and limited computer storage meant a choice was required.

A possible limitation in the parametric financial analysis is that as wool prices change, so generally do stock prices. The program does not alter the stock prices (and hence the value of sheep sales and purchases remains unchanged), when the wool price is varied. Thus it can be argued that the parametric financial analysis may provide a biased indication of the financial implication of a fall in the wool price.³⁷ In fact, the degree of any

37. For example, the parametric financial analysis may show that for a given year the cash deficit would be increased if the wool price fell from expected. However if the development plan in this year included substantial sheep purchases the cost of this may be over-estimated. It is possible that a fall in the wool price might not lead to an increased cash deficit because the cost of buying in sheep might fall also.

bias and its direction, is likely to depend very much on the balance between both sales and purchases of sheep. If both sales and purchases of sheep are appreciable, and if the wool price is less than expected, the value of sales will tend to be overestimated but the cost of purchases will also tend to be overestimated. Hence to some degree, these two factors may tend to offset each other.

The converse situation may arise. For example, if one year a "large" proportion of the total cash income was expected to come from sales of sheep, and no purchases of sheep were anticipated, and if the wool price was lower than expected, income from sheep sales would probably be less than expected and accordingly the program would, in these circumstances, tend to overestimate the cash surplus (or underestimate the cash deficit).

Program Output For The Development Plan - The Evaluation

The program provides three different criteria which are all measures of the profitability of the development plan. These criteria are:

- (1) The present value of the development plan.
- (2) The payback period.
- (3) The increase in personal drawings after payback, assuming personal drawings during the development plan remain at the same level as they are in the base year.

These measures of profitability are all discussed fully in Chapter 4.

The Parametric Evaluation of The Development Plan

If the development plan has a positive present value, the present value, payback period and increase in personal drawings after payback are all re-evaluated for different price and/or production assumptions. The program allows the adviser to nominate a "percentage change" for wool production and a "percentage change" for wool price. The adviser may, for example, nominate

10 percent for both wool production and wool price. The program then re-evaluates the profitability (present value, payback period, personal drawings increase) at wool prices 90 percent and 110 percent of the expected wool price. A similar re-evaluation is carried out with respect to wool production. The result is that nine separate evaluations are obtained so that the present value, payback period and personal drawings increase are established for each "cell" in the table (table 5.2) below.

TABLE 5.2

Parametric Evaluation of The Development Plan

Wool Price \ Wool Production	10% Less Than Expected	Expected	10% More Than Expected
10% Less Than Expected			
Expected			
10% More Than Expected			

The Computer Program³⁸

The program consists of five separate programs which were written as individual entities and "linked" subsequently.³⁹ For convenience the five separate programs are referred to as the base year, financing, post development, evaluation and parametric evaluation program respectively. The name given to each of the five programs indicates its function. The five programs are used in the analysis and evaluation of every sheep farm development plan and they follow in the sequence as given above. Each program is described in turn.

Base Year Program⁴⁰

The function of this program is to calculate the static stock reconciliations for both sheep and cattle in the base year from which the base year budget is derived.

Certain information provided by the adviser is used not only by this program but also by subsequent programs in the series. Furthermore some

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38. The program is written in FORTRAN II for an I.B.M. 1620 Computer with disks, 40,000 decimal digits of storage and a monitor control system. The program is stored on a disk which permits quick processing of a development plan because only three control cards must precede each batch of input data. The program does not print the output headings. Rather an output form has been designed and it is envisaged that the program output would be printed on to this pre-designed form. Furthermore the program does not always print fractions. This may lead to rounding errors appearing on the output forms.
39. The source program listings of all five programs are included in Appendix B. "Program" always refers to the five separate programs as one entity, unless specified otherwise.
40. The base year program is based on a program originally written by Alan Wright. See "Stock Reconciliation by Computer", Alan Wright, Discussion Paper No. 38, Department of Agricultural Economics and Farm Management, Massey University of Manawatu, October 1965.

of the output provided by the base year program is also required by subsequent programs. A "CALL LINK" instruction directs the computer to the financing program.

Financing Program

This program, has three functions for each year of development. Firstly it performs the stock reconciliations, secondly it calculates the budget and thirdly the parametric financial analysis. A "CALL LINK" instruction directs the computer to the post development program.

Post Development Program

The function of this program is, in principle, identical to the base year program except that it is concerned with the post development year. A further "CALL LINK" instruction directs the computer to proceed with the evaluation program.

Evaluation Program

This program calculates the present value, payback period and personal drawings increase after payback for the development plan. If the present value of the development plan is positive, a "CALL LINK" instruction directs the computer to proceed with the parametric evaluation program. If the development plan has a negative present value, the "program" ceases at this point.

Parametric Evaluation Program

The function of this program is to calculate the present value, payback period and increase in personal drawings after payback when wool production and/or wool price are varied.

Some of The Limitations in The Program

Some limitations in the program are as follows:

- (1) The program does not calculate the interest charge on the bank overdraft on the "daily balance" basis as do trading banks or stock and station firms. Instead, if in any year a cash deficit is expected, assuming there is no overdraft or cash in the bank at the commencement of the year, interest will be charged on this deficit in the following year. In practice, this method of charging interest is not likely to unduly distort the projected overdraft position from the true overdraft position.
- (2) In calculating taxation, the program does not allow for the carry forward of a negative taxable income to be offset against taxable income in subsequent years of development. This means tax payments tend to be overestimated if there is a negative taxable income in any year.⁴¹
- (3) It has been assumed in the program that the financial year runs from the 1st July to the 30th June. Farmers who balance at the end of March may use the program but a problem may arise in relation to second shearing. If the farmer second shears his ewes, it is assumed in the program that this takes place in March/April. It is also assumed in the program that this wool clip falls in the financial

41. If the farmer has a negative taxable income, the value of the special exemptions is lost - i.e. the farmer can show a taxable income up to the value of the special exemptions and still pay no tax. Thus rather than show a negative taxable income, accountants usually recommend to farmers to defer expenditure or bring income forward to bring the taxable income up to the value of the personal exemptions. This reduces tax in future years. If the program shows a negative taxable income in any year of development, the farmer's accountant would probably recommend adopting measures to raise the taxable income up to the value of the personal exemptions, and thus the tax would be less than that calculated by the program.

year between the 1st July and 30th June.

If the farmer balances at the end of March the second shear wool clip may fall in the following financial year. Thus for farmers who balance at the end of March but who also second shear, the wool clip from the second shearing can fall in the "wrong" financial year. This is likely to distort the cash flow and bank overdraft level if sheep numbers are increasing rapidly over time.

- (4) In calculating taxation, the "Nil Standard Value Scheme for Livestock"⁴² is not considered, that is, it is assumed in the program that the difference between the standard value of livestock at the 1st July and the standard value of livestock at the 30th June, is assessable income for taxation. The effect of this omission is to overestimate tax payments for those farmers who have adopted the scheme.
- (5) The program does not take into account either "Special" or "Initial" depreciation.⁴³ Only the normal depreciation allowances on plant, machinery and buildings are used as a deduction in assessing liability for taxation. This omission would introduce an appreciable bias in the year in which a new house was erected for an employee - it is not likely to be very significant in relation to plant and machinery because usually these items do not constitute an important component of development expenditure on sheep farms.⁴⁴
- (6) It is assumed in the program that all wether lambs are sold as lambs and the program does not permit any breeding cattle policies. Both

42. For details of this scheme see "Farmers Tax Guide", Information Pamphlet, Inland Revenue Department, November 1969.

43. For an explanation of "Initial" and "Special" depreciation allowances, see "Farmers Tax Guide", op. cit.

44. This statement is based upon the author's observation of development schemes.

of these restrictions must reduce the number of development plans for which the program can be used - especially the restriction on breeding cow policies.

It should be noted that the program could in fact be modified to incorporate all the situations discussed above, except for the calculation of overdraft interest on a daily balance basis. Unfortunately limitations on computer storage at the time the system was designed meant in fact a "restricted" program had to be written.

Flow Diagram Showing The Logic of The Program

Figure 5.1 is a flow diagram showing the logic of the program. The program initially reads the data for the base year, calculates the stock reconciliations and budget, and then prints this information.

The total number of years of development (N) is then read and an index (I) is set equal to one. The program then reads the data for year "I" of development. The stock reconciliations, income, expenditure, cash flow and overdraft are calculated and printed for year "I". The program then increases the index (I) by one and compares "I + 1" with "N". If "I + 1" is less than or equal to "N", the data for year "I + 1" of development is read, the calculations performed and the results printed. The index is then increased by one again and compared with "N" once more.

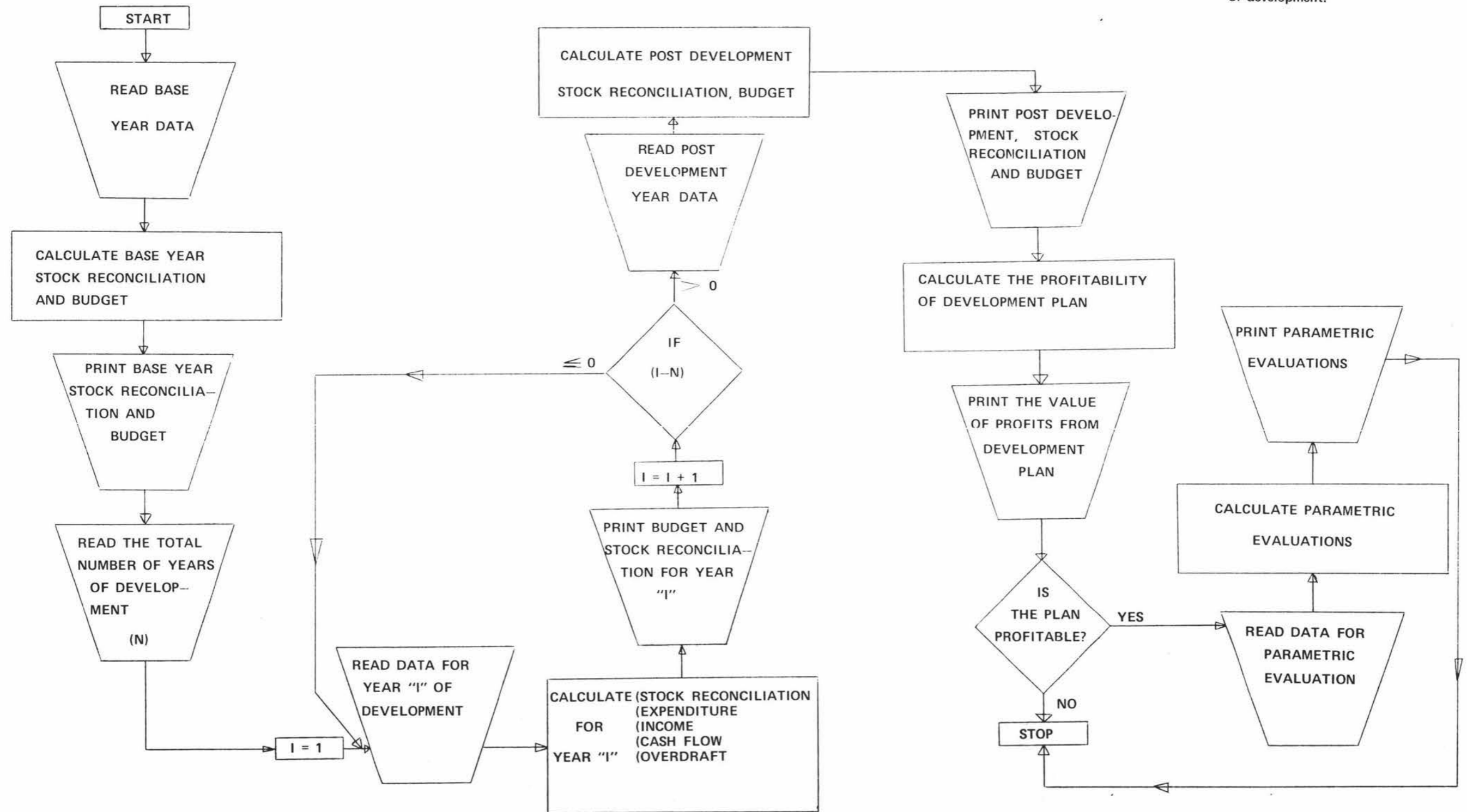
When the calculations for each year of development have been completed, the index "I" will exceed "N". The program then reads the data for the post development year, calculates the stock reconciliations and budget and prints this information.

The profitability of development is then calculated (present value etc.) and printed. If the present value is negative the program ceases. Data for the parametric evaluations (the "percentage changes" for wool production and price) is next read, if the present value of the plan is positive. The para-

FIG. 5-1

SHEEP FARM DEVELOPMENT PROGRAM

FLOW DIAGRAM



NOTE:

1. N = The total number of years of development.
2. I = An index of the number of years of development.

metric evaluations are then calculated and printed.

Case Study - The Use of The Program In The Analysis and Evaluation of A Development Plan

This section illustrates a case study of a development plan analysed by the program. The input forms (tables 5.5 to 5.8) show the information provided about the development plan. The output forms (tables 5.9 to 5.17) show the analysis and evaluation of the development plan.

A Background Description of The Farm

The farm for which the development plan is analysed is situated about 10 miles west of Palmerston North. It is 867 acres in area and the present cover consists of:

400 acres in scattered and dense scrub, gorse and barberry
200 acres in poor pasture
240 acres in good pasture
27 acres in waste, buildings etc.
<u>867 acres</u>

The poor pasture has little clover content and considerable quantities of browntop and danthonia but in the good pasture a reasonable amount of white clover and perennial ryegrass is present. Some grazing is also available to stock on areas where there is scattered scrub.

The farm is fairly steep in contour with very little flat area suitable for haymaking. It is subject to erosion on some of the faces. The rainfall is approximately 40 inches, generally well spread, but with an occasional dry summer.

The property was purchased by the present owner in June 1969. Under the previous owner it had been running both sheep and cattle, the flock con-

sisting of Romney ewes mated to Romney rams. Nearly all the ewe lambs were kept for replacements, any surplus to flock requirements being sold as two-tooths. All the wether lambs were sold as lambs, approximately half of them being fattened and sold to the freezing works, the balance being sold in the Fielding saleyards. The lambing percentage was normally about 100 percent.

The cattle policy was one of buying in weaner Angus or Angus Hereford cross heifers. These were wintered and sold in the following autumn, at a gross profit of \$20 per head.⁴⁵

The overall stocking rate on the 440 acres in grass was approximately five ewe equivalents an acre.⁴⁶ This figure, however, made no allowance for the grazing obtained in the scattered scrub areas, which was difficult to estimate.

The grass area of the farm is adequately subdivided but additional fencing is required if the area in scrub is cleared and sown in pasture.

The buildings comprise a house, woolshed and haybarn. All are in reasonable condition. The woolshed has sufficient capacity, both for the present sheep numbers, and for an increase in the number of sheep by another 1200 to 1400 ewes plus replacements. The haybarn has a capacity of 1000 bales. At present some 500 bales are bought in annually and fed to both sheep and cattle.

The plant and machinery comprise a car, tractor, sheep crate and other

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45. The gross profit refers to the difference between the buying and selling prices.
46. Assuming each yearling heifer is equal to three ewe equivalents and that a ewe hogget is equal to 0.7 ewe equivalents. The ewe equivalent figures used are based on those of Coop. See Coop, I.E., "The Ewe Equivalent System", Canterbury Chamber of Commerce Agriculture Bulletin, No. 454, September 1967.

sundry equipment. No additional plant and machinery is required for the development that is envisaged.

The Physical Development

The physical development plan described here is that which the farmer proposes to adopt. The farmer intends to increase the rate of fertiliser application on the 440 acres in pasture and to oversow with white clover, the 200 acres in poor pasture. Furthermore, 180 acres of the area in scrub is to be cleared and sown down to permanent pasture.

The farmer wishes to develop the farm rapidly. He plans to increase the ewe numbers from 1500 to 2880 ewes in two years. There will be no change to the cattle policy of buying weaner heifers and selling at 18 months of age. The farmer prefers to increase sheep, rather than cattle, because of their lower capital requirements and because they are more effective in grazing seedling gorse than are cattle. He anticipates some gorse germination on the area in scrub, after the scrub is cleared. It is hoped to kill any seedling gorse by hard grazing with ewes.⁴⁷

In the first year of development the 240 acres in good pasture is to be topdressed with superphosphate at three hundredweight per acre (all the area in pasture has been receiving an overall annual maintenance dressing of one hundredweight of superphosphate per acre). The 200 acres in poor pasture is to be oversown with white clover at two pounds per acre and is also to receive a dressing of superphosphate at three hundredweight per acre. A

47. The author would agree that sheep are more suitable than cattle for grazing out seedling gorse. Some gorse is already present on the area in pasture and thus some gorse regrowth on the area in scrub, when cleared, is a possibility. If there is any gorse regrowth, it is best to destroy it by hard grazing at the seedling stage. Suckling also recommends the grazing of gorse seedlings by sheep. See Suckling, F.E.T., "Hill Pasture Improvement", Newton King Group of Companies and the New Zealand D.S.I.R., 1965, p.44.

start is to be made on the clearing of the scrub. Approximately 60 acres will be root-raked,⁴⁸ sown down in permanent pasture, and top-dressed with superphosphate at three hundredweight per acre. This area will also be fenced.

The farmer considers that the additional feed produced should enable a total of 2400 ewes, plus hoggets, to be wintered at the end of the first year. Cattle numbers and policy will be unchanged.

The increase in ewe numbers will require the purchase of more hay than has been bought in previous years. Accordingly an allowance will be made in the budget for the purchase of 1000 bales of hay, which is twice the quantity normally purchased.

The development expenditure in the first year of development is summarised in table 5.3.

48. This is one of the methods of removing scrub. Scrub is "raked out" by a bulldozer fitted with tines attached to the blade. The objective of this method of clearing scrub is to minimise disturbance to the soil surface and thus try to reduce gorse germination.

TABLE 5.3Development Expenditure In The First Year of Development

<u>Item</u>	<u>Cost</u> <u>\$</u>
(1) 60 acres of scrub to be root-raked at \$20 per acre	1200
(2) Fencing of the 60 acre cleared block	600
(3) Superphosphate on the 60 acre cleared block - three hundredweight per acre at \$36 per ton applied	324
(4) Seed at \$10 per acre on the 60 acre cleared block	600
(5) Seed at \$1 per acre on the 200 acres in poor pasture	200
(6) Superphosphate at three hundredweight per acre on 440 acres - 66 ton at \$36 per ton applied	2376
(7) Fodder - 1000 bales of hay at 40 cents per bale	400
TOTAL	<u>\$5700</u>

In the second year of development, a further 120 acres is to be root-raked, sown down to permanent pasture and topdressed with superphosphate at three hundredweight per acre.

In addition, the 60 acres cleared in the previous year, and the 440 acres in pasture at the beginning of development, is to receive a dressing of two hundredweight of superphosphate per acre.

A new haybarn, which is expected to cost \$500 and provide storage capacity for another 1000 bales of hay, will be required. A total of 1500 bales of hay will be purchased in this year. The development expenditure

in this second year of development is summarised in table 5.4.

TABLE 5.4

Development Expenditure In The Second Year of Development

<u>Item</u>	<u>Cost</u> <u>\$</u>
(1) 120 acres of scrub to be root-raked at \$20 per acre	2400
(2) Seed at \$10 per acre on the cleared 120 acre block	1200
(3) Superphosphate on the 120 acre cleared block - three hundredweight per acre at \$36 per ton applied	648
(4) Superphosphate at two hundredweight per acre on 500 acres - 50 ton at \$36 per ton applied	1800
(5) Haybarn	500
(6) Fodder - 1500 bales of hay at 40 cents per bale	600
TOTAL	<u>600</u> <u>\$7148</u>

The anticipated feed produced will mean that about 2880 ewes plus replacements, will be carried into the second winter. The cattle policy, and numbers, will be unchanged.

Development is assumed to terminate at this point with sheep numbers raised from 1500 ewes plus replacements, to 2880 ewes plus replacements. In the post development year, a total of 62 tons of superphosphate is assumed to be applied at a rate of two hundredweight per acre on the 620 acres (the 440 originally in grass plus the 180 developed from scrub to grass).

An allowance of \$500 is made in the post development year for casual labour at lambing, shearing, and for some general maintenance work. A further allowance of \$400 is made for weedkiller for the control of gorse.

The Analysis of The Development Plan - Completing The Input Form

The physical development described has been analysed using the program. The input forms (tables 5.5, 5.6, 5.7 and 5.8) show the information required about the development plan. The value assigned to each of the variables will not be explained in detail nor will every variable be defined.⁴⁹

Variables Assumed to Be Constant In All Years of The Development Plan

The variables numbered one to 38 are assumed to be constant in all years of the development plan. For example, as can be seen from the table 5.5, death rates of five percent are anticipated for all classes of sheep (variables numbered 4, 5 and 6): all lambs are to be shorn as lambs (variables numbered 10 and 11); the ewes are to be shorn twice per year (variable number 13) and the expected wool price is 22 cents per pound⁵⁰ (variable number 12).

Variables numbered 20 to 25 refer to the expected selling prices for each class of sheep whilst variables numbered 26 and 27 refer to the buying prices for both rams and two-tooth ewes.

The farmer wishes to buy two-tooth ewes, if there are insufficient two-tooth ewes to meet the target for ewe numbers. Hence a buying price must be specified for two-tooth ewes. However because no five or six year old ewes will be purchased, variables numbered 28 and 29 can be left blank (treated as zero by the program).

49. For the explicit definition of each variable, see Appendix A.

50. For the explanation of the values assigned to variables numbered 14 to 19, see Appendix K.

TABLE 5.5

SHEEP FARM DEVELOPMENT PROGRAM - INPUT FORM

Variable No.	Description	Value	Variable No.	Description	Value
1.	Farm Identification Number	1	33.	Selling Price - 4 Year/ $4\frac{1}{2}$ Year Steers	0
2.	Percentage Rams to Ewes	2	34.	Purchase Price - Weaner Steers	60
3.	Total Killers Required	20	35.	Purchase Price - Yearling/18 Month Steers	0
4.	% Death Rate - Ewes	5	36.	Purchase Price - 2 Year/ $2\frac{1}{2}$ Year Steers	0
5.	% Death Rate - Ewe Hoggets	5	37.	Purchase Price - 3 Year/ $3\frac{1}{2}$ Year Steers	0
6.	% Death Rate - Lambs	5	38.	% Death Rate - Cattle	1
7.	Wool Clipped per Ram	12	39.	Initial Bank Overdraft Level	1000
8.	Wool Clipped per Lamb	2.5	40.	Initial Bank Credit Level	0
9.	Shearing Cost/100 Sheep	12	41.	Interest Rate - (%)	6.0
10.	% of Ewe Lambs Shorn	100	42.	Life Insurance Premiums	100
11.	% of Wether Lambs Shorn	100	43.	Mortgage-Balance Outstanding	26000
12.	Expected Wool Price (cents/lb)	22	44.	Total Annual Charges	1940
13.	No. of Times Ewes Shorn	2	45.	Interest Rate - (%)	6
14.	Special Taxation Exemptions	785	46.	Mortgage-Balance Outstanding	0
15.	Overhead Costs	400	47.	Total Annual Charges	0
16.	Rent and Interest	1500	48.	Interest Rate - (%)	0
17.	Variable Costs per Lamb (cents)	15	49.	Total Number of Ewes	1500
18.	Variable Costs per Hogget (cents)	10	50.	Culling % - Ewe Lambs	5
19.	Variable Costs per Ewe (cents)	20	51.	Culling % - 2-Tooth Ewes	5
20.	Selling Price - Wether Lambs	5	52.	Culling % - 4-Tooth Ewes	5
21.	Selling Price - Ewe Lambs	5	53.	Culling % - 6-Tooth Ewes	5
22.	Selling Price - 2-Tooth Ewes	5	54.	Culling % - 4 Year Ewes	100
23.	Selling Price - 4-Tooth, 6-Tooth and 4 Year Ewes	3	55.	Culling % - 5 Year Ewes	0
24.	Selling Price - 5 Year Ewes	4	56.	Culling % - 6 Year Ewes	0
25.	Selling Price - 6 Year Ewes and Older	3	57.	Culling % - 7 Year Ewes	100
26.	Purchase Price - Rams	40	58.	Lambing Percentage	95
27.	Purchase Price - 2-Tooth Ewes	7	59.	Wool Clipped per 2-Tooth Ewe	6
28.	Purchase Price - 5 Year Ewes	0	60.	Wool Clipped per Ewe	5
29.	Purchase Price - 6 Year Ewes	0	61.	Wool Clipped per Hogget	6
30.	Selling Price - Yearling/18 Month Steers	80	62.	Wages	0
31.	Selling Price - 2 Year/ $2\frac{1}{2}$ Year Steers	0	63.	Manure and Lime	790
32.	Selling Price - 3 Year/ $3\frac{1}{2}$ Year Steers	0	64.	Seeds	0
			65.	Weed and Pest Control	100

The cattle policy is one of buying in weaners and selling at 18 months. Thus of the four variables numbered 30 to 33, only variable number 30 need be completed. Similarly of the next four variables (34 to 37 inclusive) only variable number 34 need be completed (Purchase price weaner steers).⁵¹

Variable number 39 shows a bank overdraft of \$1000 at the commencement of development on which the interest charge is six percent (variable number 41). It can be seen that the farmer pays \$100 in deductible life insurance premiums (variable number 42).

Variables numbered 43 to 45 refer to the mortgage balance outstanding, total annual charges, and interest rate payable on a table mortgage at the commencement of development.

Variables Which Refer To The Base Year

Variables numbered 49 to 73 (tables 5.5 and 5.6) refer to the base year and the first nine of these variables (up to number 57) refer to the ewe numbers and culling policy for this year. The input form shows that 1500 ewes are carried, five percent of each age class are culled, and the ewes are cast for age at five years. A static stock reconciliation is calculated, using the variables numbered 49 to 54, showing the number of two-tooths required to maintain a constant flock size at 1500 ewes.

The variable number 58 refers to the lambing percentage in the base year whilst variable number 59 shows that the two-tooth ewes entering the flock are shorn as two-tooths (in February prior to mating). The wool clipped per ewe at five pounds per head (variable number 60) is half the total wool

51. The farmer actually buys in heifers rather than steers. This is no problem if "heifer" is read where "steer" appears on the input and output forms.

clipped per ewe per year as the ewes are shorn twice per year.

Variables numbered 62 to 72 refer to the base year expenditure. If the base year stock numbers are carried (1500 ewes plus replacements and 150 cattle) the farmer requires no paid labour and hence nothing is allowed for wages. Manure and lime (variable number 63) expenditure of \$790 is the cost of applying superphosphate at one hundredweight per acre on the 440 acres in grass. This is the estimate of the annual fertiliser expenditure necessary to maintain the base year carrying capacity.⁵²

Given woolpack price (variable number 70) the cost of woolpacks can be found. This variable is also a constant in all years of the development plan.

Variables numbered 74 to 79 inclusive refer to the base year cattle policy which has been to run 150 heifers, buying as weaners and selling at 18 months. Thus "150" is entered opposite variable number 74, "1" is entered opposite variable number 75, and "100" is entered opposite variable number 76.⁵³

From variables numbered 80 to 84 the depreciation deduction is calculated in each year of development. Variable number 80 refers to the depreciation allowance on the buildings and variables numbered 81, 82, 83 and 84 refer to the total balance sheet value of those items of plant and machinery for which the depreciation allowance is 10, 15, 20 and 50 percent of diminished value respectively.⁵⁴

Variables Which Refer to Years of Development (Tables 5.6 and 5.7)

Variables numbered 85 to 101 refer to the total stock numbers at the

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52. See Appendix K for details of variables numbered 65 to 69 and 71 and 72.
 53. "1" indicates to the program that weaners are to be purchased. For details of the code number to use if the purchase age is not weaner, see Appendix A.
 54. See Appendix K for details of these items.

TABLE 5.6

SHEEP FARM DEVELOPMENT PROGRAM - INPUT FORM

Variable No.	Description	Value	Variable No.	Description	Value
66.	Vehicle Expenses	50	100.	Number of Rising 3 Year Steers	0
67.	Fuel and Oil	150	101.	Number of Rising 4 Year Steers	0
68.	Car Expenses	250	102.	Standard Value - Ewe Hoggets	4
69.	Cartage	50	103.	Standard Value - 2-Tooth Ewes	6
70.	Woolpack Price (cents)	160	104.	Standard Value - Other Ewes	5
71.	Fodder	200	105.	Standard Value - Rams	10
72.	Repairs and Maintenance	300	106.	Standard Value - Killers	4
73.	Other Income (Assessable)	0	107.	Standard Value - Rising 1 Year Steers	40
74.	Total Number of Steers	150	108.	Standard Value - Rising 2 Year Steers	0
75.	Purchasing Age - Steers	1	109.	Standard Value - Rising 3 Year Steers	0
76.	Selling % - Yearling/18 months	100	110.	Standard Value - Rising 4 Year Steers	0
77.	Selling % - 2 Year/2½ Year	0	111.	Minimum Culling % - Ewe Lambs	5
78.	Selling % - 3 Year/3½ Year	0	112.	Minimum Culling % - Ewe Hoggets	10
79.	Selling % - 4 Year/4½ Year	100	113.	Minimum Culling % - 2-Tooth Ewes	2
80.	Depreciation Cost Price	225	114.	Minimum Culling % - 4-Tooth Ewes	2
81.	Depreciation 10% D.V.	1200	115.	Minimum Culling % - 6-Tooth Ewes	2
82.	Depreciation 15% D.V.	0	116.	Minimum Culling % - 4 Year Ewes	50
83.	Depreciation 20% D.V.	2300	117.	Minimum Culling % - 5 Year Ewes	100
84.	Depreciation 50% D.V.	0	118.	Minimum Culling % - 6 Year Ewes	0
85.	Number of Ewe Hoggets	300	119.	Minimum Culling % - 7 Year Ewes	100
86.	Number of 2-Tooth Ewes	400	120.	Purchasing Age - Ewes	1
87.	Number of 4-Tooth Ewes	383	121.	Code-Office Use Only	2
88.	Number of 6-Tooth Ewes	366	122.	% Change in Wool Price	.10
89.	Number of 4-Year Ewes	351	123.	% Change in Wool Production	.05
90.	Number of 5-Year Ewes	0			
91.	Number of 6-Year Ewes	0			
92.	Number of 7-Year Ewes	0			
93.	Number of 2-Tooth Rams	10			
94.	Number of 4-Tooth Rams	8			
95.	Number of 6-Tooth Rams	7			
96.	Number of 4-Year Rams	5			
97.	Number of Killers	20			
98.	Number of Rising 1 Year Steers	150			
99.	Number of Rising 2 Year Steers	0			

beginning of development. Then follow the standard values, used by the farmer, for each class of stock (variables numbered 102 to 110).

Variables numbered 111 to 119 refer to the percentage of the sheep in each age class, on hand at the 1st July, that must be culled at the end of the year. The input form shows that the farmer thinks that half his five year old ewes can be retained for a further year but that all six year old ewes must be culled (variable number 117 is equal to 100).

The farmer wishes to buy two-tooth ewes to make up any deficit between the target and expected ewe numbers. This is indicated by "1" opposite variable number 120.⁵⁵

The farmer wishes to know the financial implication of a 10 percent (0.10) change in the price of wool (variable number 122), and a five percent (0.05) change in wool production (variable number 123) in each year of development.

The variables numbered 124 to 159 (table 5.7) must be given values for each year of development. There are two such years, hence the first two columns contain entries.

Variable number 124 shows that the target for ewe numbers for the end of the first year is 2400, and for the end of the second year is 2880 ewes.

Weaner cattle are to be purchased in both years of development. This is indicated by a "1" in both columns. In both years all cattle are sold at 18 months (indicated by "100" in both columns for the variable number 126). The target number of cattle to be wintered in each year is 150, this figure appearing opposite variable number 130 for both years (columns).⁵⁶

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55. See Appendix A for the other numbers to use if the farmer wished to buy five year old or six year old ewes to make up a shortfall between projected and target ewe numbers.
56. Details of variables numbered 131 to 144 can be found in Appendix K for both years of development.

A sum of \$1500 has been included for personal drawings. This is the minimum amount the farmer requires for living expenses.

The need to stock ewes heavily to graze out seedling gorse means that wool production and lambing percentage are expected to fall below the base year level. Thus both the wool clipped per ewe and the lambing percentage (variables numbered 148 and 150), are expected to be lower than in the base year. It is planned however, to give preferential feeding to young stock so that the expected two-tooth and hogget wool production is the same as in the base year.

Variables numbered 154, 155 and 156 in the second year of development refer to the erection of the haybarn. Variable number 155 indicates that the depreciation allowance is calculated as a percentage of the cost price.⁵⁷ Variable number 156 shows that the item is to be depreciated at 2.5 percent per year.

Variables Which Refer to The Post Development Year (Table 5.8)

Variables numbered 161 to 190 refer to the post development year, following the completion of development. The property is then expected to carry 2880 ewes plus replacements, together with 150 cattle.

From variables numbered 162 to 166 the program calculates the number of two-tooth replacement ewes required to maintain flock numbers constant at 2880 ewes. It can be seen that when development is completed, the farmer intends to revert to his pre-development policy of casting ewes for age at five years. Lambing percentage (at 100) is expected to rise above the level anticipated during development (90 percent). Wool production per ewe at

57. If the capital item (variable number 154) is an item of plant and machinery for which the depreciation allowance is calculated on a percentage of diminishing value, "2" is entered opposite variable number 155.

TABLE 5.8

SHEEP FARM DEVELOPMENT PROGRAM - INPUT FORM

Variable No.	Description	Value
161.	Total Number of Ewes	2880
162.	Culling % - Ewe Lambs	5
163.	Culling % - 2-Tooth Ewes	10
164.	Culling % - 4-Tooth Ewes	5
165.	Culling % - 6-Tooth Ewes	5
166.	Culling % - 4-Year Ewes	100
167.	Culling % - 5-Year Ewes	0
168.	Culling % - 6-Year Ewes	0
169.	Culling % - 7-Year Ewes	100
170.	Lambing Percentage	100
171.	Wool per 2-Tooth Ewe	6
172.	Wool per Ewe	5
173.	Wool per Ewe Hogget	6
174.	Wages	500
175.	Manure and Lime	2230
176.	Seeds	0
177.	Cartage	50
178.	Vehicle Expenses	100
179.	Fuel and Oil	250
180.	Car Expenses	250
181.	Fodder	600
182.	Repairs and Maintenance	300
183.	Weed and Pest Control	400
184.	Other Income (Assessable)	0
185.	Total Number of Steers	150
186.	Purchasing Age - Steers	1
187.	Selling % - Yearling/18 Month	100
188.	Selling % - 2 Year/2½ Year	0
189.	Selling % - 3 Year/3½ Year	0
190.	Selling % - 4 Year/4½ Year	100
191.	% Change in Wool Price	0.10
192.	% Change in Wool Production	0.05

five pounds per shearing is also above the level expected during development (four and a half pounds per shearing).

Variables numbered 174 to 183 refer to the expenditure required to maintain carrying capacity at the post development level.

Wages at \$500 refers to the allowance for casual labour at lambing, shearing and for general maintenance work. In the post development situation it is planned to apply two hundredweight of superphosphate per acre over the 620 acres in grass (the 440 acres in grass at the commencement of development and the 180 acres developed from scrub into grass), the cost of which is \$2230.

The remainder of the expenditure items are the same as in the second year of development with the exception of weed and pest control (variable number 183) which has been increased because of the expected need to spray regrowth gorse on the area cleared of scrub.

Variables numbered 185 to 190 refer to the cattle numbers and policy in the post development year. It can be seen that the cattle numbers and policy will be the same after development, as before and during development.

Variables numbered 191 and 192 are used in the parametric evaluation of the profitability of the development plan. The input form shows that the plan is to be evaluated at wool prices 10 percent less than and 10 percent more than expected (the expected wool price is 22 cents per pound), and that the plan is also to be evaluated for wool production five percent less than and five percent more than expected.

Program Output - A Discussion of The Analysis of The Development Plan

This section discusses the program output, that is, the analysis and evaluation of the development plan, which is shown on the output forms (tables 5.9 to 5.17). The first eight of these tables show the stock

reconciliations, budget and production summary for the base year, the first and second year of development, and the post development year. Finally the last table (table 5.17) shows the evaluation and parametric evaluation of the development plan. The significance of the analysis and evaluation for the farmer, will also be considered.

Base Year - Stock Reconciliations, Budget and Production Summary
(Tables 5.9, 5.10)

The sheep reconciliation shows the number of ewes in each age group, if the flock is maintained at 1500 ewes. There is a surplus of 176 two-tooth ewes⁵⁸ for sale annually. The other sheep sales are made up of 303 five year old ewes, small numbers of ewes of other ages, 656 wether lambs, together with a small number of ewe lambs. The only sheep purchased are seven rams.

The cattle reconciliation is very simple. There are 150 weaner purchases which at balance date are shown as yearlings.⁵⁹ There are 148 cattle sold the following year (as yearling to 18 month), and thus there are no two year old cattle on hand at the end of the year. The cattle reconciliation is identical in each year of the development plan and will not be commented upon further.

The budget and production summary (table 5.10) includes the main items⁶⁰

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58. The two-tooths to be sold are ewe hoggets at the beginning of the year and appear in the stock reconciliation as "ewe hogget sales". Similarly the four-tooth, six-tooth, four year old, and five year old ewe sales appear in the stock reconciliation as sales of two-tooth, four-tooth, six-tooth and four year old ewes respectively.
59. Purchases of weaner cattle are shown as yearling purchases and any rising one year cattle on hand at 30th June are shown as yearlings.
60. The output form which shows the budget and production summary, is the same in all years of the development plan. Certain program output obtained for each physical year of development is not obtained for the base year. Thus the base year budget and production summary contains several zeros, for example, "Added Principal Repayments", and the "Parametric Financial Analysis". Output may be provided for these variables only during physical years of development.

TABLE 5.9

SHEEP FARM DEVELOPMENT PROGRAM - OUTPUT FORM

ANNUAL OUTPUTReference No: 1 Year: _____

Sheep Reconciliation

	Killers	Wether Lambs	Ewe Lambs	Ewe Hoggets	2-th Ewes	4-th Ewes	6-th Ewes	4 yr Ewes	5 yr Ewes	6 yr Ewes	7 yr Ewes	Total Ewes	Rams
Beginning of Year	20	0	0	643	434	392	353	319	0	0	0	1500	30
Purchases	0	0	0	0	0	0	0	0	0	0	0		7
Sales	0	656	33	176	20	18	16	303	0	0	0		
End of Year	20	0	0	643	434	392	353	319	0	0	0	1500	30

Cattle Reconciliation

	Yearling Steers	2 Year Steers	3 Year Steers	4 Year Steers	Total Steers
Beginning of Year	150	0	0	0	150
Purchases	150	0	0	0	
Sales	148	0	0	0	
End of Year	150	0	0	0	150

TABLE 5.10

SHEEP FARM DEVELOPMENT PROGRAM - OUTPUT FORM

ANNUAL OUTPUT

Budget and Production Summary

Sheep Sales (\$)	Sheep Purchases (\$)	Cattle Sales (\$)	Cattle Purchases (\$)	Change in Livestock Standard Value (\$)		Wool Production (lbs)	Gross Cash Income (\$)		
5717	300	11880	9000	+	-	22902	22635		
				0	0				
Deductible Expenses (\$)	Added Principal Repayments (\$)	Overdraft Interest (\$)	Added Interest Payments (\$)	Non-deductible Expenses (\$)	Personal Drawings (\$)	Life Insurance Premiums (\$)			
15998	0	60	0	380	4755	100			
Depreciation (\$)	Taxable Income (\$)	Total Tax (\$)	Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Total Mortgages (\$)	Total Debt (\$)	Added Debt (\$)
805	5832	1401	4755	0	0	1000	26000	27000	0

Parametric Financial Analysis

Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Wool Production (lbs)	Wool Price (cents)

of income and expenditure.

The sheep and cattle sales and purchases are obtained by multiplying the number to be bought or sold, by the appropriate prices.

Wool production, at 22,902 pounds, is the total of the wool shorn from the lambs, ewe hoggets, killers, two-tooth ewes, rams and the two ewe shearings.

Gross cash income is the total income from wool, sheep sales, cattle sales and other income.

Deductible expenses refers to the total of the tax deductible expenses. The overdraft interest payment of \$60 is the interest payable on the bank overdraft of \$1000.

The non deductible expenses refer to all the expenses, other than personal drawings, which are not tax deductible. The amount of \$380 is the principal repayment on the table mortgage.

The important feature of the base year budget is that if no development takes place, a cash surplus of \$4755 is expected annually. This cash surplus is obtained after deducting the tax payment of \$1401. Personal drawings and cash surplus are the same for the base year.⁶¹

The total debt at the commencement of development is \$27,000, made up of a mortgage liability of \$26000 and the bank overdraft of \$1000.

First Year of Development - Stock Reconciliations, Budget and Production Summary (Tables 5.11 and 5.12)

The sheep reconciliation (table 5.11) shows the number of sheep in each age class at the beginning of development (these figures are supplied by the

61. This sum is also the base year cash profit.

TABLE 5.11

SHEEP FARM DEVELOPMENT PROGRAM - DATA OUTPUT FORM

Reference No: 1Year: 1ANNUAL OUTPUT

Sheep Reconciliation

	Killers	Wether Lambs	Ewe Lambs	Ewe Hoggets	2-th Ewes	4-th Ewes	6-th Ewes	4 yr Ewes	5 yr Ewes	6 yr Ewes	7 yr Ewes	Total Ewes	Rams
Beginning of Year	20	0	0	300	400	383	366	351	0	0	0	1500	30
Purchases	0	0	0	907	0	0	0	0	0	0	0		23
Sales	0	621	32	28	7	7	6	166	0	0	0		
End of Year	20	0	0	609	1163	372	356	340	166	0	0	2400	48

Cattle Reconciliation

	Yearling Steers	2 Year Steers	3 Year Steers	4 Year Steers	Total Steers
Beginning of Year	150	0	0	0	150
Purchases	150	0	0	0	
Sales	148	0	0	0	
End of Year	150	0	0	0	150

TABLE 5.12

SHEEP FARM DEVELOPMENT PROGRAM - OUTPUT FORM

ANNUAL OUTPUT

Budget and Production Summary

Sheep Sales (\$)	Sheep Purchases (\$)	Cattle Sales (\$)	Cattle Purchases (\$)	Change in Livestock Standard Value (\$)		Wool Production (lbs)	Gross Cash Income (\$)		
4141	7269	11880	9000	+ 6680	- 0	24808	21479		
Deductible Expenses (\$)	Added Principal Repayments (\$)	Overdraft Interest (\$)	Added Interest Payments (\$)	Non-deductible Expenses (\$)	Personal Drawings (\$)	Life Insurance Premiums (\$)			
27904	0	60	0	380	1500	100			
Depreciation (\$)	Taxable Income (\$)	Total Tax (\$)	Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Total Mortgages (\$)	Total Debt (\$)	Added Debt (\$)
805	-550	0	0	8405	0	9405	25620	35025	8025

Parametric Financial Analysis

Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Wool Production (lbs)	Wool Price (cents)
0.0	8159	0.0	9159	23567	24.2
0.0	8678	0.0	9678	23567	22.0
0.0	9196	0.0	10196	23567	19.8
0.0	8951	0.0	9951	24808	19.8
0.0	8705	0.0	9705	26048	19.8

farmer), the number of purchases, sales, and the number on hand at the end of the first year of development.

It can be seen from table 5.11 that 907 two-tooth ewes must be purchased to attain the target for ewe numbers at the end of the first year of 2400 ewes. Twenty three rams are also to be purchased, giving a total of 48 rams, which is two percent of the ewe total (the farmer puts out two rams per 100 ewes).

The sales are made up of all the wether lambs, less the 20 to be retained for killers in the following year, 166 five year old ewes and small numbers of other sheep. The numbers of ewes in each age group to be sold are the "minimum culling percentages", specified by the farmer.

The budget and production summary (table 5.12) includes the main items of income and expenditure for the first year of development.

The change in livestock standard value refers to the difference between the livestock at standard value at the beginning of development and the standard value of livestock at the end of the first year.

The standard value of the stock at the end of the year is \$6,680 higher than at the beginning of the year. The values obtained for wool production, gross cash income and deductible expenses are obtained in the same way as was explained with reference to the base year.

The taxable income is negative, and thus no tax is payable. The cash flow analysis shows that a cash deficit of \$8,405 is expected which, added to the bank overdraft of \$1000 at the beginning of the year, gives an expected bank overdraft level of \$9,405 at the end of the first year of development. Thus the additional debt at the end of this year is \$8,025⁶² which is the diff-

62. The total debt at the end of the first year of development is \$8,025 higher than the debt at the beginning of the year. The cash deficit in this year is however, \$8,405, which is \$380 higher than the additional debt of \$8,025. The reason for the difference is the \$380 principal repayment on the table mortgage which reduces the balance outstanding on the mortgage.

erence between \$35,025, the total debt at the end of the first year, and \$27,000, the total debt at the commencement of development.

The parametric financial analysis shows the cash flow and the bank overdraft or credit level if wool production and/or wool price were to differ from that expected. (The expected wool production is 24,808 pounds and the expected wool price is 22 cents per pound). It was specified in the input form that the farmer wished to know the financial implications of a 10 percent change in the wool price and a five percent change in wool production, from that expected.⁶³

The first row under the parametric financial analysis shows that the cash deficit is \$8,159, if the wool production is five percent less than expected (23,567 pounds) and if the wool price is 10 percent more than expected (24.2 cents per pound). The bank overdraft is \$9,159, which is \$246 less than the expected level of \$9,405. It can be seen from the parametric financial analysis that the most unfavourable outcome is that where the wool price is 10 percent less than expected (19.8 cents per pound) and the wool production is five percent less than expected (23,567 pounds). This gives a cash deficit of \$9,196 and a bank overdraft level of \$10,196. These figures are both \$791 higher than the expected cash deficit and bank overdraft level respectively.

The change in cash deficit, from that expected, is a direct function of the change in wool price and wool production. Thus for example the wool production of 23,567 pounds and a wool price of 24.2 cents per pound gives a

63. In calculating the parametric net incomes no direct changes are made to the costs of woolpacks and cartage when wool production rises or falls. Each parametric net income can be considered as the income after allowing for any changes in the costs of woolpacks and cartage.

wool income of \$246 more than that obtained from the expected wool production of 24,808 pounds at 22 cents per pound. This \$246 extra wool income is directly reflected in the cash deficit which is \$246 less ($\$8,405 - \$8159 = \246) than the cash deficit from the expected wool production and wool price.

Second Year of Development - Stock Reconciliations, Budget and Production Summary (Tables 5.13 and 5.14)

The stock reconciliation (table 5.13) shows the number of sheep on hand at the beginning of the second year of development, the number of purchases, sales and the number on hand at the end of this year.

It can be seen that to attain the target for ewe numbers at the end of the year of 2880 ewes, 435 two-tooths must be purchased. A further 16 rams must also be purchased.

The sheep sales comprise all the wether lambs (except those retained for killers), all the six year old ewes, half the five year old ewes and small numbers of other sheep.

The overdraft interest payment of \$564 in the budget and production summary (table 5.14) is the interest payable on the overdraft of \$9,405, the expected overdraft level at the end of the first year of development. The non-deductible expenses of \$902 are made up of the \$500 cost of the new haybarn, together with \$402 for principal repayment on the mortgage.

In this second year of development a taxable income of \$2,729 is anticipated on which the tax payable is \$310. A cash deficit of \$3121 is expected which means that at the end of this year the bank overdraft is expected to be \$12,526. This is the sum of the bank overdraft at the end of the first year of development (\$9405), together with the cash deficit in the second year of development ($\$3121 + \$9405 = \$12,526$).

The total debt at the end of the second year of development is \$37,743, which is \$10,743 higher than the total debt at the beginning of development.

TABLE 5.13

SHEEP FARM DEVELOPMENT PROGRAM - DATA OUTPUT FORM

ANNUAL OUTPUT

Reference No: 1 Year: 2

Sheep Reconciliation

	Killers	Wether Lambs	Ewe Lambs	Ewe Hoggets	2-th Ewes	4-th Ewes	6-th Ewes	4 yr Ewes	5 yr Ewes	6 yr Ewes	7 yr Ewes	Total Ewes	Rams
Beginning of Year	20	0	0	609	1163	372	356	340	166	0	0	2400	48
Purchases	0	0	0	435	0	0	0	0	0	0	0		16
Sales	0	1006	51	57	22	7	6	161	158	0	0	0	
End of Year	20	0	0	974	956	1083	346	331	161	0	0	2880	57

Cattle Reconciliation

	Yearling Steers	2 Year Steers	3 Year Steers	4 Year Steers	Total Steers
Beginning of Year	150	0	0	0	150
Purchases	150	0	0	0	
Sales	148	0	0	0	
End of Year	150	0	0	0	150

TABLE 5.14

SHEEP FARM DEVELOPMENT PROGRAM - OUTPUT FORM

ANNUAL OUTPUT

Budget and Production Summary

Sheep Sales (\$)	Sheep Purchases (\$)	Cattle Sales (\$)	Cattle Purchases (\$)	Change in Livestock Standard Value (\$)		Wool Production (lbs)	Gross Cash Income (\$)		
				+	-				
6806	3711	11880	9000	3750	0	34504	26277		
Deductible Expenses (\$)	Added Principal Repayments (\$)	Overdraft Interest (\$)	Added Interest Payments (\$)	Non-deductible Expenses (\$)		Personal Drawings (\$)	Life Insurance Premiums (\$)		
26584	0	564	0	902		1500	100		
Depreciation (\$)	Taxable Income (\$)	Total Tax (\$)	Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Total Mortgages (\$)	Total Debt (\$)	Added Debt (\$)
713	2729	310	0	3121	0	12526	25217	37743	10743

Parametric Financial Analysis

Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Wool Production (lbs)	Wool Price (cents)
0.0	2869	0.0	12274	32779	24.2
0.0	3415	0.0	12820	32779	22.0
0.0	3985	0.0	13390	32779	19.8
0.0	3715	0.0	13120	34504	19.8
0.0	3445	0.0	12850	36229	19.8

An interesting feature of the parametric financial analysis is that taxation has tended to stabilise the cash flow when the wool price and/or wool production differs from that expected. This feature was not shown in the previous analysis as the taxable income was always negative and hence no tax was payable.

The parametric financial analysis shows that if the wool price is 24.2 cents per pound and the wool production is 32,779 pounds, there is a cash deficit of \$2,869. The wool income is increased by \$335, compared with the expected income. The cash deficit however, is only \$252 less than expected ($\$3121 - \$2869 = \252). The difference of \$83 ($\$335 - \$252 = \83) is payable in added tax.

Conversely if the wool income is less than the expected, the cash deficit will not increase proportionately. Thus if the wool production is five percent less than expected (32,779 pounds), and the wool price 10 percent less than expected (19.8 cents per pound), the wool income will be \$1,110 less than the expected wool income. The cash deficit is however only \$864 higher ($\$3985 - \$3121 = \864) than that expected (\$3121). Thus taxation tends to stabilise the affect of fluctuating prices on cash flow.

The parametric financial analysis can also be viewed as a measure of the risk in development.

Post Development Year - Stock Reconciliations, Budget and Production Summary (Tables 5.15 and 5.16)

The sheep reconciliation (table 5.15) shows the number of ewes in each age class, if ewe numbers were to be maintained at 2,880, with ewes being cast for age at five years. It can be seen from the output form that 866 two-tooth replacement ewes must enter the flock each year to maintain constant flock numbers at 2,880 ewes. There would be an annual surplus of 367 two-tooths for sale. The other main classes of sheep sold are the wether lambs and the five

TABLE 5.15

SHEEP FARM DEVELOPMENT PROGRAM - DATA OUTPUT FORM

ANNUAL OUTPUT

Reference No: 1

Year: _____

Sheep Reconciliation

	Killers	Wether Lambs	Ewe Lambs	Ewe Hoggets	2-th Ewes	4-th Ewes	6-th Ewes	4 yr Ewes	5 yr Ewes	6 yr Ewes	7 yr Ewes	Total Ewes	Rams
Beginning of Year	20	0	0	1299	866	741	668	603	0	0	0	2880	57
Purchases	0	0	0	0	0	0	0	0	0	0	0		14
Sales	0	1348	68	367	82	35	31	573	0	0	0		
End of Year	20	0	0	1299	866	741	668	603	0	0	0	2880	57

Cattle Reconciliation

	Yearling Steers	2 Year Steers	3 Year Steers	4 Year Steers	Total Steers
Beginning of Year	150	0	0	0	150
Purchases	150	0	0	0	
Sales	148	0	0	0	
End of Year	150	0	0	0	150

TABLE 5.16

SHEEP FARM DEVELOPMENT PROGRAM - OUTPUT FORM

ANNUAL OUTPUT

Budget and Production Summary

Sheep Sales (\$)	Sheep Purchases (\$)	Cattle Sales (\$)	Cattle Purchases (\$)	Change in Livestock Standard Value (\$)		Wool Production (lbs)	Gross Cash Income (\$)		
11663	576	11880	9000	+	-	44680	33372		
				0	0				
Deductible Expenses (\$)	Added Principal Repayments (\$)	Overdraft Interest (\$)	Added Interest Payments (\$)	Non-deductible Expenses (\$)	Personal Drawings (\$)	Life Insurance Premiums (\$)			
20257	0	60	0	426	7152	100			
Depreciation (\$)	Taxable Income (\$)	Total Tax (\$)	Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Total Mortgages (\$)	Total Debt (\$)	Added Debt (\$)
629	12485	5435	7152	0	0	1000	25217	26217	0

Parametric Financial Analysis

Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Wool Production (lbs)	Wool Price (cents)

year old ewes.

The budget and production summary (table 5.16) includes the pattern of income and expenditure when all debt, associated with development, has been repaid. This debt will have been repaid when the bank overdraft falls to \$1000.

It can be seen that the personal drawings and the cash surplus are both \$7152. The sum available for personal drawings in the base year was \$4755. Thus the development plan will, after all the debt has been repaid, allow the farmer to spend an additional \$2396 ($\$7152 - \$4755 = \2396) on consumption or investment.⁶⁴

The Evaluation and Parametric Evaluation of The Development Plan (Table 5.17)

The present value of the development plan is \$17,486. In calculating the present value, the discount rate used is the interest rate charged on the bank overdraft.

The payback period, the time taken to repay the debt associated with the development plan, assuming personal drawings during development remain at the base year level (\$4755), is 11 years.⁶⁵ As noted previously the farmer can then increase his personal drawings or increase his investment by a further \$2396.

The parametric evaluation shows the profitability of the development plan over a range of price and production levels. The lower and upper "limits"

64. The sum of \$2396 is the new equilibrium cash profit, the added profits from development after production has stabilised and all debt, associated with development, has been repaid.

65. The overdraft at the end of the second year of development is \$12,526 and at the beginning of development is \$1000. If the farmer's personal drawings remain at \$1500, it will take five years to reduce the debt to \$1000, assuming each year the cash surplus of \$5652 goes towards reduction of the debt. The sum of \$5652 is the difference between the post development cash surplus of \$7152 and \$1500, the sum allowed for personal drawings during development.

TABLE 5.17

SHEEP FARM DEVELOPMENT PROGRAM - OUTPUT FORMPLAN OUTPUTDevelopment Plan Evaluation

Present Value	Payback Period (Years)	Increase in Personal Drawings Possible After Payback
\$17486	11	\$2396

Parametric Development Plan Evaluation

Wool Price \ Wool Production	Lower Limit	Expected	Upper Limit
Lower Limit	\$15872 11 Years \$ 2351	\$16320 11 Years \$ 2360	\$16839 11 Years \$ 2376
Expected	\$16898 11 Years \$ 2378	\$17486 11 Years \$2396	\$18130 11 Years \$ 2419
Upper Limit	\$18067 11 Years \$ 2417	\$18751 10 Years \$ 2440	\$19571 10 Years \$ 2473

Note: The present value, payback period (years) and personal drawings increase (after payback) are given in this sequence for each "cell" of the above table.

for wool production are for a five percent deviation below and above the expected wool production. The lower and upper "limits" for wool price are for a 10 percent deviation below and above the expected wool price.⁶⁶

In the calculation of the parametric evaluations for the development plan, for example that evaluation for the lower limit for wool production and the lower limit for wool price, wool production in all years is decreased by five percent and the wool price is decreased in all years by 10 percent. Thus if no development takes place, the base year cash surplus is different from the base year cash surplus obtained, given the expected wool price and the expected wool production.

Each of the nine parametric evaluations employs the principle explained above. For each evaluation a new base year is defined, giving a different sum available for personal drawings if no development occurred.

The parametric evaluations are designed to evaluate the profitability of the plan if the farmer was optimistic or pessimistic in all his forecasts of wool production and/or wool price.

One result of this particular method of analysing the affect of variation in the wool price and/or wool production on the profitability of development is seen on table 5.17. It can be seen that variation in the wool price and/or wool production (over the range selected) has not greatly affected the profitability of development. Thus the present value of the development plan at the upper limit for wool production (five percent above expected) and the upper limit for wool price (10 percent above the expected wool price of 22 cents per pound), is only \$3700 higher than for the outcome where both wool production and wool price are at the lower limit (five and 10 percent below

66. These were specified in the input form - the last two items.

the expected values respectively).

Discussion of The Analysis and Evaluation of The Development Plan

The analysis and evaluation of the development plan shows that the plan is profitable, but does require substantial financial resources to implement and also has quite a long payback period (11 years).

The farmer needs to decide if the plan is sufficiently profitable for him to accept the risk implicit in the borrowing necessary to adopt the plan. If the plan is implemented the farmer's liabilities will increase appreciably and this poses a threat to the economic viability of the farm. If the farmer is prepared to accept this risk, he needs to ascertain if he is able to finance the development. If he is unable to do this, or considers that the risk in doing so is unacceptable, then the plan must be either modified in some way or rejected and a new plan evolved.

The farmer may wish, after seeing the analysis and evaluation, to review the plan. The particular feature that might be reconsidered is the decision to purchase two-tooth ewes to make up the shortfall between projected and target ewe numbers. This decision, to buy two-tooth ewes at \$7 per head, has contributed very substantially to the plan's requirements for borrowed capital. An alternative plan might be investigated based on the buying in of five year old ewes, rather than two-tooth ewes.

A Consideration of The Use of The Program By A Farm Adviser

This section considers some points about the possible field use of the program by a farm adviser.

The most important decision a farmer can make about a development plan is to start to implement the plan. The farmer at this stage is likely to be particularly concerned with the first year of the plan, even if it is expected to extend over several years.

Agriculture in New Zealand over time is subject to fluctuating prices, especially product prices, and technological change. A farmer's management objectives may also change over time. Thus it is seldom that a three or even a two year development plan will be implemented as originally planned. Changing technology, or prices, or even management objectives require that the original development plan be modified, sometimes quite dramatically.

Thus each year, in response to change, the farmer usually has to formulate a "new" development plan. This "new" development plan may be only a slight modification of the original development plan. Another evaluation will be required because the profitability of the farm in the absence of any further development, and the profitability of development, may have changed.

The program has been designed to fit in with this philosophy of development. Thus it is thought that a developing farmer, in association with his adviser, will probably each year have to reformulate his development plan in the light of change, complete the input form once again and obtain a new analysis and evaluation. From this the farmer must decide whether to continue with, or cease, further development.

Summary

This chapter has described and discussed a program which will analyse and evaluate a development plan for a sheep farm. A flow diagram of the logic of the program has been given. Finally an example has been given of a development plan analysed and evaluated using the program.

CHAPTER 6

A COMPUTER PROGRAM FOR THE ANALYSIS OF A DAIRY FARM DEVELOPMENT PLAN

Introduction

This chapter outlines a program which analyses and evaluates a dairy farm development plan. Many of the principles of this program, however, are very similar to, or identical with, the principles already described for the sheep farm development program. This chapter will not traverse in detail those features of the dairy program that are closely related to features already described for the sheep program. The chapter includes an example of the analysis and evaluation of a development plan.

Basic Principles of The Program

The basic principles of the program are similar to those already described for the sheep farm development program. Firstly the adviser is required to formulate a development plan which is feasible for all resources, other than finance. Secondly the development plan must be concerned with increasing cow numbers over some period of time.

The program calculates the financial resources required to adopt the plan and makes an evaluation of the profitability.

Information Provided By The Adviser About The Development Plan

The information that an adviser must provide about a development plan that he wants analysed and evaluated can be grouped into four categories, in a similar way to that explained for the sheep program.

Information Assumed to be Constant In All Years of The Development Plan

The following items are assumed to constant in all years of the development plan.¹

1. These items are all defined explicitly in Appendix F.

- (1) Death rates in calves, yearling heifers, two year old heifers and cows.
- (2) Buying and selling prices for all classes of stock - heifer calves, weaner heifers, yearling heifers, two year old heifers and cows.
- (3) The expected butterfat price.
- (4) "Fixed costs" such as rates, rent, insurance premiums (excluding life insurance), and interest on flat mortgages.
- (5) The cost of:
 - (i) Electricity per cow.
 - (ii) Shed expenses per cow.
 - (iii) Animal health expenses per cow.
 - (iv) Artificial insemination expenses per cow.
 - (v) The variable expenses associated with each heifer calf.
 - (vi) The variable expenses associated with each yearling heifer.
- (6) The percentage of the herd mated by artificial insemination.
- (7) The calving percentage.
- (8) The value of the special taxation exemptions for calculating taxation liability.
- (9) The value of the life insurance premiums which are deductible for calculating taxation liability.

Information Relating to The Base Year of The Development Plan

The adviser, for the base year, must estimate the total herd numbers²

2. Total herd numbers refers to the sum of the two year old heifers and cows on hand at the beginning of the financial year (1st July).

that should be carried in the absence of any further improvement to the farm, but assuming that present productivity is maintained.

He must also specify the "normal" culling policy for heifer calves, yearling heifers, two year old heifers and cows of each age ranging from cows calving for the second time to cows calving for the seventh time.³

For the base year, the adviser is required to state the stock replacement policy that would be followed if the total herd numbers are maintained at the base year level. Nine different stock replacement policies are permitted and the adviser must nominate one of these. The stock replacement policy, nominated for this year, is also used by the program for each year of physical development in calculating the stock reconciliations. The nine policies are:

- (1) The retention of heifer calves with no stock purchases.
- (2) The retention of heifer calves, together with the purchase of heifer calves.
- (3) The retention of heifer calves, together with the purchase of weaner heifers.⁴
- (4) The retention of heifer calves, together with the purchase of yearling heifers.⁵

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3. The culling percentage for heifer calves refers to the proportion of heifer calves, born alive, that must be culled as bobby calves. The culling percentage for all other age classes refers to the percentage of each age class, on hand at the beginning of the year that must be culled at the end of the year. For example, the "Culling % - two year Heifers" refers to the percentage of two year old heifers on hand at the beginning of the year that must be culled at the end of the year (i.e. in June - after one season's production). The adviser may specify that no two year heifers need be culled.
 4. A weaner heifer is assumed to be approximately 10 months of age at purchase date and bought prior to balance date (30th June).
 5. A yearling heifer is assumed to be approximately twelve months of age at purchase date and bought after balance date.

- (5) The retention of heifer calves, together with the purchase of two year old heifers.
- (6) The retention of heifer calves, together with the purchase of cows.⁶
- (7) The sale of all heifer calves and the purchase of yearling heifers.
- (8) The sale of all heifer calves and the purchase of two year old heifers.
- (9) The sale of all heifer calves and the purchase of cows.

If the adviser nominates policy number seven, eight or nine, the program will calculate the number of either yearling heifers (policy number seven) or two year old heifers (policy number eight or nine) to be purchased each year to maintain constant total herd numbers at the base year level.⁷ All heifer calves are assumed to be sold.

If however the adviser nominates any one of the first six policies, the program will calculate the minimum number of heifer calves that must be retained each year to provide sufficient two year old heifers to maintain constant total herd numbers at the base year level.

If there are insufficient two year old heifers available to maintain constant total herd numbers when all available calves are retained, it is assumed in the program that the balance are purchased.⁸ The age of stock purchased

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6. It is assumed in the program that any two year old heifers or cows purchased are bought prior to balance date and are in calf.
 7. Stock replacement policy numbers eight and nine are identical for the base year only. The reason is that very few farmers would maintain a herd indefinitely by buying cows each year, but many would increase herd numbers over a two or three year period by buying cows. Thus policy numbers eight and nine are the same for the base year but different for physical development.
 8. That is the difference between the number of two year old heifers required to maintain constant herd numbers at the base year level and the number of two year old heifers available from retaining heifer calves.

depends upon the stock policy nominated by the adviser.⁹ It would normally be expected however that sufficient two year old heifers would be available for herd replacements.¹⁰

From the stock reconciliation, the number of stock to be sold is found,¹¹ and the butterfat output, and income, is calculated.

The adviser must estimate the major items of expenditure for the base year. The annual expenditure on manure and lime, wages, vehicle expenses, cartage, fuel and oil, car expenses and fodder so that the carrying capacity can be maintained indefinitely, must all be stated by the adviser. The program calculates directly electricity, animal health, shed, artificial insemination, calf and yearling expenses.

From the information provided by the adviser about the base year, the program calculates income and expenditure and thus the cash surplus (personal drawings).

Information Relating to Each Year of Development

The number of stock in each age class on hand at the beginning of development is given by the adviser.¹²

The adviser must nominate a "target herd size" for the 30th June of each

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9. The ages at which heifers can be purchased are either calf (policy number two), weaner (policy number three), yearling (policy number four) or two year old heifer (policy numbers five and six). Stock replacement policy numbers five and six are identical for the base year only. If the adviser nominates policy number six and the calving percentage is so low that stock must be purchased to maintain herd numbers, it is assumed in the program that two year old heifers will be purchased.
 10. A herd would need to have a very low calving percentage, or high death rates in calves or yearlings, to be unable to provide sufficient two year old heifers to maintain constant herd numbers, assuming cows are retained within the herd for five or six lactations.
 11. All bull calves are assumed to be sold as bobbies.
 12. The age classes are yearling heifers, two year old heifers, and cows ranging in age from second calvers to cows calving for the eighth time. It is assumed in the program that no heifer calves are on hand at the commencement of development.

year. The target herd size is the total number of two year old heifers and cows. The program can cope with a plan that has up to six years of physical development.

In each year of development the program calculates either the minimum number of heifer calves to retain so that the target for herd numbers, two years hence is attained, or the number of yearling heifers, two year old heifers, or cows to purchase so that the target for herd numbers for that particular year is attained.

In calculating the stock reconciliations, the stock replacement policy and the culling policy for stock of all ages is the same as for the base year. Thus if the adviser specifies the stock replacement policy as any one of the first six policies listed,¹³ the program calculates the minimum number of heifer calves to retain, so that the target for herd numbers, two years hence, is reached.¹⁴

If by retaining all the available heifer calves the target for two years hence is unattainable, additional stock are purchased so that projected herd numbers are equal to the target. The age at which stock are purchased depends upon the stock policy nominated by the adviser. For example, if stock policy number two is nominated, additional heifer calves are purchased so that the target, two years hence, is attained. On the other hand if stock policy number four is nominated, additional yearlings are purchased at the beginning of the following year so that the target is reached.¹⁵ It is only if insufficient

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13. The first six policies listed all have the common feature of retaining heifer calves together with, in the case of policies two, three, four, five and six, the purchase of heifer calves, weaner heifers, yearling heifers, two year old heifers and cows respectively.
 14. Those heifer calves, over and above the minimum number that must be retained to meet the target herd size in two years time, are sold as calves.
 15. If the adviser specifies stock replacement policy number six, cows are assumed to be purchased at the end of the following year if insufficient heifer calves are retained to attain the target for herd numbers.

heifer calves are retained, that additional stock are purchased, if the adviser specifies stock policy number two, three, four, five or six.

It is possible of course for the target herd size to be unattainable. This may happen if the adviser nominates the stock replacement policy as number one, the retention of heifer calves with no purchases of stock. Similar points apply here, to those made in Chapter 5 for the case of the sheep farmer not prepared to buy ewes.

If the adviser nominates the stock replacement policy as either number seven, eight or nine, it is assumed in the program that all heifer calves are sold. The program calculates the number of either yearling heifers, two year old heifers or cows to purchase in each year of development, so that the target for herd numbers at the 30th June each year is reached.¹⁶

Information Relating To The Post Development Year

The items the adviser is required to specify for the post development year are identical in principle to those that must be given for the base year.

The adviser must estimate the total herd numbers the farm should carry in the post development situation. The stock replacement policy must also be given by the adviser. This can be any one of the nine stock policies previously listed and need not necessarily be the same as that used in the base year and each year of development.

The culling percentage for stock of each age¹⁷ is given by the adviser. From the culling policy and the stock replacement policy the number of heifer calves to retain is calculated (if the stock replacement policy is a number

16. Any cows or two year old heifers purchased are assumed to commence milking in the year after the year of purchase.

17. The age classes for which a culling policy must be specified are the same as for the base year.

between one and six), or the number of yearling or two year old heifers to purchase is calculated (if the stock replacement policy is number seven, eight or nine). A static stock reconciliation is computed in the same way as explained in relation to the base year. From the stock reconciliation the value of stock sales, and the expected butterfat production and income, is found. The gross cash income is simply the sum of the income from the sales of butterfat, livestock and any non dairying income.

The expenditure, necessary to maintain the stock numbers in the post development situation, again must be estimated by the adviser. In particular, the adviser must determine the expenditure on wages, manure and lime, seeds, contract cultivation, vehicle expenses, cartage, fuel and oil, car expenses, fodder, repairs and maintenance, and any other cash costs necessary to maintain the post development carrying capacity. Costs such as those associated with calves, yearlings, shed, electricity, animal health and artificial breeding are calculated directly by the program in the same way as explained previously.

The program output consists of the static stock reconciliation together with a summary of the financial information.

Income in Each Year of Development

The program calculates the butterfat production, and income, for each year of development. The butterfat production is found each year by multiplying the number of two year old heifers on hand at the 1st July by the expected butterfat production per heifer, and by multiplying the number of cows on hand at the 1st July by the expected butterfat production per cow. The adviser specifies production per heifer and per cow and can change both, each year.

The number of stock to be sold in each year, and their value, is calculated

by the program. The adviser can include, in each year, income from non-dairying sources. Gross cash income is the total of the income received from butterfat, stock, and any income received from non-dairying sources.

Expenditure In Each Year of Development

The adviser is required to estimate, for each year, the required expenditure, to make the targets for herd numbers feasible. Certain expenditure items are calculated directly by the program. The major items of expenditure are the same as those listed when the sheep farm development program was discussed.¹⁸ The expenditure on each of these items can be estimated in advance because it will be related to herd numbers (except personal drawings), and the adviser is required to estimate these for each year of development.

Thus for example the required expenditure on an item such as fodder which includes the cost of making and/or buying any feed supplements (the cost of making hay and silage or the cost of buying in meals for example), is related to the stock numbers carried which the adviser specifies. The cost of fodder in any year may also be dependent upon the number of yearling heifers carried. The adviser must express the costs for each yearling on a per animal basis - the total cost of carrying the yearlings is found by multiplying the number of yearlings on hand at the 1st July by the costs per yearling. The cost of any hay made for feeding to yearling heifers would be included under the variable costs associated with the yearling heifers.

The expenditure for each year of development on calf costs, shed, electricity, animal health and artificial breeding expenses, are all calculated

18. The items are all listed and defined in Appendix F.

directly by the program.¹⁹

In regard to interest and principal charges on any mortgages, interest on the bank overdraft, taxation, and depreciation allowances, the comments made in Chapter 5 apply here. Both programs are identical in their treatment of these items. This program also makes provision for development to be financed by table mortgage, a feature also explained in the previous chapter.

Program Output for Each Year of Development

The output for each year of development consists of a stock reconciliation, a budget and production summary, and a parametric financial analysis.

The stock reconciliation shows the number of yearling heifers, two year old heifers, cows and total herd numbers at the beginning and end of the year. The number of heifer calves, yearling heifers,²⁰ two year old heifers and cows, purchased and sold, is also shown.

The items in the budget and production summary are not listed here as they appear on the output form in the case study and are discussed later (p.138)

The parametric financial analysis, is, in principle, identical to that described for the sheep farm. The adviser nominates a "percentage change" for both butterfat price, and production. For each year of development the cash flow, and the bank overdraft or credit level, are recalculated using the expected butterfat price and the expected butterfat production, plus or minus the "percentage change" for each variable.

The adviser thus has, as with the sheep program, six estimates of cash flow and the bank overdraft or credit level for each year of development.

19. The cost of these items each year is found simply by multiplying the herd numbers at the 1st July by the cost of each of the above items. The expenditure on calves is found by multiplying the number of heifer calves to be retained by the costs per calf.

20. The output form shows the purchases of weaner heifers as yearling heifers, that is, no separate column is included for weaner heifers.

This will not remove the uncertainty surrounding the expected butterfat production and price; it does however show the financial implications of changes in these crucial variables.

Program Output For The Development Plan - The Evaluation and Parametric Evaluation

The program provides the same three measures of the profitability of the development plan as is provided by the sheep program. These measures are the present value, the payback period and the increase in personal drawings after payback.

If the present value of the development plan is positive, a parametric evaluation is carried out. The program allows the adviser to nominate a "percentage change" for both butterfat production and butterfat price. The result is that nine separate evaluations are obtained, each with the three measures of profitability.

A Brief Description of The Computer Program

The program consists of seven separate programs. These are:

- (1) Base year program.
- (2) Financing program for stock replacement policy numbers one, two or three.
- (3) Financing program for stock replacement policy numbers four, five or six.
- (4) Financing program for stock replacement policy numbers seven, eight or nine.
- (5) Post development year program.
- (6) Evaluation program.
- (7) Parametric evaluation program.

In the analysis of a development plan, only one of the three financing

programs is used, the program selected depending upon the stock replacement policy nominated by the adviser. Thus for the analysis of any one development plan, only five programs are used.

The name given to each of the programs indicates its function. The functions of each program will not be described here, as this has already been considered when the sheep farm program was discussed. All seven programs are "linked together" as was explained with reference to the sheep program.

Limitations in The Program

The limitations in this program are similar to those discussed for the sheep program.

Case Study - The Use of The Program In The Analysis and Evaluation of a Development Plan

This section illustrates a case study of a development plan analysed and evaluated using the program. The input forms (tables 6.3, 6.4 and 6.5) show the information provided about the development plan. The output forms (tables 6.6 to 6.10) show the analysis and evaluation of the plan.

A Background Description of The Farm

The farm is situated two miles south of Shannon and is approximately 20 miles from Palmerston North. It is 193 acres in area, of which an area in peat of about 130 acres has poor natural drainage. This latter area has, however, been drained, and a network of open drains flow into a Manawatu Catchment Board drain.

The farmer considers that the present drainage system, with some modification, is adequate to support not only the present herd of 120 cows and heifers, but also an increase of 40 cows. The potential production of the property could, however, only be attained by installing an extensive tile and mole drain-

age system. The non peat area of about 60 acres is free draining and is used for wintering and for grazing in the early spring if the area in peat is too wet to graze.

The annual rainfall in this area is approximately 40 inches, generally evenly distributed, but with an occasional dry summer.

The pastures consist predominantly of white clover and perennial ryegrass. Pasture production and hence butterfat production is low however, because of inadequate subdivision, a low stocking rate and a low topdressing rate of two hundredweight of superphosphate per acre. To increase production on this property, it would be essential to install a central race, subdivide further and increase the quantity of superphosphate applied.

The cowshed is a "walk through" type with twelve bails. It is adequate for the present herd of 120 cows and heifers but would need to be converted to a herringbone if herd numbers were raised above 120 cows and heifers.

The house, although approximately 50 years old, has been repiled recently and a considerable sum spent on repairs. Further expenditure will not be required in the foreseeable future but if stock numbers were increased, additional labour would need to be employed and this would necessitate an extra room being built (assuming a youth were to be employed).

The Physical Development

The development to be described is only one of the alternatives being considered for this property. Essentially the plan is to increase herd numbers from the present level of 120 to 160 cows and heifers. It is considered that this can be carried out without having to spend a substantial sum of money on drainage.

In the first year of development it is planned to increase the herd numbers by 20 cows. To do this, the shed will need to be converted to a herring-

bone, new milking machines installed, some additional fencing erected, extensions made to the drainage system, a central race installed and four hundredweight of superphosphate per acre applied.

The cost of each of the above items is shown in table 6.1. The total cost of development is \$7780 in the first year.

TABLE 6.1

Development Expenditure In The First Year of Development

<u>Item</u>	<u>Cost \$</u>
(1) Conversion of the cowshed to a herringbone	4000
(2) Installation of a new milking machine	1000
(3) Fencing	200
(4) Drainage	300
(5) Metal for the central race and bridges across the Catchment Board drain	1000
(6) Fertiliser - 40 tons of superphosphate at \$32 per ton applied	1280
TOTAL	\$7780

In the second year of development, an additional room will be added to the house because a youth is to be employed, some improvements are to be made to the water supply, another haybarn will be erected, additional fencing will be erected and the level of superphosphate will be maintained at four hundredweight per acre. The cost of each of these items is shown in table 6.2.

The total cost is \$2880.

TABLE 6.2Development Expenditure In The Second Year of Development

<u>Item</u>	<u>Cost \$</u>
(1) Addition of a room to the house	400
(2) Improvements to the water supply	500
(3) Erection of a haybarn	400
(4) Additional fencing	300
(5) Fertiliser - 40 tons of superphosphate at \$32 per ton applied	1280
Total	<u>\$2880</u>

Development is assumed to terminate at this point with herd numbers increased from 120 to 160 cows plus replacements, over a two year period.

The Analysis and Evaluation of The Development Plan - Completing The Input Form

The input forms (tables 6.3, 6.4 and 6.5) show the information required for the analysis and evaluation of the development plan.

Variables Which Are Assumed to Be Constant in All Years of The Development Plan

The variables numbered one to 21 are assumed to be constant in all years of the development plan. Variable number 5 (Purchase price - two year heifers) is \$70. The farmer proposes to increase cow numbers by retaining heifer calves. If, however, he is unable to retain sufficient heifer calves to attain the target for herd numbers, he is prepared to purchase two year old heifers, so that pro-

jected and target herd numbers are equal.

The expected butterfat price (variable number 9) of 25 cents per pound is low and is a reflection of the farmer's pessimistic view of the future prospects for the dairy industry.

Calving percentage (variable number 18) refers to the number of calves alive at one week of age per 100 cows mated. The next three variables (numbers 19, 20 and 21) refer to death rates; from the calf to the yearling age; from the yearling to the two year old heifer age; and the annual death rate in cows and two year old heifers.

As can be seen from the variables numbered 22 to 31, the farmer had no liabilities at the commencement of development and in fact had a cash reserve of \$1900 (variable number 23).²¹

Variables Which Refer To The Base Year (Table 6.3)

The variables numbered 32 to 57 refer to the base year.

Variable number 33 (stock increase option) is five which indicates that the replacement policy is to rear heifer calves, but that two year old heifers are to be purchased if insufficient heifer calves can be reared.

The variables numbered 34 to 43 show the proportion of the stock in each age class, on hand at the 1st July, that must be culled at the end of the year. It can be seen that five percent of heifer calves must be sold (small or born late in the season) and also that five percent of the yearlings must be culled (fail to conceive or unsuitable in some other way). The input form shows that cows are to be retained in the herd for up to five lactations.

Expected butterfat per heifer (variable number 44) and expected butterfat per cow (variable number 45) refer to the anticipated base year production levels.

21. Details of variables numbered 10 and 11 may be found in Appendix L.

TABLE 6.3

DAIRY FARM DEVELOPMENT PROGRAM - INPUT FORM

Variable No.	Description	Value	Variable No.	Description	Value
1.	Farm Identification Number	7	21.	% Deaths - 2 Year Heifers and Cows	3
2.	Purchase Price-Heifer Calves	0	22.	Initial Bank Overdraft Level	0
3.	Purchase Price-Weaner Heifers	0	23.	Initial Bank Credit Level	1900
4.	Purchase Price - Yearling Heifers	0	24.	Interest Rate - (%)	6
5.	Purchase Price - 2 Year Heifers	70	25.	Life Insurance Premiums	100
6.	Purchase Price - Cows	0	26.	Mortgage-Balance Outstanding	0
7.	Sale Price - Bobby Calves	10	27.	Total Annual Charges	0
8.	Sale Price - Boner Cows	50	28.	Interest Rate - (%)	0
9.	Expected B'fat Price (cents per pound)	25	29.	Mortgage - Balance Outstanding	0
10.	Special Taxation Exemptions	785	30.	Total Annual Charges	0
11.	Overhead Costs	711	31.	Interest Rate - (%)	0
12.	Rent and Interest	0	32.	Total Herd Size	120
13.	Electricity/Cow	1.3	33.	Stock Increase Option	5
14.	Shed Expenses/Cow	1.2	34.	Culling % - Heifer Calves	5
15.	Animal Health/Cow	1.5	35.	Culling % - Yearling Heifers	5
16.	A.I. Cost/Cow	2.0	36.	Culling % - 2 Year Heifers	3
17.	% of Herd Mated by A.I.	80	37.	Culling % - 2nd Calvers	2
18.	Calving Percentage	93	38.	Culling % - 3rd Calvers	2
19.	% Deaths-Calf to Yearling	5	39.	Culling % - 4th Calvers	2
20.	% Deaths-Yearling to 2-Year old Heifer	3	40.	Culling % - 5th Calvers	100
			41.	Culling % - 6th Calvers	0

(Cont'd)
TABLE 6.3

DAIRY FARM DEVELOPMENT PROGRAM - INPUT FORM

Variable No.	Description	Value	Variable No.	Description	Value
42.	Culling % - 7th Calvers	0	63.	Number of Yearling Heifers	30
43.	Culling % - 8th Calvers	100	64.	Number of 2-Year Heifers	28
44.	Expected Butterfat/Heifer	240	65.	Number of 2nd Calvers	24
45.	Expected Butterfat/Cow	280	66.	Number of 3rd Calvers	26
46.	Expenses/Calf	7	67.	Number of 4th Calvers	22
47.	Expenses/Yearling	4	68.	Number of 5th Calvers	20
48.	Seeds, Manure and Lime	640	69.	Number of 6th Calvers	0
49.	Wages	0	70.	Number of 7th Calvers	0
50.	Vehicle Expenses	100	71.	Number of 8th Calvers	0
51.	Cartage	50	72.	Standard Value - Yearling Heifers	20
52.	Fuel and Oil	400	73.	Standard Value - 2 Year Heifers	40
53.	Car Expenses	250	74.	Standard Value - Cows	50
54.	Fodder	200	75.	Code - Office Use Only	2
55.	Repairs and Maintenance	350	76.	Target Herd Size - Year ^{End of} 1	140
56.	Other Cash Costs (Deductible)	0	77.	Target Herd Size - Year 2	160
57.	Other Income (Assessable)	0	78.	Target Herd Size - Year 3	0
58.	Depreciation - Cost Price	175	79.	Target Herd Size - Year 4	0
59.	Depreciation - 10% Diminished Value	568	80.	Target Herd Size - Year 5	0
60.	Depreciation - 15% D.V.	0	81.	Target Herd Size - Year 6	0
61.	Depreciation - 20% D.V.	2300	82.	% Change in Butterfat Production	0.05
62.	Depreciation - 50% D.V.	0	83.	% Change in Butterfat Price	0.10

Expenses per calf and expenses per yearling refer to the variable costs associated with rearing calves and yearlings. The variable costs cover items such as hay, veterinary expenses and milk powder for calves and hay and veterinary expenses for yearlings.

The variables numbered 48 to 56 refer to the base year expenditure.²²

Variables numbered 63 to 71 refer to the number of animals of each age on hand at the commencement of development and the three variables numbered 72, 73 and 74 refer to the standard values elected by the farmer.

The variables numbered 76 and 77 refer to the targets for herd numbers for the end of the first and second year of development. Physical development extends over two years and variables numbered 78 to 81 can be ignored.

The percentage change, for butterfat output (variable number 82), is 10 percent (0.1), and for butterfat price is five percent (0.05). These numbers are used in calculating the parametric financial analysis.

Variables Which Refer to Years of Development (Table 6.4)

Entries have been made in the first two columns (table 6.4) for variables numbered 84 to 108 inclusive for the two years of development.

The expected butterfat production per heifer and per cow is at the same level as in the base year. Although more fertiliser is to be applied, it is considered that it may take some time for fertility to build up and hence during development, projected per animal production is expected to continue at the base year level.²³

22. Details of the values assigned to these variables and to variables numbered 58 to 62 may be found in Appendix L.

23. Details of some of the values assigned to variables numbered 86 to 108 for both years of development, may be found in Appendix L.

TABLE 6.4

DAIRY FARM DEVELOPMENT PROGRAM - INPUT FORM

Variable No.	Description	Year					
		1	2	3	4	5	6
84.	Expected Butterfat/Heifer	240	240				
85.	Expected Butterfat/Cow	280	280				
86.	General Development	1500	800				
87.	Wages	0	1300				
88.	Manure and Lime	1280	1280				
89.	Seeds	0	0				
90.	Contract Cultivation	0	0				
91.	Vehicle Expenses	100	100				
92.	Fuel and Oil	450	450				
93.	Car Expenses	250	250				
94.	Cartage	50	50				
95.	Fodder	220	260				
96.	Repairs and Maintenance	350	350				
97.	Other Cash Costs (Deductible)	0	0				
98.	Other Income (Assessable)	0	0				
99.	New Mortgage	0	0				
100.	Total Annual Charges	0	0				
101.	Interest Rate - (%)	0	0				
102.	Capital Expenditure	4000	400				
103.	Depreciation System	1	1				
104.	Normal Depreciation Rate - (%)	10	2.5				
105.	Capital Expenditure	1000	400				
106.	Depreciation System	2	1				
107.	Normal Depreciation Rate - (%)	10	2.5				
108.	Personal Drawings	1500	1500				
109.	Code	99	99	99	99	99	99

TABLE 6.5

DAIRY FARM DEVELOPMENT PROGRAM - INPUT FORM

Variable No.	Description	Value
110.	Total Herd Size	160
111.	Stock Increase Option	5
112.	Culling % - Heifer Calves	5
113.	Culling % - Yearling Heifers	5
114.	Culling % - 2 Year Heifers	3
115.	Culling % - 2nd Calvers	2
116.	Culling % - 3rd Calvers	2
117.	Culling % - 4th Calvers	2
118.	Culling % - 5th Calvers	100
119.	Culling % - 6th Calvers	0
120.	Culling % - 7th Calvers	0
121.	Culling % - 8th Calvers	100
122.	Expected Butterfat/Heifer	280
123.	Expected Butterfat/Cow	320
124.	Wages	1300
125.	Manure and Lime	1280
126.	Seeds	0
127.	Contract Cultivation	0
128.	Vehicle Expenses	100
129.	Cartage	50
130.	Fuel and Oil	450
131.	Car Expenses	250
132.	Fodder	260
133.	Repairs and Maintenance	400
134.	Other Cash Costs (Deductible)	0
135.	Other Income (Assessable)	0
136.	% Change in Butterfat Price	0.10
137.	% Change in Butterfat Production	0.05

Variables Which Refer to The Post Development Year. (Table 6.5)

The variables numbered 110 to 135 refer to the post development situation. As can be seen from the input form the total herd numbers are 160. The stock replacement policy and the culling policy remains unchanged from the base year.

It is anticipated that both production per heifer and production per cow will increase. Accordingly production per heifer has been raised to 280 pounds and the production per cow to 320 pounds of butterfat.

In relation to expenditure, all items are the same as in the second year of development except repairs and maintenance which is increased because of the need to maintain more fences and buildings.

Variables numbered 136 and 137 show that the profitability of the development plan is to be evaluated at butterfat prices and production differing by 10 and five percent from those expected.

Program Output - The Analysis and Evaluation of The Development Plan

This section discusses the analysis and evaluation of the development plan and is similar in principle to the corresponding section of Chapter 5.

Base Year - Stock Reconciliation, Budget and Production Summary (Table 6.6)

Table 6.6 shows the program output for the base year. It can be seen that to maintain the herd numbers constant at 120 cows and heifers, the farmer must every year, retain sufficient heifer calves to have 28 yearling heifers on hand at the 30th June. This provides him with 26 two year old heifers entering the herd each year.

The annual sales of stock are 81 bobby calves made up of all the bull calves, which number 56,²⁴ the balance being the surplus heifer calves, that

24. The number of calves born is found by multiplying 120 by the calving percentage of 93.

ANNUAL OUTPUT

Reference No: 7 Year: _____

Stock Reconciliation

	Heifer Calves	Yearling Heifers	2 Year Heifers	Cows	Total Herd Size
Beginning of the Year	0	28	26	93	120
Purchases	0	0	0		
Sales	81	1	0	23	
End of Year	0	28	26	93	120

Budget and Production Summary

B'fat Production (lbs)	B'fat Income (\$)	Cattle Sales (\$)	Calf Sales (\$)	Other Income (\$)	Gross Cash Income (\$)	
32531	8132	1225	812	0	10170	
Calf Purchases (\$)	Weaner Purchases (\$)	Yearling Purchases (\$)	2 Year Hfr. Purchases (\$)	Cow Purchases (\$)	Change in Livestock Standard Value (\$)	
0	0	0	0	0	+ 0 - 0	
Deductible Expenses (\$)	Interest on New Mortgages (\$)	Overdraft Interest (\$)	Non-deductible Expenses (\$)	Principal on New Mortgages (\$)	Personal Drawings (\$)	
3701	0	0	0	0	4991	
	Life Insurance Premiums (\$)	Depreciation (\$)	Taxable Income (\$)	Total Tax (\$)		
	100	691	5777	1377		
Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Total Mortgages (\$)	Total Debt (\$)	Additional Debt (\$)
4991	0	1900	0	0	0	0

Parametric Financial Analysis

Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	B'fat Price (c)	B'fat Production (lbs)

is those over and above the minimum number of calves required to maintain herd numbers at 120 cows and two year old heifers. The sales of cows and two year old heifers number 23.²⁵

The budget and production summary²⁶ shows that in the base year, butterfat production is 32,531 pounds and the butterfat income is \$8132.

The cattle sales at \$1,225 are made up of the sales of yearling heifers, two year old heifers, and cows, multiplied by the price for boner cows (\$50). The calf sales at \$812 are the 81 bobby calves, at \$10 per head. Gross cash income at \$10,170 is the total income from butterfat stock sales, calf sales and other income.

The deductible expenses at \$3,701 refers to the tax deductible expenses and is made up of the overhead costs of \$711, the costs of rearing the heifer calves and yearling heifers, the variable costs associated with the cows (shed, animal health, artificial insemination, and electricity), together with the costs of manure and lime, wages etc., required to maintain base year carrying capacity.

The cash surplus in the base year is \$4,991, which is also the sum available for personal drawings.²⁷

The farmer at the beginning of development has \$1900 in the bank which is shown under the bank credit level. The farmer has no mortgage liabilities, hence total mortgage liabilities are zero as is total debt which is the sum

-
25. Because any cull two year old heifers or cows sold are all assumed to be sold as "boners", the sales of two year old heifers are not shown separately in the stock reconciliation but are included in the cow sales.
26. The output form is the same for the base year, each year of development, and the post development year. Certain information, obtained for each year of development is not obtained for the base year or the post development year. Where this happens a zero will appear, or the position will be left blank.
27. This sum is also the base year cash profit.

of the mortgage and overdraft liabilities.

The First Year of Development - Stock Reconciliation, Budget and Production Summary (Table 6.7)

The stock reconciliation shows the number of stock at the beginning of development, the number of purchases, sales, and the number of stock at the end of the first year of development.

The stock at the commencement of development comprise 30 yearling heifers, 28 two year old heifers and 92 cows. These numbers are supplied by the farmer. To attain the target for herd numbers of 140 cows and heifers at the end of the year, it is necessary for the farmer to purchase 17 two year old heifers.

Sales in this year consist of one cull yearling heifer, 21 cows and two year old heifers and 58 calves. It is necessary for the farmer to keep all the available heifer calves, in order to have 160 cows and two year old heifers at the end of the second year of development. The two heifer calves not kept are those that must be culled because of unsuitability. Thus at the end of the first year of development, the farmer has 50 yearling heifers, 45 two year old heifers and 94 cows.

The budget and production summary show the butterfat production, butterfat income, cattle sales, calf sales, gross cash income and deductible expenses. These are all calculated in an identical manner to that explained previously.

The purchases of two year old heifers at \$1229 refers to the cost of buying the 17 two year old heifers at \$70 per head. The non deductible expenses, at \$5,000, is the cost of converting the milking shed to a herringbone at \$4,000 and the \$1000 cost of new milking plant. Personal drawings, at \$1500 is the sum required by the farmer for living expenses during development.

The taxable income of \$2598 attracts a tax liability of \$278, giving a

ANNUAL OUTPUT

Reference No: 7 Year: 1

Stock Reconciliation

	Heifer Calves	Yearling Heifers	2 Year Heifers	Cows	Total Herd Size
Beginning of the Year	0	30	28	92	120
Purchases	0	0	17		
Sales	58	1	0	21	
End of Year	0	50	45	94	140

Budget and Production Summary

B'fat Production (lbs)	B'fat Income (\$)	Cattle Sales (\$)	Calf Sales (\$)	Other Income (\$)	Gross Cash Income (\$)	
32480	8120	1152	586	0	9858	
Calf Purchases (\$)	Weaner Purchases (\$)	Yearling Purchases (\$)	2 Year Hfr. Purchases (\$)	Cow Purchases (\$)	Change in Livestock Standard Value (\$)	
0	0	0	1229	0	+1234 -0	
Deductible Expenses (\$)	Interest on New Mortgages (\$)	Overdraft Interest (\$)	Non-deductible Expenses (\$)	Principal on New Mortgages (\$)	Personal Drawings (\$)	
7303	0	0	5000	0	1500	
	Life Insurance Premiums (\$)	Depreciation (\$)	Taxable Income (\$)	Total Tax (\$)		
	100	1191	2598	278		
Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Total Mortgages (\$)	Total Debt (\$)	Additional Debt (\$)
0	4322	0	2422	0	2422	2422

Parametric Financial Analysis

Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	B'fat Price (¢)	B'fat Production (lbs)
0	4674	0	2774	22.5	34104
0	4963	0	3036	22.5	32480
0	5265	0	3365	22.5	30856
0	4642	0	2742	25.0	30856
0	4049	0	2149	27.5	30856

cash deficit of \$4,322 for the year. The farmer commenced the year with a credit balance in the bank of \$1,900 and thus at the end of the first year he has a bank overdraft of \$2,422. This is his total debt as he has no mortgage liabilities and it is also the additional debt above that existing at the commencement of development.

The parametric financial analysis shows the cash deficit and bank overdraft level when the butterfat price and production differs from that expected (the expected butterfat price is 25 cents per pound and the expected butterfat production is 32,480 pounds).

It can be seen that the most unfavourable outcome is that where the butterfat price is 10 percent less than that expected (22.5 cents per pound), and the butterfat production is five percent less than that expected (30,856 pounds). This gives a cash deficit of \$5,265, which is \$943 higher than the expected value. The bank overdraft is also \$943 higher than that expected, at \$3,365.

The analysis shows that when the butterfat production is 30,856 pounds and the butterfat price is 22.5 cents per pound, the butterfat income is reduced by \$1,178 ($\$8,120 - \$6,942 = \$1,178$), compared with that expected. A fall in the butterfat income of \$1,178 below the value expected, however, leads to a lesser increase in the cash deficit, which is higher by only \$943 ($\$5,265 - \$4,322 = \943). The fall in butterfat income has been accompanied by a \$235 ($\$1,178 - \$943 = \235) decrease in taxation.

The Second Year of Development - The Stock Reconciliation, Budget and Production Summary (Table 6.8)

The stock reconciliation shows the number of stock in each age group at the beginning of the second year of development, the number of purchases, sales, and the number on hand at the end of this year.

In order to reach the target of 160 cows and two year old heifers at the end of the second year, the farmer must purchase one two year old heifer.

ANNUAL OUTPUT

Reference No: 7 Year: 2

Stock Reconciliation

	Heifer Calves	Yearling Heifers	2 Year Heifers	Cows	Total Herd Size
Beginning of the Year	0	50	45	94	140
Purchases	0	0	1		
Sales	95	2	0	23	
End of Year	0	33	47	112	160

Budget and Production Summary

B'fat Production (lbs)	B'fat Income (\$)	Cattle Sales (\$)	Calf Sales (\$)	Other Income (\$)	Gross Cash Income (\$)	
37391	9347	1273	952	0	11572	
Calf Purchases (\$)	Weaner Purchases (\$)	Yearling Purchases (\$)	2 Year Hfr. Purchases (\$)	Cow Purchases (\$)	Change in Livestock Standard Value (\$)	
0	0	0	60	0	637	
Deductible Expenses (\$)	Interest on New Mortgages (\$)	Overdraft Interest (\$)	Non-deductible Expenses (\$)	Principal on New Mortgages (\$)	Personal Drawings (\$)	
6984	0	145	800	0	1500	
	Life Insurance Premiums (\$)	Depreciation (\$)	Taxable Income (\$)	Total Tax (\$)		
	100	1104	4121	733		
Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Total Mortgages (\$)	Total Debt (\$)	Additional Debt (\$)
1455	0	0	967	0	967	967

Parametric Financial Analysis

Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	B'fat Price (C)	B'fat Production (lbs)
1113	0	0	1309	22.5	39261
821	0	0	1601	22.5	37391
513	0	0	1909	22.5	35521
1144	0	0	1278	25.0	35521
1727	0	0	695	27.5	35521

The stock sales comprise 23 cows and two year old heifers, two yearling heifers, and 95 calves. Sufficient heifer calves are retained so that there will be 160 cows and two year old heifers on hand at the end of the third year.

Most of the items in the budget and production summary, should be clear. The overdraft interest payment of \$145 is the interest payable on the bank overdraft of \$2,422 at the end of the first year of development. The non-deductible expenses at \$800 is the cost of the new haybarn and the additional accomodation for the youth to be employed.

A cash surplus of \$1,455 is expected and this reduces the bank overdraft which falls from \$2,442 at the beginning of the year to \$967 at the end of the year. The total debt and the additional debt above that prevailing at the beginning of development, are both \$967.

The interpretation of the parametric financial analysis should also be clear. It can be seen that the financial outcomes range from a cash surplus of \$513 to one of \$1,727 with the bank overdraft level ranging from \$1,909 to \$695.

The Post Development Year - The Stock Reconciliation, Budget and Production Summary (Table 6.9)

The stock reconciliation shows that to maintain herd numbers at 160 cows and two year old heifers, 35 two year old heifers must enter the herd every year, which requires the retention of 37 yearling heifers. The stock sales comprise 108 bobby calves, 30 cows and two year heifers, and a yearling heifer.

Butterfat output at 49,775 pounds in the post development year is 17,244 pounds above the base year output. The gross cash income has risen from \$10,170 to \$15,165, an increase of \$4,995.

The personal drawings, at \$6,467, are \$1,476 higher than they were in

TABLE 6.9

DAIRY FARM DEVELOPMENT PROGRAM - OUTPUT FORM

ANNUAL OUTPUT

Reference No: 7 Year: _____

Stock Reconciliation

	Heifer Calves	Yearling Heifers	2 Year Heifers	Cows	Total Herd Size
Beginning of the Year	0	37	35	124	160
Purchases	0	0	0		
Sales	108	1	0	30	
End of Year	0	37	35	124	160

Budget and Production Summary

B'fat Production (lbs)	B'fat Income (\$)	Cattle Sales (\$)	Calf Sales (\$)	Other Income (\$)	Gross Cash Income (\$)
49775	12443	1632	1089	0	15165

Calf Purchases (\$)	Weaner Purchases (\$)	Yearling Purchases (\$)	2 Year Hfr. Purchases (\$)	Cow Purchases (\$)	Change in Livestock Standard Value (\$)
0	0	0	0	0	0 ⁺ 0 ⁻

Deductible Expenses (\$)	Interest on New Mortgages (\$)	Overdraft Interest (\$)	Non-deductible Expenses (\$)	Principal on New Mortgages (\$)	Personal Drawings (\$)
6057	0	0	0	0	6467

Life Insurance Premiums (\$)	Depreciation (\$)	Taxable Income (\$)	Total Tax (\$)
100	1016	8090	2539

Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	Total Mortgages (\$)	Total Debt (\$)	Additional Debt (\$)
6467	0	1900	0	0	0	0

Parametric Financial Analysis

Cash Surplus (\$)	Cash Deficit (\$)	Bank Credit Level (\$)	Bank Overdraft Level (\$)	B'fat Price (c)	B'fat Production (lbs)

TABLE 6.10

DAIRY FARM DEVELOPMENT PROGRAM - OUTPUT FORMPLAN OUTPUTDevelopment Plan Evaluation

Present Value	Payback Period (Years)	Increase in Personal Drawings Possible After Payback
\$11669	10	\$1475

Parametric Development Plan Evaluation

B'fat Price \ B'fat Product- ion	Lower Limit	Expected	Upper Limit
Lower Limit	\$8190 12 Years \$1310	\$9460 11 Years \$1371	\$10601 11 Years \$1430
Expected	\$10702 11 Years \$ 1434	\$11669 10 Years \$ 1475	\$12078 10 Years \$ 1482
Upper Limit	\$12060 10 Years \$1482	\$12263 10 Years \$1484	\$12526 9 Years \$1486

Note: The present value, payback period (years) and personal drawings increase (after payback) are given in this sequence for each "cell" of the above table.

the base year (\$4,991). This is the additional sum that the farmer will be able to spend on either further consumption or investment, after payback.

The Evaluation and Parametric Evaluation of The Development Plan (Table 6.10)

The evaluation shows the development plan has a present value of \$11,669 when profits are discounted using the same rate of interest as charged on the bank overdraft. The development plan will take 10 years to reach payback if the sum allowed for personal drawings in each year of development is \$4,991, the sum available for personal drawings in the base year.²⁸

The parametric evaluations show the present value, payback period and increase in personal drawings after payback for different butterfat prices and butterfat output levels. The "upper limit" for butterfat production is five percent above, and the "lower limit" is five percent below, the expected butterfat production. The "upper limit" for butterfat price is 10 percent above the expected price (25 cents per pound) and the "lower limit" is 10 percent below the expected price.

As can be seen from the output form, the evaluations range from a present value of \$8190 with a payback period of 12 years and an increase in personal drawings after payback of \$1310 to a present value of \$12,526 with a payback period of nine years and an increase in personal drawings of \$1486 after payback.

A Discussion of The Development Plan

As mentioned earlier, this development plan is only one of the alternat-

28. It can be seen from table 6.9 that if personal drawings remain at \$1500, payback would be reached in the third year of development. The cash surplus in this year will be more than sufficient to repay the debt of \$967 outstanding at the end of the second year of development.

ives being considered for this property. Other possible alternatives are the diversification into various beef enterprises.

The development plan is profitable at a very conservative price for butterfat and is also profitable at an even lower butterfat price. Nevertheless, the really important point to determine is the profitability of the possible beef enterprises compared with the alternative of increasing butterfat production. This would require a detailed analysis and evaluation of the feasible beef alternatives.

The profitability of the development plan is likely to have been significantly affected by the fact that any increase in herd size requires the conversion of the present shed to a herringbone at a cost of \$4,000, together with new milking plant which will cost \$1,000. At the same time however, the expected increase in herd numbers is modest (only another 40 cows). This still leaves the property carrying less than a cow to the acre. The difficulty is that the herd could not be increased above 160 without spending a considerable sum of money on drainage.

General Comments

It is anticipated that this program would be used in a similar way to that described for the sheep farm development program. That is because of change, in particular changing technology and prices, the need will normally arise every year to review the development plan, formulate a "new" development plan, analyse, and evaluate it. Thus it would generally be expected that the farmer would complete a new input form each year during the development plan.

Summary

This chapter has described a program that analyses and evaluates a development plan for a dairy farm.²⁹ The chapter also includes an example of a development plan analysed by the program.

29. The source program statements are all listed in Appendix G.

CHAPTER 7

THE ROLE OF THE COMPUTER IN FARM MANAGEMENT EXTENSION AND RESEARCH

Introduction

This chapter considers the role of the computer in assisting farm advisers towards the solution of farm management problems and comments on the place of the computer in farm management research.

The Characteristics of The Computer

It is important in considering the contribution of the computer towards the solution of management problems that the computer's role be not overstressed. The computer can be programmed (instructed) to perform, in principle, only two types of operation. Firstly it can be instructed to perform simple operations such as addition, subtraction, multiplication etc. Secondly the computer can be instructed to choose between alternative courses of action, for example, to perform a certain operation if a number "A" is less than another number "B", but to perform another operation if "A" is greater than "B" (or even to perform a third operation if "A" should equal "B"). The computer is capable of choice - it can compare "A" and "B" and determine the appropriate course of action to take.¹

The computer is, however, incapable of innovation. The programmer must always specify all possible courses of action and the circumstances in which each course of action is to be followed.

The widespread use of computers in industry, commerce, and in other fields, is due to the computer's speed of operation, accuracy, and flexibility in the sense that programs can be written for a wide range of problems.

1. The computer is capable of choice only when the need for this has been foreseen and the appropriate action to take is specified for every circumstance.

The Use of A Computer As An Aid to A Farm Adviser

In considering the possible use of a computer to assist in the solution of management problems, it is important to remember that the advent of the computer has not changed farmers' management problems. Whether the computer will be useful or not in contributing towards the solution of a management problem, cannot be answered without considering the particular problem and the characteristics of the computer. Management needs to decide "what needs to be known" to solve a management problem, before it is possible to decide if there is a need for a computer.

Sometimes the computer is used to provide information which appears to have little relevance for farm managers. This may stem from a fascination with the computer and a failure to understand the information required by management. Thus Stewart² has said,

"it seems important not to be so preoccupied by the power of the computer for doing arithmetic that we fail to distinguish between farm arithmetic and farm management."

It is clear that for many management decisions, perhaps the majority, there will be little or no direct use for computers. For example decisions on day to day grazing management, on whether the lambs should be drenched or the best type of fencing material, are all decisions for which the availability of a computer could be of little or no direct assistance to a manager.

In the author's view there are several ways in which the availability of a computer is, or, could be, useful to a farm adviser. These ways are:

- (1) Extending the scope for the application of operations research techniques.
- (2) Preparation of handbooks for standard problems.

2. Stewart, J.D., "Computers in Farm Management", Farm Policy, Vol. 7, No. 1, June 1967, p.33.

- (3) Financial control.
- (4) Record analysis.

Extending The Scope For The Application of Operations Research Techniques

The operations research³ approach to problems is concerned with studying systems as a whole. A significant feature of the approach is that it considers the interaction between the various components that go to make up the system. Operations research work is concerned with attempting to find optimum solutions to problems. An optimum solution implies that it is possible to state explicitly the goals of an organisation. Essentially operations research is concerned with finding the optimum combination of all the alternatives in terms of the goals of an organisation.

A number of mathematical techniques are employed in the solution of operations research problems. One such technique is linear programming.⁴

Linear programming can be used in the solution of any problem given an objective, alternative ways of achieving that objective and limited supplies of a number of resources, all of which can be expressed in quantitative form.

The usual objective in most farm management problems is either to maximise profit or to minimise cost. Other objectives can be considered.

Linear programming is normally employed only if there are many ways in which the objective can be attained. If the objective is one of profit maximisation for a farmer, the alternative ways the objective might be attained would be represented by different enterprises. Each enterprise would be specified in terms of profitability and requirements for resources. Linear

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- 3. For a general introduction into Operations Research and the techniques of Operations Research, see Churchman, C.W., Ackoff, R.L., and Arnoff, E.L., "Introduction to Operations Research", Wiley and Sons Inc., New York, 1957.
 - 4. See Heady, E.O., and Candler, W.V., "Linear Programming Methods", op. cit., p. 24.

programming would be used to select that combination of enterprises that maximised profit, subject to requirements for resources not exceeding the available supply.

The third component of a linear programming problem concerns the constraints or restrictions. For the farmer concerned with the problem of determining the farm plan that maximises profits, the constraints will limit the choice of plans that can be considered. Thus the farmer will always have a limited supply of land, labour and capital and no plan can be considered that, for example, requires more land than is available. Constraints other than resource supplies may need to be considered in a linear programming problem. The farmer may wish for example to include a particular enterprise, even if more profitable enterprises are excluded. This kind of restriction can be readily incorporated into the linear programming model.

The term "linear" is used because linear programming assumes linear relationships, in particular, the input-output coefficients are assumed to be constant as are the prices paid for factors and products.⁵

Most farm management problems where linear programming can be employed, require computing facilities. The problem is usually so complex that its solution would not be attempted in the absence of a computer.

A characteristic of operations research techniques is that the solutions obtained are optimum or "best" solutions, in terms of the specified objective. Hence it can be argued that the computer has increased the scope for obtaining optimum solutions to management problems.

5. The input-output coefficients are the enterprise or "activity" requirements for resources. Because these are assumed to be constant, linear programming implies linear production functions.

Preparation of Handbooks For Standard Problems

Computers could be used in the preparation of handbooks for advisers providing answers to "standard problems". Thus certain problems can be considered as standard problems, the same in principle on all farms, but the detail of the actual problem changing from farm to farm.

For example, the problem of the optimum time to replace a machine, is in principle, a similar problem for all farmers. The problem, in it's simplest form, is to replace a machine at that point in time which will minimise costs per unit of time. In practice the optimum time to replace a machine varies from farmer to farmer, depending upon expected repair costs, opportunity cost of capital, the salvage values at different points in time etc.

It may take a considerable time to determine the optimum time to replace a machine for a particular farmer. It should be possible however, to use a computer and analyse the replacement problem under a range of assumptions about expected repairs, opportunity costs of capital etc. The results could be recorded in a handbook which would then be distributed to advisers. Thus a guide to a machinery replacement problem could be found simply by reference to the handbook.⁶

Financial Control

One way in which the computer has proved useful to management, is in facilitating financial control. It is apparent that farmers are becoming increasingly aware of the importance of adequate financial control as an aid to management. Financial control involves two tasks.

6. Discounting, compounding and annuity tables as published by the New Zealand Department of Agriculture in, "Farming as a Business", Cost Benefit Handbook, Volume Two, Department of Agriculture, is an example of the use of a computer in the analysis of a standard management problem.

- (1) The preparation of a budget together with a statement of the flow of anticipated receipts and payments throughout the financial year.
- (2) A system for recording actual receipts and payments to enable a comparison to be made between actual and budgeted receipts and payments.

The importance of financial control to management will not be discussed here. It is sufficient to note that an up to date and accurate knowledge of the actual financial position, as compared with budgeted position, is useful for decisions on taxation management and for adjustments to the budget, throughout the financial year. Financial control is essential in providing "an early warning system" enabling a deteriorating financial position to be detected, and prompt remedial action taken.

Several computing centres are organised to assist farmers in financial control.⁷ The centres require a farm adviser to prepare a plan and budget for a farmer, the budget showing the expected month during the year that revenue will be received and expenditure will fall due for payment. Given this information, the cash flow profile showing each month the projected bank overdraft or credit level, can be estimated.

The second aspect of financial control involves the recording of actual receipts and payments and a comparison of the actual bank overdraft/credit level against the forecast level. This has been carried out manually and by the use of a computer, the farmer completing each month forms providing information on actual expenditure and receipts for that month. It is only if

7. See Payne, W.G., "Financial Control by Current Working Capital Forecasts", Discussion Paper No. 50, Department of Agricultural Economics and Farm Management, December 1968.

farms have a large number of receipts and payments each month that it is economic to use a computer for this phase of financial control. For many farmers, the number of receipts and payments each month do not justify the use of a computer.

Record Analysis

A fourth use of the computer is in the analysis of farm records. Much of this record analysis, performed at computing centres, consists of interfarm comparisons whereby the records of an individual farmer are compared with that of the average of a group of farmers, operating under similar conditions. This approach to Farm Management has been the subject of some criticism⁸ and it is probably true to say that 'record analysis' where this involves averaging of data for interfarm comparisons has been found to be of little use by farm advisers in New Zealand.

Record analysis, for individual farms however, can probably be usefully undertaken with a computer.

The Computer and Farm Management Research

Eisgruber⁹ at a symposium on the use of computers for farm record keeping and data processing argued that the computer should be employed

"whenever its' utilisation will result in an enhancement of our innate ability to solve problems, to reason and to accomplish."

He argued with reference to farm management research that it was a mistake to search for problems more or less well adapted for computer analysis at the expense of other types of research. In his view primary emphasis should

8. See Stewart, op. cit., p.31.

9. Eisgruber, L., "Use of High Speed Computers for Farm Record Keeping and Data Collections", Journal of Farm Economics, Vo. 45, No.5, 1963, p.1183.

be attached to the recognition of farm management problems and their solution "per se" while the methods by which the problems should be analysed (and possibly solved) were of secondary importance.

Computers are likely to have a very important place in farm management research. The field of farm management research can be classified into three groups and it can be seen that computers are likely to be useful in each field. The fields are:

- (1) Methodological research.
- (2) Farm surveys.
- (3) Evaluation of experimental results.

(1) Methodological research.

This field of research is concerned with the development of new methods for the analysis of management problems or the application of new techniques to established methods of analysis. In both of these areas of research computers have been used. The subject of this thesis can be regarded as the application of a new technique to an established method of analysis.¹⁰

(2) Farm surveys.

These are concerned with the collection and analysis of data from farms. Computers may be used in this type of work, depending upon the nature of the particular survey.¹¹

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10. The study of grazing management by simulation is an example of methodological research for which a computer is required. See Arcus, P.L., "An Introduction to the Use of Simulation in the Study of Grazing Management Problems", Proceedings of the New Zealand Society of Animal Production, Vol. 23, 1963, p.159.
 11. See Cronin, M.B., "A Study of Factors Hindering Increased Production on the Rangitaiki Plains and in Galatea", M. Agr. Sc. thesis, Massey University, January 1968, for an example of a farm survey for which a computer was used in the analysis of the survey findings.

(3) Evaluation of experimental results.

This field of research is concerned with the evaluation of new technology and the integration of this into farm management systems. Computers can be used if mathematical programming is employed to determine the result of introducing new technology into a management system.¹²

Summary

The chapter has discussed some ways in which the availability of a computer could be useful to farm advisers. It has been shown that computers have an important role to play in Farm Management research.

12. See for example Frampton, A.R., "The Economics of Growing Sugar Beet on Farms in South Otago", Discussion Paper No. 35, Department of Agricultural Economics and Farm Management, Massey University, July 1965.

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CHAPTER 8SUMMARY AND CONCLUSIONSSummary

The thesis has been concerned with the writing of computer programs for farm advisers who have the problem of advising farmers on development. The hypothesis examined was that the computer might be useful in this work, firstly in reducing the number of trivial calculations performed by an adviser in budgeting a development plan, and secondly, in exploring the financial and economic implications of variation in certain key parameters. It was believed that by using a computer, "more information" could be given to the farmer about a development plan.

The nature and the tasks of management were defined and discussed and the changing role and organisation of management was considered. The need for increased managerial resources in agriculture was commented upon.

The uses and limitations of budgeting were reviewed. The different types of budgets, commonly used in agriculture, were then considered and discussed.

The problem of evaluating a development plan was discussed. It was argued that in evaluating a development plan, the problem is to establish the degree to which the plan seems likely to fulfil the farmer's economic and non-economic objectives. The role of the farm adviser in the evaluation of a development plan was considered.

A number of criteria, used to economically evaluate a development plan, were defined and their usefulness critically appraised.

A computer program was described which analyses and evaluates a development plan for a sheep farm. A flow diagram showing the logic of the program was given and the limitations of the program were noted.

An example was shown of a sheep farm development plan analysed using the program. The development plan was described and the input form shown with the information required for the analysis. The development plan was found to be profitable but required a substantial amount of finance and a suggestion was made as to an alternative development plan the farmer might wish to consider.

In using the program, it was argued that because of changing technology, prices and managerial objectives, a "new" development plan may have to be formulated each year, the input form completed once more and the development plan analysed again. From this the farmer could decide whether to continue with or cease, further development.

A computer program was described that analyses a dairy farm development plan. An example was also shown of a development plan, analysed by the program. The plan was found to be profitable, at a conservative price for butterfat.

Finally the role of the computer in farm management extension and research were discussed. It was argued that computers could be useful to advisers in several different ways. It was shown that the computer has a very important place in farm management research.

Conclusions

A number of conclusions have been drawn from the study.

(1) The study has shown that it is feasible to write a computer program for some development plans that will reduce the number of trivial calculations in budgeting the plan and also provide more information about the financial and economic implications of change in key variables. The analysis of each case study by the programs required only a few minutes, excluding the time to write the programs, and assuming the time taken to obtain the basic information about the development plans is constant, whether the

plan is to be analysed manually or by a computer program.

No attempt was made to estimate the time required, using manual procedures, to obtain the same information as obtained using either program. The author has had some experience in this field however, and considers that it would take at least a week to 10 days to perform these calculations using a desk calculator.

(2) Because of the limited computer storage, it has been found to be necessary in writing the programs to require the adviser to formulate a development plan which is feasible for all resources other than capital. It is only for some situations that it is possible to usefully formulate a plan in this manner. These situations arise where a resource such as labour or the managerial capacity of the farmer is the factor restricting the rate of development. For some farmers finance is the limiting resource determining the rate of development (perhaps the farmer is not prepared to borrow, or is able or willing to borrow up to some defined limit). In this situation the program is relatively inefficient because it does not permit the adviser to specify a constrained financial situation, even if this is known before development commences. Thus it may be argued that in these circumstances the program tends to be rather 'hit or miss'. If the program analysis shows the development plan to be infeasible for finance, then it is necessary for the adviser to evolve a new plan which appears likely to be feasible for the financial resources.

It can be argued though that at least in some cases, this is not a serious weakness. Thus for example if the farmer is restricted by a lending institution in the amount that can be borrowed, then this factor will influence the formulation of the development plan. If the program analysis shows that the plan is reasonably profitable but exceeds the financial constraint, then a good case can be made to the lending institution to

raise the lending limit. The lender will be able to see that the plan is sufficiently profitable for the farmer to be able to repay the borrowed money.

Sometimes a farmer may be reluctant to allow his total indebtedness to exceed a certain limit. Again this factor will influence the formulation of the development plan. The program analysis may show a profitable plan but one which exceeds the farmer's self imposed financial constraint. In these circumstances the farmer needs to be made aware that if he abides by his financial constraint, he must forgo possibly a very profitable investment opportunity. It is possible to imagine that at least some farmers in this category could be persuaded to relax their self imposed financial constraints, when made aware of a sufficiently attractive investment opportunity.

If the lending institution is not prepared to increase its lending limit, or the farmer refuses to relax his self imposed financial constraint, then it will be necessary for the adviser to reformulate the plan if the program analysis shows the financial constraint is violated. This will probably require that the planned rate of increase in stock numbers and development expenditure be lowered, and the development plan analysed once more. It should be noted that this may still require less time (by the adviser) than the manual budgeting of the development plan, year by year, within a financial constraint.

(3) The writing of a program for the constrained financial situation is likely to be a more exacting task than the writing of the programs that have been presented in this thesis. The reason for this is that the program would probably have to "evolve" the development plan. It would be necessary for the adviser to define each area of the farm to be developed as separate "activities". Each activity would be specified by its cost of development and the added carrying capacity following development. The

adviser would specify the financial constraint which might be that the overdraft in any year is not to exceed say \$3000. The program could be written so as to "complete" the development of the activities as fast as possible, within the financial constraint.¹

The writing of a financially constrained program would be a more complicated programming task than the writing of the programs in this thesis, because it would be necessary for the program to "explore ahead". That is, it would need to ensure that, if a group of activities were completed in any year, that the financial constraint for the particular year and future years be satisfied.

Furthermore, this program might require the adviser to state the supply of certain resources, such as labour, and the labour requirement for the development activities. The requirements of development for other resources would also need to be considered in some way, for example, management.

The program that has been written has an advantage in that it does not require the adviser to state explicitly the resource supplies and requirements for development. Resource feasibility is implicit in the development plan evolved by the adviser. A program written for a constrained financial situation would require that the resource supplies and requirements for development be specified.

(4) The author believes that the variability between farms and between development plans on different farms, is such that the farm adviser's work in budgeting a development plan for a farmer is not "obviously susceptible" to computer routines. Computer programs can most usefully be written where a

1. The farmer should still however be persuaded to consider the financially unconstrained development plan as well. It is possible that a development plan could be formulated which violated the financial constraint but was very much more profitable than the plan evolved that satisfied the financial constraint.

large number of calculations are involved which follow some "standard form". This is not the case for farm development plans.

A solution to the problem is to attempt to write a few sufficiently flexible programs that will "fit" large numbers of development plans. To do this, would mean relatively large input forms and much of the input form could be superfluous for any one development plan. These types of input forms might tend to be fairly tedious to complete.

An alternative solution is to write a comparatively large number of programs for different components of development plans, in particular stock policies. For example a program could be written for a cattle policy of increasing breeding cow numbers, rearing the heifer calves required for replacements and selling all the steers as weaners. Another program could be written for the cattle policy of running breeding cows, but sometime during development changing to an "all steer" policy. Programs for sheep policies that could be written would include the conventional breeding policy of rearing replacement two-tooth ewes and casting for age at five years; the establishment of a Romney and a Perendale ewe flock from a Romney flock; and the conversion of a Romney ewe flock to a Border Leicester Romney cross-bred flock. It should be possible this way to build up an inventory of programs which could be linked together in various combinations to fit specific development situations. For the analysis of any one development plan only a "few" programs would be required.

This system would simplify the process of completing the input forms for a development plan. It would of course be necessary to design appropriate linking systems between the various input forms used for any one development plan. This is unlikely to be a major problem.

(5) If a farm is sufficiently "large" then the cost of writing programs for that particular farm may be justified. There is an increasing

trend towards large scale farming in New Zealand and this may lead to a demand for advisers (perhaps private consultants) knowledgeable both in farm management and computer programming. The advisers could be expected to know when programs could be useful for a particular farmer and perhaps be able to write the programs.

The rapid development however, of computer "software" means that it is difficult for a non programming specialist to keep abreast of the field. Access to a computer may also be a problem for somebody other than an employee of a computer manufacturing or leasing firm. Thus it seems more likely that new job opportunities may arise for farm advisers, well versed in the principles of computers, who can formulate programming problems suitable for specialist programmers who could then write the programs.

(6) The programs are likely to be most useful where development plans extend over many years. In these circumstances, it may be necessary to review and reformulate the development plan several times. Much of the input information should not change from plan to plan and hence the adviser should be able to complete the input form quite quickly after some initial experience with the particular farm. In these circumstances the time saving for the adviser should be substantial compared with the alternative of frequent manual budgeting. The "original" plan should be able to be updated quite simply.

(7) The programs are sufficiently flexible for the adviser to be able to examine at least some alternative development plans easily. In both case studies, alternative development plans were indicated which could be explored simply using the programs. In the case of the sheep farm case study an alternative development plan which involved the purchase of five year old ewes rather than two-tooth ewes, might be analysed.

A dairying alternative to the case study development plan, which could

easily be examined, would be the profitability of development if the cow numbers were raised to one and a half cows per acre and an extensive tile and mole drainage system installed.

The programs, in permitting the adviser to examine some alternative development plans, represent a considerable advance over the normal practice of advisers manually budgeting only one development plan. The programs permit alternative development plans to be appraised "in depth". This should lead to management making more informed decisions on development plans.

(8) The general conclusion from the study is that programs can be written that are useful to advisers engaged in budgeting farm development plans.

This study was undertaken using a computer with inadequate storage capacity at the time the programs were written. Hence the programs (the sheep program in particular) are not sufficiently flexible at present for widespread use in the field. However additional computer storage, now available, would enable either the flexibility of the programs to be greatly improved or the writing of large numbers of programs for the different stock policies encountered in development situations, as discussed earlier.

The author believes that work should be continued in this field. The programming may be complex but the potential payoff in terms of reducing the time required to budget a development plan, seeing the implications of changes in "key" variables, and "in depth" appraisal of alternative development plans, justifies a continued effort.

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APPENDIX ASHEEP FARM DEVELOPMENT PROGRAM GUIDE AND DEFINITION OF INPUT VARIABLESIntroduction

This appendix is in two parts:

- (1) The program guide which outlines general principles to be followed in completing the input form.
- (2) The definition of every variable appearing in the input form.

Program Guide

The purpose of this program guide is to explain the procedure to be followed by an adviser in completing the input form for the sheep farm development program. It is assumed that readers are already familiar with Chapter 5 of the Thesis which describes a computer program designed to analyse and evaluate a sheep farm development plan.

The input variables that the adviser is required to complete can be classified broadly into four groups as follows:

- (1) Those variables which are assumed to be constant in all years of the development plan. (Variables numbered one to 38).
- (2) These variables which refer to the base year (variables numbered 49 to 79).
- (3) Those variables which refer to years of development (variables numbered 39 to 48 and 80 to 159).
- (4) Those variables which refer to the post development year (variables numbered 161 to 190).

For those variables where the adviser is asked to state a price, for example, "Selling Price - Wether Lambs" - the variable is to be entered in dollars unless otherwise stated.

If any variable is left blank, that item will be treated as zero. For example, if the farmer does not pay any life insurance premiums, then variable number 42 "Life Insurance Premiums" can be left blank and will be treated as zero.

SHEEP FARM DEVELOPMENT PROGRAM - INPUT FORMDEFINITION OF VARIABLES

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1. Farm Identification No: Any single digit number which will be printed on the output form and provide a reference for checking on the identity of the input data.
2. Percentage Rams to Ewes: The number of rams required for every 100 ewes put to the ram.
3. Total Killers Required: The number of stock required annually for domestic consumption. These are provided for in the program by retention of wether lambs which are assumed to be killed in the following year.
4. % Death Rate - Ewes: The normal annual death rate in the ewe flock. It is assumed in the program that half the total ewe deaths occur prior to the "normal" shearing time of say October/November. The remainder of the ewe deaths are assumed to occur between October/November and the end of the year (June). If the ewes are shorn twice per year, however, it is assumed in the program that all the ewe deaths for the year occur before the second shearing. (i.e. no ewe deaths occur between the second shearing and the end of the year). A positive value must be assigned to this variable.
5. % Death Rate - Ewe Hoggets: The normal death rate in the ewe hoggets from the time of culling as ewe lambs (say May/June) to the two-tooth ewe stage (the following February/March). It is assumed that half the total deaths occur before the hogget shearing in say October and the remainder between October and February/March.

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6. % Death Rate - Lambs: The normal death rate in the lambs between docking and the following May/June. It is assumed in the program that ewe and wether lambs have the same death rates.
7. Wool Clipped per Ram: The weight (pounds) of wool clipped (including crutchings) per year from each ram.
8. Wool Clipped per Lamb: The weight (pounds) of wool clipped per lamb shorn. It is assumed that any lambs shorn, are shorn after half the total lamb deaths between docking and the end of the year have taken place.
9. Shearing Cost per 100 Sheep: The normal charge for shearing. It is assumed that this is the same for lambs, hoggets and ewes and is doubled for ram shearing.
10. % of Ewe Lambs Shorn: The proportion of the ewe lambs alive at weaning time that are shorn at this time.
11. % of Wether Lambs Shorn: The proportion of the wether lambs alive at weaning time that are shorn at this time.
12. Expected Wool Price (cents/lb): The expected net wool price in cents per pound. (Net means after freight, cartage, commission, Wool Board Levy and any other wool selling charges have been deducted.)
13. Number of Times Ewes are Shorn: The number of times the ewes, other than the two-tooths entering the flock (in February) are shorn each year. This figure must be either one or two. If the ewes are shorn once per year, it is assumed in the program that this takes place in say October/November and that all ewes on hand at this time are shorn. If the ewes are shorn twice per year, then the second shearing is assumed to take place about March and all ewes, other than the two-tooths which have just entered the ewe flock (and

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which at this stage are about 18 - 19 months old), are assumed to be shorn again. The program also allows the two-tooth ewes, entering the flock, to be shorn at this time (i.e. the "pre-tupping" shearing of the two-tooth ewes - this is explained later).

14. Special Taxation Exemptions: The total value of the personal, wife, and child exemptions. For a married man with two children, the total value of the exemptions is \$785, i.e.:

	\$
Personal	275
Wife	240
Two children	<u>270</u>
	<u>\$785</u>

15. Overhead Costs: These are costs which it is assumed in the program are constant in all years of the development plan. This item would generally be expected to include the following; rates, insurance premiums (do not include life insurance premiums), accountancy fees, bank charges such as cheque books (do not include interest on the bank overdraft (if any) which the program calculates), newspaper subscriptions, telephone rental and rural mail delivery charges.
16. Rent and Interest: This item is also assumed in the program to be constant in all years of the development plan. Interest payments which are constant each year and which should be included here are interest payments on flat mortgages (if any).
17. Variable Costs Per Lamb (cents): The total cost of drenching, vaccination, and crutching, but not shearing, per lamb. The program multiplies this number by the number of lambs docked to calculate variable costs for that year.
18. Variable Costs per Hogget (cents): The total cost of drenching,

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vaccination, and crutching, but not shearing, per hogget. The program multiplies this number by the number of hoggets on hand at the beginning of each year to calculate the variable costs for that year.

19. Variable Costs per Ewe (cents): The total cost of crutching, drenching, and vaccination, but not shearing, per ewe. The program multiplies this figure by the number of ewes on hand at the beginning of each year to calculate variable costs for that year.

20. to 25. Selling Prices for wether lambs, cull ewe lambs, cull two-tooth ewes, cull mixed age ewes (four-tooth, six-tooth, and four year old), five year old ewes, six year old and older ewes. Prices must be net prices, that is, less selling charges like commission and cartage, where necessary. These prices are simply multiplied by the number of sheep to be sold in each age class to establish the value of sheep sales in each year.

26. to 29. Purchasing Prices for rams, two-tooth, five year old, and six year old ewes respectively. Prices should be on farm prices, that is, include cartage where necessary. The program calculates the cost of sheep purchases by multiplying the number of sheep to be purchased by the appropriate prices.

30. to 33. Selling Prices for yearling to 18-month steers, two years to two and a half years old steers, three years to three and a half years old steers, and steers over four years old respectively. The prices should be net prices with commission and cartage deducted where appropriate.

34. to 37. Purchasing Prices for weaner steers, yearling to 18 month steers, two years to two and a half years old steers and three years to three and a half years old steers respectively. The prices should

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- be net prices with cartage included where appropriate.
38. % Death Rate - Cattle: The normal annual death rate in cattle which is assumed to be the same for cattle of all ages. A positive value must be assigned to this variable.
39. Initial Bank Overdraft Level: Indicate the level of the bank overdraft (if any) at the commencement of development. The program will calculate the interest payable on this overdraft.
40. Initial Bank Credit Level: If the bank account is not overdrawn then it will normally be in credit. Indicate the credit (if any) in the bank account at the commencement of development. Variable number 39 will normally be zero and variable number 40 positive, or vice versa. (It is possible both 39 and 40 will be zero).
41. Interest Rate - (%): The interest rate charged on any bank overdraft. It is assumed in the program that no interest is earned if the bank account is in credit. A positive value must be assigned to this variable.
42. Life Insurance Premiums: Indicate the amount to be spent on life insurance premiums which qualify as a special exemption for calculating taxation liability. Life insurance premiums which are not exempt for taxation liability must be included under personal drawings. (See variable number 145.)
43. Mortgage - Balance Outstanding: Indicate the balance outstanding at the commencement of development on any one mortgage.
44. Total Annual Charges: The total principal and interest charge payable annually on the above mortgage (variable number 43).
45. Interest Rate - (%): The rate of interest payable on the above mortgage. Variables numbered 44 and 45 permit the program to calculate the interest and principal charges on this mortgage for

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each year of the development plan.

46. to 48. These variables permit the adviser to specify a second mortgage (if any). The program will calculate the interest and principal charges for each year of the development plan on this mortgage.
49. Total Number of Ewes: The total number of ewes carried in the base year of the development plan.
50. to 57. Culling % for Different Age Classes: Variables numbered 50 to 57 refer to the percentage of each age class on hand at the beginning of the year to be culled at the end of that year. The culling rate must be 100 percent in the year stock are finally sold. Variables numbered 50 to 57 enable the program to calculate the number of two-tooth ewes required annually to maintain constant ewe numbers (variable number 49).
The program can cope with replacement policies other than two-tooth. If for example the farmer buys five year ewes and keeps them for two years, then this is equivalent to buying two-tooth ewes and selling all the four-tooths (i.e. selling as six-tooths). The input form should show all the ewe lambs as being sold and the cost of buying a five year old ewe must be entered opposite variable number 27. If the replacement policy is one of buying in five year old ewes, the adviser must remember to read "five year old ewe" wherever "two-tooth ewe" appears and to read "six year old ewe" wherever "four-tooth ewe" appears.
58. Lambing Percentage: The number of lambs docked per 100 ewes mated. This figure is simply multiplied by variable number 49 to calculate the number of lambs docked in the base year.
59. Wool Clipped per 2-Tooth Ewe: The wool clipped (pounds) per head from two-tooth ewes entering the flock only if the two-tooth ewes are shorn in the period between January (i.e. just prior to tugging)

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- and June in the year they enter the ewe flock. If the two-tooth ewes are not shorn in this period, then this entry must be left blank. If shorn earlier than this (between June and January) the expected wool clip produced should be entered under variable number 61.
60. Wool Clipped per Ewe: The total wool clipped (pounds) per ewe annually including crutchings. If ewes are shorn twice per year half the annual expected wool clip per ewe should be entered here.
61. Wool Clipped per Hogget: Total wool clipped (pounds) including crutchings per hogget. It is assumed in the program that half the total hogget deaths occur before the hogget shearing.
62. to
72. Costs: These cover the main items of expenditure required for the base year budget other than those calculated directly by the program such as shearing expenses, variable costs and stock purchases. Variables numbered 62 to 72 are (except 70) simply summed and added to the other items of expenditure. In completing the entries for variables numbered 62 to 72, the adviser must consider not only total sheep numbers carried in the base year but also total steer numbers (see variable number 74).
62. Wages: Include the cost of permanent, casual, and contract labour required to maintain the base year stock numbers (sheep and cattle).
63. Manure and Lime: The cost of manure and lime including transport to the farm and the cost of application less the fertiliser transport subsidy and any discounts or rebates.
64. Seeds: Self explanatory.
65. Weed and Pest Control: The cost of materials (including application costs) used in the prevention or control of weeds.

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66. Vehicle Expenses: The cost of repairs and maintenance to any farm vehicles.
67. Fuel and Oil: The net cost (after allowing the rebate to farmers) of fuel and oil for all plant and machinery other than the car.
68. Car Expenses: The cost of repairs, fuel, and oil for the farmer's car.
69. Cartage: The cost of cartage on any sundry inward items.
70. Woolpack Price (cents): The cost of a woolpack, including twine.
71. Fodder: The cost of any bought in feedstuffs (for example, meals, mangolds etc.) together with the costs of making hay, silage or any other supplementary feed crops.
72. Repairs and Maintenance: The cost of repairs and maintenance to farm buildings and fences.
73. Other Income (Assessable): Include any income, other than that from wool, lambs, sheep, cattle etc. Income from hay or crop sales should be included here. This income is assumed to be cash income and assessable for taxation.
74. Total Number of Steers: The total number of steers carried in the base year. Variables numbered 75 to 79 define the base year cattle policy from which the program calculates a static stock reconciliation showing the number of steers that must be purchased annually to maintain total steer numbers as per variable number 74.
75. Purchasing Age - Steers: The program permits steers to be purchased as either:
- (1) weaners (approximately nine months old)
 - (2) yearling to 18 months old
 - (3) two years to two and a half years old
 - (4) three years to three and a half years old.

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The age at which steers are normally purchased must be indicated by entering "1" opposite 75 if weaners are normally purchased, or "2" opposite 75 if steers of the age, yearling to 18 months, are normally purchased etc. Only 1, 2, 3 or 4 can be entered opposite 75.

76. Selling % - Yearling to 18 Month Steers: Enter the percentage of rising yearling steers on hand at the beginning of the year, that would be sold as yearling to 18 month steers. (That is, sold before the following winter when they would be two years old.)
77. Selling % - 2 Year/2½ Year Steers: Enter the percentage of rising two year steers on hand at the beginning of the year, that would be sold as two years to two and a half years old steers.
78. Selling % - 3 Year/3½ Year Steers: Enter the percentage of rising three year old steers on hand at the beginning of the year, that would be sold as three, to three and a half year old steers.
79. Selling % - 4 Year/4½ Year Steers: The program does not permit steers to be kept longer than this - therefore this item must be 100.
80. Depreciation - Cost Price: The depreciation allowance, in general, for plant and machinery is claimed as a percentage of the diminished value, whilst the allowance is claimed as a percentage of cost price for buildings. The depreciation claim on items for which the allowance is calculated as a percentage of cost price will be constant during the development plan. Therefore, for this item enter total depreciation on those items for which the depreciation allowance is calculated as a percentage of cost price.
81. Depreciation 10% D.V.: The total book value¹ of plant and machin-

1. Book Value refers to the value of these items in the farmer's balance sheet.

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- ery for which the depreciation allowance is 10 percent of diminished value (D.V.). Enter the total book value, at the commencement of the development plan, of those items of plant and machinery for which the depreciation allowance is 10 percent of the diminished value. The program will calculate the annual depreciation deduction.
82. Depreciation 15% D.V.: The total book value of plant and machinery for which the depreciation allowance is 15 percent of the diminished value. As above, enter the total book value at the commencement of the development plan of those items of plant and machinery for which the depreciation allowance is 15 percent of the diminished value.
83. Depreciation 20% D.V.: The total book value of plant and machinery for which the depreciation allowance is 20 percent of the diminished value. Similar to above.
84. Depreciation 50% D.V.: The total book value of plant and machinery for which the depreciation allowance is 50 percent of the diminished value. Similar to above.
85. to 101. Variables numbered 85 to 101 refer to the number of stock in each age class, on hand at the beginning of development. It is assumed in the program that development commences at the beginning of a financial year, hence the stock on hand at the start of development would be those on hand at 1st July.
102. to 110. Standard Values of Livestock: Enter the standard value for each class of stock used by the farmer.
111. to 119. Minimum Culling % - Sheep: These variables require the adviser to specify the minimum percentage in each age class that must be culled at the end of the year. Variables numbered 111 to 119 are assumed to be constant for each year of development. For

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example the adviser would for "Minimum Culling % - Ewe Lambs" specify the proportion of the ewe lambs that must be sold as ewe lambs (if any). The variable numbered 112 "Minimum Culling % - Ewe Hoggets" refers to the proportion of ewe hoggets on hand at the beginning of the year which must be culled at the end of the year (as two-tooth ewes). The variable numbered 113 "Minimum Culling % - 2-tooth Ewes" refers to the proportion of two-tooth ewes on hand at the beginning of the year which must be culled at the end of the year (as four-tooth ewes). The minimum culling percentage must be 100 in the year that sheep are finally sold.

120. Purchasing Age - Ewes: The program permits a shortfall between target and ewe numbers to be made up by either

- (1) purchase of two-tooth ewes
- or (2) purchase of five year old ewes
- or (3) purchase of six year old ewes.

If the adviser wishes a shortfall to be made up by the purchase of two-tooth ewes, then "1" should be entered opposite variable numbered 120. If, on the other hand, the shortfall is to be made up by the purchase of five year old ewes, then "2" should be entered opposite 120, or "3" if the shortfall is to be made up by purchasing six year old ewes. Obviously, only 1, 2 or 3 can be entered opposite variable number 120. If the entry is left blank it is assumed that any shortfall in ewe numbers is not to be made up by the purchase of ewes. If the number of ewes on hand at the end of any year exceeds the target number, then the program will reduce ewe numbers by "selling off" any seven and six

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year old ewes and, if necessary, making a proportionate reduction both in the number of two-tooth and five year old ewes until the anticipated ewe numbers and the target are equal.

121. Code-Office Use Only: This item will be completed by the computer centre staff and is the number of years of development.
122. % Change in Wool Price: The program calculates for each year, the cash flow when the wool price differs from that expected. (Variable No. 12 is the expected wool price). Enter here the percentage change in wool price from the expected price for which the cash flow is to be calculated for each year of development. Enter this figure as a decimal.
123. % Change in Wool Production: The program also calculates for each year the cash flow when wool production differs from that expected. Enter here the percentage change in wool production from that expected for which the cash flow is to be calculated. Enter this figure as a decimal.
- Variables numbered 124 to 159 must be completed for each year of development.
124. Target Ewe Numbers End of Year: The number of breeding ewes required to be on hand at the end of each year of development.
125. Purchasing Age - Steers: The program permits steers to be purchased at any one of the following ages -
- (1) Weaner.
 - (2) Yearling to 18 months.
 - (3) Two years to two and a half years old.
 - (4) Three years to three and a half years old.

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The age at which steers are to be purchased is indicated by entering either "1", "2", "3" or "4" opposite variable number 125. Thus if for example, weaner steers are to be purchased, then "1" is entered opposite "Purchasing Age - Steers" and "2" is entered if yearling to 18 month steers are to be purchased.

126.to
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Selling % - Steers: Variables numbered 126 to 129 require the adviser to specify the cattle selling policy for each year of development. The adviser must specify the percentage of the cattle in each age class, on hand at the beginning of the year, to be sold in that year.

130.

Target Steer Numbers - End of Year: The adviser must specify the total number of steers required to be on hand at the end of each year of development. The program calculates the number of steers to be sold, determines the total number of steers remaining and compares this with the target for steer numbers. If the expected steer numbers exceed the total, additional rising four year old steers are sold, then any rising three year steers are sold etc., until the target and expected numbers are equal.

131. to
143.

Expenditure Items: The adviser is required to estimate for each year of development the necessary expenditure to make the projected stock increase targets feasible. Expenditure items 131 to 144 are simply summed and together with expenditure on stock purchases etc., used in the calculation of tax payments, overdraft levels etc., for each year of development. Variables numbered 133 to 144 (with the exception of 136) have already been defined previously in the base year context. Variables numbered 131, 132 and 136 have been added

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because a greater break up of expenditure may be desirable for the years of development than for the base year. Items 131 to 144 are assumed to be cash costs and deductible for taxation. The proportion of the car expenses and repairs to house which is not deductible for taxation purposes must be included under personal drawings. (See variable number 145.)

144. Other Cash Costs (Deductible): This variable permits the adviser to include separately any other cash expenditure deductible for taxation not already included above (variables numbered 131 to 143) or calculated by the program (stock purchases, variable costs such as costs per ewe, costs per hogget etc.).
145. Personal Drawings: Include the sum of money required for expenditure on food, clothing, education expenses, car expenses (non-deductible portion), repairs to house (non-deductible portion) etc.
146. Other Income (Assessable): The program will calculate the income from sales of wool, cattle etc., but a farmer may receive income from other sources, for example, rent, cash crops. The program assumes that any income included here is cash and is assessable for taxation.
- 147.to 149. Wool Clipped Per Two-Tooth Ewe, Ewe and Ewe Hogget Respectively: These variables have been defined previously (variables numbered 59, 60 and 61). Exactly the same definitions apply here. The inclusion of these three variables at this point permits the adviser to alter their values for each year of development.
150. Lambing Percentage: The inclusion of this variable, defined previously, permits the adviser to change the lambing percentage each year.

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151. New Mortgage: The farmer may, after seeing the financial implications of development, wish to finance it by raising a mortgage at some point. The inclusion of this variable permits this and the two following variables enable the program to calculate the associated interest and principle charges for each year.
152. Total Annual Charges: The amount that must be paid annually by way of interest only (if the new mortgage is a flat mortgage) or principal and interest (if the new mortgage is a table mortgage).
153. Interest Rate - (%): The interest rate on the new mortgage.
154. Capital Expenditure: Capital expenditure in this context is defined as expenditure which is not completely deductible for taxation in the year the expenditure is incurred. Capital expenditure items are those on which depreciation is claimed annually - buildings, plant and machinery. The program permits up to two items of capital expenditure to be purchased in each year of development. Include under variable number 154 the cost of any one item of capital expenditure.
155. Depreciation System: If the item in question (variable number 154) is a new building and depreciation is thus claimed as a percentage of the cost price, enter "1" opposite 155. If however, the capital expenditure is a plant or machinery item, then depreciation is claimed as a percentage of diminishing value and "2" must be entered opposite 155.
156. Normal Depreciation Rate - (%): Enter the normal depreciation allowance for the particular item (variable number 154). The program can then calculate the depreciation deduction for subsequent years of development.

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iable
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157. to
159. Variables numbered 157 to 159 are identical to variables numbered 154 to 156. They simply permit the adviser to include a second item of capital expenditure.
160. Code - Office Use Only: A check to ensure that the correct input data has been "read in".
161. to
190. These variables enable the program to calculate a budget for the post development situation. The variables will not be defined in detail because they have all been explained previously.
161. Total Number of Ewes: The total number of ewes carried in the post development situation. This will be the same figure as the total number of ewes in the final year of development. Variables numbered 162 to 170 enable the program to calculate a static stock reconciliation showing the number of two-tooth ewes required to maintain flock numbers constant. No culling rate has been specified for ewe hoggets as the program assumes any surplus ewe hoggets are sold as two-tooth ewes. The static stock reconciliation for the post development situation is, in principle, exactly the same as that described for the base year.
191. % Change in Wool Price: The program will calculate the profitability of development at different prices for wool production. Enter here the percentage change in wool price (from the expected wool price) for which the profitability of development is to be calculated. Thus for example if the adviser wishes to know the profitability of development at a wool price which differs by 10 percent from that expected, then .10 should be entered opposite variable number 191. This figure must be entered as a decimal.

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192. % Change in Wool Production: The program will also calculate the profitability of development at different wool production levels. Enter here the percentage change in wool production (from expected wool production) for which the profitability of development is to be calculated. This must also be entered as a decimal.

APPENDIX BSOURCE PROGRAM LISTINGS - SHEEP PROGRAMS

This appendix includes the source program listings for each of the five programs and the eight subprograms. The programs are listed in the order of use, and each subprogram appears immediately following the program in which it first appears. For example the subprogram TAXES (which calculates the taxation payment) follows the base year program because this subprogram is first used by this program.

The function of each program or subprogram will not be discussed here. In order to follow the programs, the source program listings should be read in conjunction with Appendix C which defines the variables appearing in executable statements in the programs. The order of the programs and subprograms appearing in this appendix is as follows:

- (1) Base year program
- (2) Subprogram TAXES
- (3) Financing program
- (4) Subprogram DEPREC
- (5) Subprogram SHEEPB
- (6) Subprogram SHEEPS
- (7) Subprogram CATTLB
- (8) Subprogram CATTLS
- (9) Subprogram FL
- (10) Subprogram PFLOW
- (11) Post development program
- (12) Evaluation program
- (13) Parametric evaluation program

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C   BASE YEAR PROGRAM
    DIMENSION F(150),GCI(12),DEX(12),XDEX(12),WOOL(12),SS(12)
    DIMENSION SP(12),TCS(12),CP(12),DEPN(12),SVC(12),V(6),T(7),S(7)
    COMMON F,GCI,DEX,XDEX,WOOL,SS,SP,TCS,CP,DEPN,SVC
    EQUIVALENCE (GCI(1),GCR),(XDEX(1),REPAY),(SS(1),TSS),(SP(1),TSP)
    EQUIVALENCE (CP(1),TVCP),(TCS(1),TVCS),(TOTE,F(51))
C   INITIALISE COMMON ARRAY
    DO 993 J=1,12
    GCI(J)=0
    DEX(J)=0
    XDEX(J)=0
    WOOL(J)=0
    SS(J)=0
    SP(J)=0
    TCS(J)=0
    CP(J)=0
    DEPN(J)=0
993  SVC(J)=0
    Y=0
C   READ CONSTANTS
    READ 101,F(1),F(2)
    READ 101,(F(J),J=4,42)
C   READ BASE YEAR DATA
    READ 101,(F(J),J=44,86)
    S2T=0.
    F(60)=F(60)/200.
    F(2)=F(2)/100.
    F(11)=F(11)/100.
    F(12)=F(12)/100.
    IF (F(5))601,601,602
601  F(5)=.1
602  DO 10 I=5,7
    10  F(I)=(100.-F(I))/100.
    DO 20 I=52,59
    20  F(I)=F(I)/100.
C   CALCULATE STATIC SHEEP RECONCILIATION
    DO 30 I=1,6
    30  V(I)=0.
    B=1.
    Z=1.
    DO 40 I=1,6
    X=Z*F(5)
    Y=X*F(I+52)
    Z=X-Y
    V(I)=Z
    40  B=B+Z
    DO 50 I=1,7
    50  T(I)=0.
    T(1)=F(51)/B

```

```

DO 60 I=2,7
C 60 T(I)=T(1)*V(I-1)
CHECK SHEEP RECONCILIATION
TEWE=0.
DO 70 I=1,7
70 TEWE=TEWE+T(I)
IF (TEWE-F(51))37,45,39
37 TEST=TEWE+5.
IF (TEST-TOTE)701,41,41
39 TEST=TEWE-5.
IF (TEST-TOTE)41,41,701
701 IERR=1
PRINT 102,IERR
CALL EXIT
41 DIFF=TEWE-TOTE
DO 80 I=1,7
K=8-I
IF (T(K))43,80,44
44 T(K)=T(K)-DIFF
GO TO 45
43 IERR=2
PRINT 102,IERR
CALL EXIT
80 CONTINUE
IERR=3
PRINT 102,IERR
CALL EXIT
45 P2T=0.
C CALCULATE EWE LAMBS,EWE LAMB SALES
TEL=TOTE*F(60)*F(7)
SEL=TEL*F(52)
TEH=TEL-SEL
C CALCULATE NUMBER OF 2 TOOTHs TO SELL
IF (F(6)-1.)48,47,46
46 IERR=4
PRINT 102,IERR
CALL EXIT
47 P2T=T(1)
IF (TEL-SEL)49,58,49
49 SEL=TEL
GO TO 58
48 A2T=TEH*F(6)
IF (A2T-T(1))51,52,52
51 DO 56 K=1,99
FK=K
G=FK/100.
F(52)=F(52)-G
IF (1.-F(52))55,55,54
55 IERR=5

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```

PRINT 102,IERR
CALL EXIT
54 SEL=TEL*F(52)
   TEH=TEL-SEL
   A2T=TEH*F(6)
   IF (A2T-T(1)) 56,57,57
56 CONTINUE
57 S2T=A2T-T(1)
   P=F(52)*100.
   PRINT 103,P
   GO TO 58
C 52 S2T=A2T-T(1)
   WETHER LAMB SALES, RAMS REQUIRED
58 SWL=TOTE*F(60)*F(7)-F(4)
   TRAM=TOTE*F(2)
   PRAM=TRAM*0.25
C   NUMBER OF EWES TO SELL IN EACH AGE GROUP
   DO 59 I=1,7
59 S(I)=0.
   DO 90 I=1,7
90 S(I)=T(I)*F(5)*F(I+52)
   DO 61 I=5,7
61 F(I)=1.-F(I)
C   NUMBER OF SHEEP TO SHEAR
   TES=TOTE
   DO 62 I=1,7
62 TES=TES-(T(I)*F(5)/2.)
C   WOOL PRODUCTION EWES
   TEW=TES*F(62)
   SHNOS=TES
   IF (F(14)-1.) 441,441,442
442 TES=TOTE-T(1)
   TEW=TEW+TES*F(62)
   SHNOS=SHNOS+TES
441 CE=F(51)*F(20)/100.
C   LAMBS WOOL COSTS
   BL=TOTE*F(60)
   CL=2.*BL*F(18)/100.
   ELS=TOTE*F(60)-TOTE*F(60)*F(7)/2.
   PELS=ELS*F(11)
   WLS=TOTE*F(60)-TOTE*F(60)*F(7)/2.
   PWLS=WLS*F(12)
   ALS=PELS+PWLS
   SHNOS=SHNOS+ALS
   TLW=ALS*F(9)
C   HOGGET WOOL COSTS
   THS=TEH-(TEH*F(6)/2.)
   SHNOS=SHNOS+THS+F(4)/2.
   THW=THS*F(63)+F(4)/2.*F(63)

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```

THW=THW+T(1)*F(61)
IF (F(61))974,974,975
975 SHNOS=SHNOS+T(1)
974 CH=TEH*F(19)/100.
TRW=TRAM*F(8)
SHNOS=SHNOS+TRAM*2.
SHGCOS=SHNOS*F(10)/100.
WOOL(1)=TEW+TLW+THW+TRW
C PRINT STATIC STOCK RECONCILIATION
PRINT 104,F(1)
PRINT 105,F(4),Y,Y,TEH,(T(I),I=1,7),TOTE,TRAM
PRINT 105,Y,Y,Y,P2T,Y,Y,Y,Y,Y,Y,Y,PRAM
PRINT 108,Y,SWL,SEL,S2T,(S(I),I=1,7)
PRINT 105,F(4),Y,Y,TEH,(T(I),I=1,7),TOTE,TRAM
C WOOLI=WOOL(1)*F(13)/100.
TOTAL SHEEP SALES AND PURCHASES
TSP=P2T*F(28)+PRAM*F(27)
TSS=SEL*F(22)+SWL*F(21)+S2T*F(23)
DO 110 I=1,3
110 TSS=TSS+S(I)*F(24)
TSS=TSS+S(4)*F(25)
DO 120 I=5,7
120 TSS=TSS+S(I)*F(26)
C CATTLE RECONCILIATION
JC=F(77)
IF (JC)71,71,72
71 IF (F(76))73,73,76
76 IERR=6
PRINT 102,IERR
CALL EXIT
72 IF (JC-4)75,75,76
75 IF (F(76))76,76,77
77 IF (F(39))78,78,79
78 F(39)=.1
79 F(39)=(100.-F(39))/100.
DO 140 J=78,81
140 F(J)=F(J)/100.
DO 141 I=1,4
141 V(I)=0.
B=1.
Z=1.
DO 142 I=JC,4
X=Z*F(39)
Y=X*F(I+77)
Z=X-Y
V(I)=Z
142 B=B+Z
DO 143 I=1,4
143 T(I)=0.

```

```

T(JC)=F(76)/B
K=JC+1
DO 144 I=K,4
C 144 T(I)=T(JC)*V(I-1)
CHECK CATTLE RECONCILIATION
TOTC=0.
DO 145 I=1,4
145 TOTC=TOTC+T(I)
IF (TOTC-F(76))146,147,148
146 TEST=TOTC+5.
IF (TEST-F(76))151,152,152
148 TEST=TOTC-5.
IF (TEST-F(76))152,152,151
151 IERR=7
PRINT 102,IERR
CALL EXIT
152 DIFF=TOTC-F(76)
DO 154 I=1,4
K=5-I
IF (T(K))153,154,155
155 T(K)=T(K)-DIFF
GO TO 147
153 IERR=8
PRINT 102,IERR
CALL EXIT
154 CONTINUE
C CATTLE SALES
147 DO 702 I=1,4
702 S(I)=0.
DO 149 I=1,4
149 S(I)=T(I)*F(I+77)*F(39)
164 PRINT 106,(T(I),I=1,4),TOTC
C CATTLE PURCHASES
IF (JC)703,703,704
703 PRINT 106,Y,Y,Y,Y
TVCP=0.
GO TO 161
704 IF (JC-1)705,705,706
705 PRINT 106,T(1),Y,Y,Y
TVCP=T(1)*F(35)
GO TO 161
706 IF (JC-2)707,707,156
707 PRINT 106,Y,T(2),Y,Y
TVCP=T(2)*F(36)
GO TO 161
3 156 IF (JC-2)157,157,158
157 PRINT 106,Y,Y,T(3),Y
TVCP=T(3)*F(37)
GO TO 161

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```

158 PRINT 106,Y,Y,Y,T(4)
    TVCP=T(4)*F(38)
161 PRINT 106,(S(I),I=1,4)
    PRINT 106,(T(I),I=1,4),TOTC
    GO TO 165
73 DO 163 I=1,4
    T(I)=0.
163 S(I)=0.
    GO TO 164
C VALUE OF CATTLE SALES
165 TVCS=0.
    DO 167 J=1,4
C TVCS=TVCS+(S(J)*F(J+30))
    COMMENCE BUDGET
    GCR=WOOLI+TSS+TVCS+F(75)
    DEX(1)=0
    DO 168 J=64,71
168 DEX(1)=DEX(1)+F(J)
    DO 169 J=73,74
169 DEX(1)=DEX(1)+F(J)
    DEX(1)=DEX(1)+(WOOL(1)/350.*F(72)/100.)+CH+CL+CE+TVCP+TSP
    DEPN(1)=F(82)+F(83)*.1+F(84)*.15+F(85)*.2+F(86)*.5
    ODINT=F(42)/100.*F(40)
    DEX(1)=DEX(1)+ODINT
    OINT1=F(47)/100.*F(45)
    REPAY1=F(46)-OINT1
    IF (REPAY1)171,172,172
171 IERR=9
    PRINT 102,IERR
    CALL EXIT
172 OINT2=F(50)/100.*F(48)
    REPAY2=F(49)-OINT2
    IF (REPAY2)173,174,174
173 IERR=10
    PRINT 102,IERR
    CALL EXIT
174 OINT=OINT1+OINT2
    REPAY=REPAY1+REPAY2
    DEX(1)=DEX(1)+OINT+F(16)+F(17)+SHGCOS
    TI=GCR-DEX(1)-DEPN(1)
    CALL TAXES (TOTAX,TI,F(44),F(15))
191 ACS=GCR-DEX(1)-REPAY-TOTAX-F(44)
    DEX(1)=DEX(1)-ODINT
    DEBT=F(48)+F(45)
    TDEBT=DEBT+F(40)
    IF (ACS)188,189,189
188 ACS=0.
189 PRINT 109,TSS,TSP,TVCS,TVCP,Y,Y,WOOL(1),GCR
    PRINT 109,DEX(1),Y,ODINT,Y,REPAY,ACS,F(44)

```

```
PRINT 109,DEPN(1),TI,TOTAX,ACS,Y,F(41),F(40),DEBT,TDEBT,Y
SVC(1)=0
F(2)=F(2)*100.
F(39)=(1.-F(39))*100.
F(11)=F(11)*100.
F(12)=F(12)*100.
DO 743 I=5,7
743 F(I)=F(I)*100.
101 FORMAT (7F8.1)
102 FORMAT (1H,13HERROR NUMBER,I6/)
103 FORMAT (/1H,27HMAXIMUM EWE LAMB CULL RATE ,F8.0)
104 FORMAT (1H1,F8.0/)
105 FORMAT (1H,F4.0,F5.0,F4.0,8F6.0,F7.0,F5.0/)
106 FORMAT(1H,5F8.0/)
108 FORMAT (1H,11F7.0/)
109 FORMAT(1H,10F9.0/)
C PROCEED TO FINANCING PROGRAM
CALL LINK (MAIN2)
END
```

```

SUBROUTINE TAXES (TAX,TINC,PRE,TAXEX)
IF (TINC)164,164,166
164 TAX=0.
RETURN
166 ASS=TINC-0.85*PRE-TAXEX
IF (ASS)164,164,167
167 TAXI=ASS*0.0785
ASS=ASS-650.
IF(ASS)200,200,168
168 TAXI=TAXI+ASS*0.1315
ASS=ASS-1050.
IF(ASS)200,200,169
169 TAXI=TAXI+ASS*0.035
ASS=ASS-300.
IF(ASS)200,200,170
170 DO 10 J=1,12
GO TO (1,2,3,1,1,1,4,5,3,5,6,7),J
1 TAXI=TAXI+ASS*0.030
GO TO 11
2 TAXI=TAXI+ASS*0.055
GO TO 11
3 TAXI=TAXI+ASS*0.010
GO TO 11
4 TAXI=TAXI+ASS*0.02
GO TO 11
5 TAXI=TAXI+ASS*0.04
GO TO 11
6 TAXI=TAXI+ASS*0.06
GO TO 11
7 TAXI=TAXI+ASS*0.05
11 ASS=ASS-500.
IF (ASS)200,200,10
10 CONTINUE
DO 13 KJ=1,2
TAXI=TAXI+ASS*0.01
ASS=ASS-2000.
IF(ASS)200,200,13
13 CONTINUE
TAXI=TAXI+0.005*ASS
200 TAX=TAXI
RETURN
END

```

```

C   FINANCING PROGRAM
    DIMENSION F(150),GCI(12),DEX(12),XDEX(12),WOOL(12),SS(12),SP(12)
    DIMENSION TCS(12),CP(12),DEPN(12),SVC(12)
    DIMENSION CS(4),VCS(4),S(10),C(10),CE(3)
    DIMENSION DEBT(36),PRINC(36),AINT(36),P(3),PC(4),A(4)
    COMMON F,GCI,DEX,XDEX,WOOL,SS,SP,TCS,CP,DEPN,SVC
    EQUIVALENCE (PREM,F(44))
C   INITIALS
    DO 30 KJ=1,36
30  DEBT(KJ)=0.
    K=1
    M=K+2
    I=1
    Y=0.
C   READ INITIAL STOCK NUMBERS, STANDARD VALUES
C   READ MINIMUM CULLING PERCENTAGES
    READ 101,(F(L),L=87,95)
    READ 101,(F(L),L=148,150)
    READ 101,(F(L),L=96,119)
C   READ NUMBER OF YEARS
    READ 102,N
    EQUIVALENCE (F(3),RN)
C   READ PERCENTAGE FALL IN WOOL PRICE, WOOL PRODUCTION
    READ 104,PWP,Q
    RN=N
C   CALCULATE INITIAL DEBT
    BYIND=F(45)+F(48)+F(40)
    COD=F(40)
    CASH=F(41)
    R=F(42)/100.
    4 IF (COD)9,9,4
    5 IF (CASH)9,9,5
    6 IF (CASH-COD)6,7,8
    6 COD=COD-CASH
    CASH=0
    GO TO 9
    7 COD=0.
    CASH=0.
    GO TO 9
    8 CASH=CASH-COD
    COD=0.
    9 IF (I-N)11,11,100
C   CALCULATE OVERDRAFT INTEREST
11  ODINT=R*COD
    PRINT 105,F(1),I
    YCASH=CASH
    YCOD=COD
C   READ DATA FOR DEVELOPMENT YEAR I
    READ 101,(F(L),L=121,147)

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```

C      READ IN NEW MORTGAGES
C      CALCULATE INTEREST PRINCIPAL ON NEW MORTGAGES
      L=K
      READ 101,DEBT(L),DEBT(L+1),DEBT(L+2)
      CIF=DEBT(K)
      DO 90 J=1,36
      AINT(J)=0
90     PRINC(J)=0
      DO 70 J=1,M,3
      IF (DEBT(J))15,70,401
401    AINT(J)=DEBT(J+2)/100.*DEBT(J)
      PRINC(J)=DEBT(J+1)-AINT(J)
      IF (PRINC(J))15,402,402
402    DEBT(J)=DEBT(J)-PRINC(J)
70     CONTINUE
      GO TO 16
15     IERR=12
      PRINT 103,IERR,I
      CALL EXIT
16     SINTNM=0.
      SPRINM=0.
      DO 80 J=1,36
      SINTNM=SINTNM+AINT(J)
80     SPRINM=SPRINM+PRINC(J)
      K=K+3
      M=K+2
C      READ IN NEW CAPITAL EXPENDITURE
C      ADD CAPITAL ITEM TO THE APPROPRIATE DEPRECIATION CLASS
      J=I+1
      CALL DEPREC (CE,XDEX,DEPN,F(82),F(83),F(84),F(85),F(86),J)
C      CALCULATE INTEREST REPAYMENT ON MORTGAGES
      OINT1=F(45)*F(47)/100.
      REPAY1=F(46)-OINT1
404    IF (F(45))403,403,404
34     IERR=13
      PRINT 103,IERR,I
      CALL EXIT
35     F(45)=F(45)-REPAY1
      GO TO 1233
403    REPAY1=0
1233   OINT2=F(48)*F(50)/100.
      REPAY2=F(49)-OINT2
      IF (F(48))405,405,406
405    REPAY2=0
406    IF (REPAY2)34,38,38
38     F(48)=F(48)-REPAY2
      REPAY=REPAY1+REPAY2
      OINT=OINT1+OINT2

```

```

C DATA TEST CHECK
  READ 101, CODE
  IF (CODE-99.) 901, 902, 901
901 IERR=14
  PRINT 103, IERR, I
  CALL EXIT
C TOTAL INITIAL STANDARD VALUE OF LIVESTOCK
902 TEWES=0.
  DO 120 J=89, 94
120 TEWES=TEWES+F(J)
  TSVBY=0.
  DO 513 KJ=95, 100
513 TSVBY=TSVBY+F(KJ)*F(KJ+9)
  DO 514 KJ=87, 88
514 TSVBY=TSVBY+F(KJ)*F(KJ+14)
  TSVBY=TSVBY+TEWES*F(103)
  DO 515 KJ=148, 150
515 TSVBY=TSVBY+F(KJ)*F(104)
  TEWES=TEWES+F(88)
  TRAM=F(95)+F(148)+F(149)+F(150)
C PRINT INITIAL SHEEP NUMBERS
  PRINT 107, F(96), Y, Y, (F(J), J=87, 94), TEWES, TRAM
C CALCULATE LAMBS, LAMBSWOOL, COSTS, SALE NUMBERS
  WL=TEWES*F(147)/200.
  EL=WL
  CL=2.*WL*F(18)/100.
  DWL=WL*F(7)/100.
  WL=WL-DWL/2.
  WOOLWL=WL*F(9)*F(12)/100.
  SHNOS=WL*F(12)/100.
  WL=WL-DWL/2.
  AL=WL-F(4)
  IF (AL) 43, 44, 44
43 F(4)=WL
  WL=0.
  GO TO 42
44 WL=WL-F(4)
42 S(1)=WL*F(21)
  SHNOS=SHNOS+(0.5*F(96))
  WOOLK=0.5*F(96)*F(146)
  F(96)=F(4)
  DEL=EL*F(7)/100.
  EL=EL-DEL/2.
  WOOLEL=EL*F(11)/100.*F(9)
  SHNOS=SHNOS+(EL*F(11)/100.)
  EL=EL-DEL/2.
  C(2)=EL*F(110)/100.
  EL=EL-C(2)
  S(2)=C(2)*F(22)

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C   HOGGET COSTS WOOL PRODUCTION SALE NUMBERS
    CH=F(87)*F(19)/100.
    DEH=F(87)*F(6)/100.
    F(87)=F(87)-DEH/2.
    WOOLEH=F(87)*F(146)
    SHNOS=SHNOS+F(87)
    F(87)=F(87)-DEH/2.
    C(3)=F(87)*F(111)/100.
    F(87)=F(87)-C(3)
C   EWES COSTS WOOL PRODUCTION
    CPE=TEWES*F(20)/100.
    DEWES=F(5)/200.*TEWES
    TEWES=TEWES-DEWES
    WOOLE=TEWES*F(145)
    SHNOS=SHNOS+TEWES
    DO 130 KJ=1,7
    F(KJ+87)=F(KJ+87)-(F(KJ+87)*F(5)/100.)
    C(KJ+3)=F(KJ+111)/100.*F(KJ+87)
130 F(KJ+87)=F(KJ+87)-C(KJ+3)
    S(4)=C(4)*F(24)
    S(5)=C(5)*F(24)
    S(6)=C(6)*F(24)
    S(10)=C(10)*F(26)
C   UPDATE EWE AGES
    DO 702 J=87,93
    KN=181-J.
    F(KN)=0.
702 F(KN)=F(KN-1)
    F(87)=0.
    F(87)=EL
    TEWES=0.
    DO 140 KJ=88,94
140 TEWES=TEWES+F(KJ)
C   COMPARE TOTAL EWES WITH TARGET FOR EWE NUMBERS
    IF (TEWES-F(121))51,811,53
C   PROJECTED EWE NUMBERS EXCEEDS TARGET
C   CALCULATE EXTRA EWES TO SELL
53 CALL SHEEPS (F,C,TEWES)
    CCP=0
    GO TO 811
51 IF (F(119))69,69,71
C   BUYING EWES NOT PERMITTED
69 PRINT 106
    DO 506 KJ=1,3
506 P(KJ)=0.
    CCP=0
    GO TO 78
C   PROJECTED EWE NUMBERS LESS THAN TARGET
C   CALCULATE NUMBER OF EWES TO BUY

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```

71 CALL SHEEPB (F,P,CCP,TEWES)
   GO TO 52
811 DO 800 KJ=1,3
800 P(KJ)=0.
   CCP=0
   52 TEWES=0.
C   CHECK THAT PROJECTED EWE NUMBERS EQUALS TARGET
   DO 150 KJ=88,94
150 TEWES=TEWES+F(KJ)
   IF (TEWES-F(121))412,78,411
412 TEST=TEWES+5.
   IF (TEST-F(121))77,78,78
411 TEST=TEWES-5.
   IF (TEST-F(121))78,78,77
   77 IERR=15
   PRINT 103,IERR,I
   CALL EXIT
C   CALCULATE SALES
   78 S(3)=C(3)*F(23)
   S(7)=C(7)*F(25)
   S(8)=C(8)*F(26)
   S(9)=C(9)*F(26)
C   CALCULATE 2-TOOTH WOOL PRODUCTION
   WOOL2T=F(88)*F(144)
   IF (WOOL2T)81,81,82
82 SHNOS=SHNOS+F(88)
C   CALCULATE 2 SHEAR WOOL PRODUCTION
81 IF (F(14)-2.)83,84,84
84 TEWES=TEWES-F(88)
   WOOLE=WOOLE+F(145)*TEWES
   SHNOS=SHNOS+TEWES
C   CALCULATE NUMBER OF RAMS REQUIRED
83 TEWES=0.
   DO 160 KJ=88,94
160 TEWES=TEWES+F(KJ)
   DO 516 KJ=148,149
   L=298-KJ
   F(L)=0.
516 F(L)=F(L-1)
   F(148)=F(95)
   F(95)=0.
   TRAM=F(148)+F(149)+F(150)
   RAMS=TEWES*F(2)/100.
   IF (RAMS-TRAM)85,85,703
703 PRAM=RAMS-TRAM
   F(95)=F(95)+PRAM
   TRAM=RAMS
   GO TO 86
85 PRAM=0

```

```

86 CPRAM=PRAM*F(27)
   WOOLR=TRAM*F(8)
   SHNOS=SHNOS+TRAM*2.
C   TOTAL SHEEP PURCHASES
C   TSP=CPRAM+CCP
C   TOTAL SHEEP SALES
   TSS=0.
   DO 170 KJ=1,10
C 170 TSS=TSS+S(KJ)
C   CATTLE RECONCILIATION
C   CALCULATE NUMBER TO SELL, VALUE OF SALES
   DO 180 KJ=1,4
   A(KJ)=F(KJ+96)
   F(KJ+96)=F(KJ+96)-(F(KJ+96)*F(39)/100.)
   CS(KJ)=F(KJ+96)*F(KJ+122)/100.
   F(KJ+96)=F(KJ+96)-CS(KJ)
C 180 VCS(KJ)=CS(KJ)*F(KJ+30)
   TVCS=0.
   DO 310 KJ=1,4
C 310 TVCS=TVCS+VCS(KJ)
C   UPDATE CATTLE AGES
   DO 704 J=97,99
   KN=197-J
   F(KN)=0.
C 704 F(KN)=F(KN-1)
   F(97)=0.
   TOT=F(98)+F(99)+F(100)
   IF (TOT)87,87,88
C 87 IF (F(127))89,89,88
C 89 TVCP=0.
   DO 290 KJ=1,4
C 290 PC(KJ)=0.
   GO TO 136
C 88 IF (F(127)-TOT)93,89,92
C   PROJECTED CATTLE NUMBERS LESS THAN TARGET
C   CALCULATE NUMBER TO BUY
C 92 CALL CATTLB(F,PC,TOT,TVCP)
   GO TO 136
C   PROJECTED CATTLE NUMBERS EXCEEDS TARGET
C   CALCULATE ADDITIONAL CATTLE TO SELL
C   SELL CATTLE
C 93 CALL CATTLS (F,PC,TVCP,CS,TVCS,TOT)
C   END OF CATTLE RECONCILIATION
C   CALCULATE TOTAL LIVESTOCK STANDARD VALUE END OF YEAR
C 136 TEWES=0.
   DO 190 KJ=89,94
C 190 TEWES=TEWES+F(KJ)
   TSVEY=F(87)*F(101)+F(88)*F(102)+TEWES*F(103)
   DO 200 KJ=96,100

```

```

200 TSVEY=TSVEY+(F(KJ)*F(KJ+9))
    TSVEY=TSVEY+TRAM*F(104)
    SVC(I+1)=TSVEY-TSVBY
    IF (TSVEY-TSVBY)761,162,163
761 SVCI=0
    SVCD=TSVBY-TSVEY
    GO TO 762
162 SVCI=0
    SVCD=0
    GO TO 762
163 SVCI=TSVEY-TSVBY
    SVCD=0
762 PRINT 107,Y,Y,Y,P(1),Y,Y,Y,P(2),P(3),Y,Y,Y,PRAM
    C(1)=WL
    TEWES=TEWES+F(88)
    PRINT 107,Y,(C(J),J=1,10)
    PRINT 107,F(96),Y,Y,(F(J),J=87,94),TEWES,TRAM
    PRINT 108
    TOT=A(1)+A(2)+A(3)+A(4)
    PRINT 109,(A(J),J=1,4),TOT
    PRINT 109,(PC(J),J=1,4)
    PRINT 109,(CS(J),J=1,4)
    TOTC=F(97)+F(98)+F(99)+F(100)
    PRINT 109,(F(J),J=97,100),TOTC
    PRINT 108
C COMMENCE BUDGET
    WOOL(I+1)=WOOLWL+WOOLEL+WOOLEH+WOOLE2T+WOOLE+WOOLE
    PACKS=WOOL(I+1)/350.*F(72)/100.
    SHGCOS=SHNOS*(F(10)/100.)
    WOOLI=WOOL(I+1)*F(13)/100.
    GCR=0.
    GCR=WOOLI+TVCS+TSS+F(143)
    DEX(I+1)=0.
    DO 210 KJ=128,141
210 DEX(I+1)=DEX(I+1)+F(KJ)
    DEX(I+1)=DEX(I+1)+PACKS+ODINT+SINTNM+TVCP+TSP+SHGCOS+CL+CPE+CH
    DEX(I+1)=DEX(I+1)+F(16)+F(17)+OINT
    TI=GCR+SVCI-SVCD-DEX(I+1)-DEPN(I+1)
    XDEX(I+1)=XDEX(I+1)+REPAY
C CALCULATE TAXATION
    CALL TAXES (TOTAX,TI,PREM,F(15)).
178 DEX(I+1)=DEX(I+1)-ODINT-SINTNM
    PRINT 111,TSS,TSP,TVCS,TVCP,SVCI,SVCD,WOOL(I+1),GCR
    PRINT 112,DEX(I+1),SPRINM,ODINT,SINTNM,XDEX(I+1),F(142),PREM
    PRINT 112,DEPN(I+1),TI
    XDEX(I+1)=XDEX(I+1)+SPRINM+F(142)
    DEX(I+1)=DEX(I+1)+ODINT+SINTNM
C CALCULATE CASH FLOW
    ACS=GCR-DEX(I+1)-TOTAX-XDEX(I+1)+CIF-PREM

```

```

CALL FL (ACS, AOD, DEX(I+1), XDEX(I+1), CIF, PREM, TOTAX, GCR, COD, CASH)
C
201 TOTAL MORTGAGE LIABILITIES
TMORT=0.
TMORT=F(45)+F(48)
DO 280 KJ=1,36,3
280 TMORT=TMORT+DEBT(KJ)
PRINT 114, TMORT
C
TRANSFER DATA INTO COMMON STORAGE
GCI(I+1)=GCR
SS(I+1)=TSS
SP(I+1)=TSP
TCS(I+1)=TVCS
CP(I+1)=TVCP
XDEX(I+1)=XDEX(I+1)-SPRINM-F(142)
DEX(I+1)=DEX(I+1)-ODINT-SINTNM
PRINT 108
C
TOTAL DEBT
TMORT=TMORT+COD
PRINT 114, TMORT
PRINT 108
C
ADDITIONAL DEBT ABOVE BASE YEAR
ADEBT=TMORT-BYIND
IF (ADEBT)202,203,203
202 ADEBT=0.
203 PRINT 114, ADEBT
C
PARAMETRIC FINANCIAL ANALYSIS
KPAR=0.
PWPRI=(1.+PWP)*F(13)/100.
PWOOL=WOOL(I+1)*(1.-Q)
608 PNI=PWPRI*PWOOL+TVCS+TSS+F(143)+SVC I-SVCD-DEX(I+1)-DEPN(I+1)-ODINT
PNI=PNI-SINTNM
CALL TAXES (TOTAX, PNI, PREM, F(15))
ACS=PNI+DEPN(I+1)+CIF+SVCD-SVCI-TOTAX-PREM-XDEX(I+1)-SPRINM-F(142)
IF (ACS)601,602,602
601 ACS=0.
AOD=SVCI+TOTAX+PREM+XDEX(I+1)-PNI-DEPN(I+1)-CIF-SVCD+SPRINM+F(142)
GO TO 603
602 AOD=0.
603 ACASH=YCASH
ACOD=YCOD
C
PARAMETRIC CASH FLOW AND OVERDRAFT ANALYSIS
CALL PFLOW (ACS, AOD, ACASH, ACOD)
PPR=PWPRI*100.
PRINT 111, ACS, AOD, ACASH, ACOD, PPR, PWOOL
KPAR=KPAR+1
GO TO (604,605,606,607,611), KPAR
604 PWPRI=F(13)/100.
PWOOL=WOOL(I+1)*(1.-Q)
GO TO 608

```

```

605 PWPRI=(1.-PWP)*F(13)/100.
    PWOOL=(1.-Q)*WOOL(I+1)
    GO TO 608
606 PWPRI=(1.-PWP)*F(13)/100.
    PWOOL=WOOL(I+1)
    GO TO 608
607 PWPRI=(1.-PWP)*F(13)/100.
    PWOOL=WOOL(I+1)*(1.+Q)
    GO TO 608
611 KPAR=0
C   INCREMENT YEAR COUNT
C   INITIALS
    I=I+1
    DO 360 KJ=1,3
      P(KJ)=0.
      PC(KJ)=0.
      VCS(KJ)=0.
360  A(J)=0.
      PC(4)=0.
      VCS(4)=0.
      A(4)=0.
      AOD=0.
      ACS=0.
    DO 1000 J=1,10
1000 C(J)=0.
      GO TO 9
101  FORMAT(8F8.1)
102  FORMAT (I4)
103  FORMAT (1H ,9HERROR NO ,I4,6H YEAR ,I4)
104  FORMAT (2F5.2)
105  FORMAT (1H1,F8.0,I4/)
106  FORMAT (1H ,19HEWE TARGET TOO HIGH/)
107  FORMAT (1H ,13F8.0/)
108  FORMAT (1H ,/)
109  FORMAT(1H ,5F8.0/)
111  FORMAT (1H ,7F8.1/)
112  FORMAT (1H ,10F12.0/)
113  FORMAT (1H ,3F12.0/)
114  FORMAT (1H ,3F12.0/)
C   PROCEED TO POST DEVELOPMENT PROGRAM
100  CALL LINK (MAIN3)
    END

```

```

SUBROUTINE DEPREC(X,XD,DEP,F82,F83,F84,F85,F86,J)
DIMENSION X(3),XD(12),DEP(12)
JJ=1
31 READ 102,X(1),X(2),X(3)
IF (X(1))29,29,221
221 MM=X(2)
IF (MM)17,17,18
17 IERR=11
PRINT 103,IERR
CALL EXIT
18 IF (MM-2)19,19,17
19 GO TO(21,22),MM
21 F82=F82+(X(3)/100.*X(1))
GO TO 29
22 IF (X(3)-20.)23,23,24
24 F86=F86+X(1)
GO TO 29
23 IF (X(3)-20.)25,26,26
26 F85=F85+X(1)
GO TO 29
25 IF (X(3)-15.)27,28,28
28 F85=F85+X(1)
GO TO 29
27 F83=F83+X(1)
29 JJ=JJ+1
XD(J)=XD(J)+X(1)
IF (JJ-2)31,31,32
32 DEP10=F83*0.10
F83=F83-DEP10
DEP15=F84*0.15
F84=F84-DEP15
DEP20=F85*0.20
F85=F85-DEP20
DEP50=F86*0.50
F86=F86-DEP50
DEP(J)=DEP10+DEP20+DEP15+DEP50+F82
102 FORMAT (3F10.1)
103 FORMAT (1H ,9HERROR NO ,I4/)
RETURN
END

```

```
      SUBROUTINE SHEEPB (F,P,CCP,TEWES)
      DIMENSION F(147),P(3)
71  IF (F(119)-3.)72,72,73
73  IERR=16
      PRINT 103,IERR
103  FORMAT (1H ,9HERROR NO ,I4/)
      CALL EXIT
72  JM=F(119)
      GO TO (74,75,76),JM
74  P(1)=F(121)-TEWES
      CCP=P(1)*F(28)
      F(88)=F(88)+P(1)
      P(2)=0.
      P(3)=0.
      GO TO 52
75  P(2)=F(121)-TEWES
      CCP=P(2)*F(29)
      F(92)=F(92)+P(2)
      P(1)=0.
      P(3)=0.
      GO TO 52
76  P(3)=F(121)-TEWES
      CCP=P(3)*F(30)
      F(93)=F(93)+P(3)
      P(2)=0.
      P(1)=0.
52  RETURN
      END
```

```

SUBROUTINE SHEEPS (F,C,TEWES)
DIMENSION F(147),C(10)
53 DIFF=TEWES-F(121)
  IF (F(94))54,54,55
55 IF (DIFF-F(94))57,57,58
58 C(9)=C(9)+F(94)
  DIFF=DIFF-F(94)
  F(94)=0.
  GO TO 54
57 F(94)=F(94)-DIFF
  C(9)=C(9)+DIFF
  GO TO 811
54 IF (F(93))59,59,61
61 IF (DIFF-F(93))62,62,63
63 C(8)=C(8)+F(93)
  DIFF=DIFF-F(93)
  F(93)=0
  GO TO 59
62 F(93)=F(93)-DIFF
  C(8)=C(8)+DIFF
  GO TO 811
59 CULL2T=(F(88)/(F(88)+F(92)))*DIFF
  CULL5Y=(F(92)/(F(88)+F(92)))*DIFF
  IF (F(88)-CULL2T)65,66,66
65 CULL2T=F(88)
66 C(3)=C(3)+CULL2T
  F(88)=F(88)-CULL2T
  IF (F(92)-CULL5Y)67,68,68
67 CULL5Y=F(92)
68 C(7)=C(7)+CULL5Y
  F(92)=F(92)-CULL5Y
811 RETURN
END

```

```

SUBROUTINE CATTLB(F,PC,TOT,TVCP)
DIMENSION F(147),PC(4)
IF (F(122)-4.)94,94,95
95 IERR=17
PRINT 103,IERR
103 FORMAT (1H ,9HERROR NO ,I4/)
CALL EXIT
94 IF (F(122))95,95,96
96 JMC=F(122)
GO TO (131,132,133,134),JMC
131 PC(1)=F(127)-TOT
TVCP=PC(1)*F(35)
F(97)=F(97)+PC(1)
DO 350 KJ=2,4
350 PC(KJ)=0.
GO TO 161
132 PC(2)=F(127)-TOT
TVCP=PC(2)*F(36)
F(98)=F(98)+PC(2)
PC(1)=0.
PC(3)=0.
PC(4)=0.
GO TO 161
133 PC(3)=F(127)-TOT
TVCP=PC(3)*F(37)
F(99)=F(99)+PC(3)
PC(1)=0.
PC(2)=0
PC(4)=0.
GO TO 161
134 PC(4)=F(127)-TOT
TVCP=PC(4)*F(38)
F(100)=F(100)+PC(4)
DO 340 KJ=1,3
340 PC(KJ)=0.
161 TOT=0.
TOT=F(97)+F(98)+F(99)+F(100)
IF (TOT-F(127))135,136,135
135 IERR=18
PRINT 103,IERR
CALL EXIT
136 RETURN
END

```

```

SUBROUTINE CATTLS (F,PC,TVCP,CS,TVCS,TOT)
DIMENSION F(147),PC(4),CS(4)
DIFF=TOT-F(127)
TVCP=0.
DO 933 J=1,4
933 PC(J)=0.
IF (DIFF-F(100))141,142,143
141 F(100)=F(100)-DIFF
CS(3)=CS(3)+DIFF
TVCS=TVCS+DIFF*F(33)
GO TO 161
142 CS(3)=CS(3)+DIFF
TVCS=TVCS+DIFF*F(33)
F(100)=0.
GO TO 161
143 CS(3)=CS(3)+F(100)
TVCS=TVCS+F(100)*F(33)
DIFF=DIFF-F(100)
F(100)=0.
IF (DIFF-F(99))144,145,146
144 F(99)=F(99)-DIFF
CS(2)=CS(2)+DIFF
TVCS=TVCS+DIFF*F(32)
GO TO 161
145 CS(2)=CS(2)+DIFF
TVCS=TVCS+DIFF*F(32)
F(99)=0.
GO TO 161
146 CS(2)=CS(2)+F(99)
TVCS=TVCS+F(99)*F(32)
DIFF=DIFF-F(99)
F(99)=0.
IF (DIFF-F(98))151,152,153
151 F(98)=F(98)-DIFF
CS(1)=CS(1)+DIFF
TVCS=TVCS+DIFF*F(31)
GO TO 161
152 CS(1)=CS(1)+DIFF
TVCS=TVCS+DIFF*F(31)
TVCS=TVCS+DIFF*F(32)
F(98)=0.
153 CS(1)=CS(1)+F(98)
TVCS=TVCS+F(98)*F(31)
DIFF=DIFF-F(98)
F(98)=0.
161 RETURN
END

```

```

SUBROUTINE FL(ACS, AOD, DE, XDE, CIF, PREM, TOTAX, GCR, COD, CASH)
  IF (ACS)181,182,193
181 AOD=DE+XDE+TOTAX+PREM-GCR-CIF
  ACS=0.
  PRINT 114, TOTAX, ACS, AOD
  PRINT 108
  IF (COD)183,183,184
184 COD=COD+AOD
189 PRINT 114, CASH, COD
  GO TO 201
183 IF (CASH)184,184,185
185 IF (CASH-AOD)186,187,188
186 AOD=AOD-CASH
  CASH=0.
  COD=COD+AOD
  AOD=0.
  GO TO 189
187 CASH=0.
  AOD=0.
  GO TO 189
188 CASH=CASH-AOD
  AOD=0.
  GO TO 189
182 AOD=0.
  PRINT 114, TOTAX, ACS, AOD
  GO TO 189
193 AOD=0.
  PRINT 114, TOTAX, ACS, AOD
  IF (CASH)194,194,195
195 CASH=CASH+ACS
  GO TO 189
194 IF (COD)195,195,196
196 IF (COD-ACS)197,198,199
197 ACS=ACS-COD
  COD=0
  CASH=ACS
  ACS=0.
  GO TO 189
198 COD=0.
  ACS=0.
  GO TO 189
199 COD=COD-ACS
  ACS=0.
  GO TO 189
108 FORMAT (1H ,//)
114 FORMAT (1H ,3F12.0/)
201 RETURN
  END

```

```
SUBROUTINE PFLOW (ACS,AOD,ACASH,ACOD)
  IF(ACS)1,1,2
  2 IF(ACASH)3,3,4
  4 ACASH=ACASH+ACS
  GO TO 10
  3 IF (ACOD)4,4,5
  5 IF (ACOD-ACS)7,8,9
  7 ACASH=ACS-ACOD
  8 ACOD=0.
  GO TO 10
  9 ACOD=ACOD-ACS
  GO TO 10
  1 IF (AOD)10,10,11
  11 IF(ACOD)12,12,13
  13 ACOD=ACOD+AOD
  GO TO 10
  12 IF (ACASH)13,13,14
  14 IF (ACASH-AOD)15,16,17
  15 ACOD=AOD-ACASH
  16 ACASH=0.
  GO TO 10
  17 ACASH=ACASH-AOD
  10 RETURN
  END
```

```

C   POST DEVELOPMENT PROGRAM
    DIMENSION F(150),GCI(12),DEX(12),XDEX(12),WOOL(12),SS(12),SP(12)
    DIMENSION TCS(12),CP(12),DEPN(12),SVC(12),V(6),T(7),S(7),B(30)
    COMMON F,GCI,DEX,XDEX,WOOL,SS,SP,TCS,CP,DEPN,SVC
    EQUIVALENCE (TOTE,B(1))
    JFK=F(3)+2.
    Y=0.
C   READ DATA FOR POST DEVELOPMENT YEAR
    READ 101,(B(J),J=1,23)
    READ 101,B(30)
    READ 101,(B(J),J=24,29)
    S2T=0.
    B(10)=B(10)/200.
    F(2)=F(2)/100.
    F(11)=F(11)/100.
    F(12)=F(12)/100.
10  DO 10 I=5,7
    F(I)=(100.-F(I))/100.
    DO 20 I=2,9
C   20 B(I)=B(I)/100.
    CALCULATE STATIC SHEEP RECONCILIATION
    DO 30 I=1,6
30  V(I)=0.
    A=1.
    Z=1.
    DO 40 I=1,6
    X=Z*F(5)
    Y=X*B(I+2)
    Z=X-Y
    V(I)=Z
40  A=A+Z
    DO 50 I=1,7
50  T(I)=0.
    T(1)=B(1)/A
    DO 60 I=2,7
C   60 T(I)=T(1)*V(I-1)
    CHECK STATIC RECONCILIATION
    TEWE=0.
    DO 70 I=1,7
70  TEWE=TEWE+T(I)
    IF (TEWE-B(1))37,45,39
37  TEST=TEWE+5.
    IF (TEST-TOTE)701,41,41
39  TEST=TEWE-5.
    IF (TEST-TOTE)41,41,701
701 IERR=20
    PRINT 102,IERR
    CALL EXIT
41  DIFF=TEWE-TOTE

```

```

DO 80 I=1,7
K=8-I
IF (T(K))43,80,44
44 T(K)=T(K)-DIFF
GO TO 45
43 IERR=21
PRINT 102,IERR
CALL EXIT
80 CONTINUE
IERR=22
PRINT 102,IERR
CALL EXIT
45 P2T=0.
C EWE LAMBS AND EWE LAMBS SALES
TEL=TOTE*B(10)*F(7)
SEL=TEL*B(2)
TEH=TEL-SEL
C CALCULATE NUMBER OF 2 TOOTHES TO SELL
IF (F(6)-1.)48,47,46
46 IERR=23
PRINT 102,IERR
CALL EXIT
47 P2T=T(1)
IF (TEL-SEL)49,58,49
49 SEL=TEL
GO TO 58
48 A2T=TEH*F(6)
IF (A2T-T(1))51,52,52
51 DO 56 K=1,99
FK=K
G=FK/100.
B(2)=B(2)-G
IF (1.-B(2))55,55,54
55 IERR=24
PRINT 102,IERR
CALL EXIT
54 SEL=TEL*B(2)
TEH=TEL-SEL
A2T=TEH*F(6)
IF (A2T-T(1))56,57,57
56 CONTINUE
57 S2T=A2T-T(1)
P=B(2)*100.
PRINT 103,P
GO TO 58
52 S2T=A2T-T(1)
C WETHER LAMB SALES, RAMS REQUIRED
58 SWL=TOTE*B(10)*F(7)-F(4)
TRAM=TOTE*F(2)

```

```

PRAM=TRAM*0.25
DO 59 I=1,7
59 S(I)=0.
DO 90 I=1,7
90 S(I)=T(I)*F(5)*B(I+2)
DO 61 I=5,7
61 F(I)=1.-F(I)
C CALCULATE WOOL PRODUCTION
TES=TOTE
DO 62 I=1,7
62 TES=TES-(T(I)*F(5)/2.)
TEW=TES*B(12)
SHNOS=TES
IF (F(14)-1.)441,441,442
442 TES=TOTE-T(1)
TEW=TEW+TES*B(12)
SHNOS=SHNOS+TES
441 CE=B(1)*F(20)/100.
BL=B(1)*B(10)
CL=2.*BL*F(18)/100.
ELS=TOTE*B(10)-TOTE*B(10)*F(7)/2.
PELS=ELS*F(11)
WLS=TOTE*B(10)-TOTE*B(10)*F(7)/2.
PWLS=WLS*F(12)
ALS=PELS+PWLS
SHNOS=SHNOS+ALS
TLW=ALS*F(9)
THS=TEH-(TEH*F(6)/2.)
SHNOS=SHNOS+THS+F(4)/2.
THW=THS*B(13)+F(4)/2.*B(13)
THW=THW+T(1)*B(11)
IF (B(11))974,974,975
975 SHNOS=SHNOS+T(1)
974 CH=TEH*F(19)/100.
TRW=TRAM*F(8)
SHNOS=SHNOS+TRAM*2.
SHGCOS=SHNOS*F(10)/100.
WOOL(JFK)=TEW+TLW+THW+TRW
PRINT 104,F(1)
PRINT 105,F(4),Y,Y,TEH,(T(I),I=1,7),TOTE,TRAM
PRINT 105,Y,Y,Y,P2T,Y,Y,Y,Y,Y,Y,Y,Y,PRAM
PRINT 108,Y,SWL,SEL,S2T,(S(I),I=1,7)
PRINT 105,F(4),Y,Y,TEH,(T(I),I=1,7),TOTE,TRAM
WOOLI=WOOL(JFK)*F(13)/100.
TSP=P2T*F(28)+PRAM*F(27)
TSS=SEL*F(22)+SWL*F(21)+S2T*F(23)
DO 110 I=1,3
110 TSS=TSS+S(I)*F(24)
TSS=TSS+S(4)*F(25)

```

```

DO 120 I=5,7
C 120 TSS=TSS+S(I)*F(26)
      CATTLE STATIC RECONCILIATION
      JC=B(25)
      IF (JC)71,71,72
71 IF (B(24))73,73,76
76 IERR=25
      PRINT 102,IERR
      CALL EXIT
72 IF (JC-4)75,75,76
75 IF (B(24))76,76,77
77 IF (F(39))78,78,79
78 F(39)=.1
79 F(39)=(100.-F(39))/100.
DO 140 J=26,29
140 B(J)=B(J)/100.
DO 141 I=1,4
141 V(I)=0.
      A=1.
      Z=1.
      DO 142 I=JC,4
      X=Z*F(39)
      Y=X*B(I+25)
      Z=X-Y
142 V(I)=Z
      A=A+Z
DO 143 I=1,4
143 T(I)=0.
      T(JC)=B(24)/A
      K=JC+1
DO 144 I=K,4
C 144 T(I)=T(JC)*V(I-1)
      CHECK CATTLE RECONCILIATION
      TOTC=0.
DO 145 I=1,4
145 TOTC=TOTC+T(I)
      IF (TOTC-B(24))146,147,148
146 TEST=TOTC+5.
      IF (TEST-B(24))151,152,152
148 TEST=TOTC-5.
      IF (TEST-B(24))152,152,151
151 IERR=26
      PRINT 102,IERR
      CALL EXIT
152 DIFF=TOTC-B(24)
DO 154 I=1,4
      K=5-I
      IF (T(K))153,154,155
155 T(K)=T(K)-DIFF

```

```

GO TO 147
153 IERR=27
PRINT 102,IERR
CALL EXIT
154 CONTINUE
147 DO 702 I=1,4
702 S(I)=0.
DO 149 I=1,4
149 S(I)=T(I)*B(I+25)*F(39)
164 PRINT 106,(T(I),I=1,4),TOTC
C CALCULATE CATTLE PURCHASES
IF (JC)703,703,704
703 PRINT 106,Y,Y,Y,Y
TVCP=0.
GO TO 161
704 IF (JC-1)705,705,706
705 PRINT 106,T(1),Y,Y,Y
TVCP=T(1)*F(35)
GO TO 161
706 IF (JC-2)707,707,156
707 PRINT 106,Y,T(2),Y,Y
TVCP=T(2)*F(36)
GO TO 161
156 IF (JC-2)157,157,158
157 PRINT 106,Y,Y,T(3),Y
TVCP=T(3)*F(37)
GO TO 161
158 PRINT 106,Y,Y,Y,T(4)
TVCP=T(4)*F(38)
161 PRINT 106,(S(I),I=1,4)
PRINT 106,(T(I),I=1,4),TOTC
GO TO 165
73 DO 163 I=1,4
T(I)=0.
163 S(I)=0.
GO TO 164
C CATTLE SALES
165 TVCS=0.
DO 167 J=1,4
167 TVCS=TVCS+(S(J)*F(J+30))
C COMMENCE BUDGET
GCR=WOOLI+TSS+TVCS+B(30)
DEX(JFK)=0.
DO 168 J=14,23
168 DEX(JFK)=DEX(JFK)+B(J)
DEX(JFK)=DEX(JFK)+(WOOL(JFK)/350.*F(72)/100.)+CH+CL+CE+TVCP+TSP
DEPN(JFK)=F(82)+F(83)*0.1+F(84)*0.15+F(85)*0.20+F(86)*0.5
ODINT=F(42)/100.*F(40)
DEX(JFK)=DEX(JFK)+ODINT

```

```

OINT1=F(47)/100.*F(45)
IF(OINT1)171,171,172
171 REPAY1=0
GO TO 173
172 REPAY1=F(46)-OINT1
173 OINT2=F(50)/100.*F(48)
IF(OINT2)174,174,175
174 REPAY2=0
GO TO 176
175 REPAY2=F(49)-OINT2
176 OINT=OINT1+OINT2
REPAY=REPAY1+REPAY2
DEX(JFK)=DEX(JFK)+OINT+F(16)+F(17)+SHGCOS
TI=GCR-DEX(JFK)-DEPN(JFK)
CALL TAXES(TOTAX, TI, F(44), F(15))
ACS=GCR-DEX(JFK)-REPAY-TOTAX-F(44)
DEX(JFK)=DEX(JFK)-ODINT
XDEX(JFK)=REPAY
DEBT=F(48)+F(45)
TDEBT=DEBT+F(40)
IF (ACS)188,189,189
188 ACS=0
189 PRINT 109, TSS, TSP, TVCS, TVCP, Y, Y, WOOL(JFK), GCR
PRINT 109, DEX(JFK), Y, ODINT, Y, REPAY, ACS, F(44)
PRINT 109, DEPN(JFK), TI, TOTAX, ACS, Y, F(41), F(40), DEBT, TDEBT, Y
GCI(JFK)=GCR
SVC(JFK)=0.
SS(JFK)=TSS
SP(JFK)=TSP
TCS(JFK)=TVCS
CP(JFK)=TVCP
101 FORMAT (7F8.1)
102 FORMAT (1H,13HERROR NUMBER,I6/)
103 FORMAT (/1H,27HMAXIMUM EWE LAMB CULL RATE ,F8.0)
104 FORMAT (1H1,F8.0/)
105 FORMAT(1H,13F7.0/)
106 FORMAT (1H,5F8.0/)
108 FORMAT (1H,11F7.0/)
109 FORMAT(1H,10F9.0/)
C PROCEED TO EVALUATION PROGRAM
CALL LINK (MAIN4)
END

```

```

C      EVALUATION PROGRAM
      DIMENSION F(150),GCI(12),DEX(12),XDEX(12),WOOL(12),SS(12)
      DIMENSION SP(12),TCS(12),CP(12),DEPN(12),SVC(12),PROF(100)
      COMMON F,GCI,DEX,XDEX,WOOL,SS,SP,TCS,CP,DEPN,SVC
      EQUIVALENCE (OD,F(40)),(PREM,F(44)),(R,F(42))
C      INITIALS
115    M=1
      N=F(3)+2.
      I=1
      L=1
      KN=0
      R=R/100.
      GCIO=GCI(1)
C      TOTAL BASE YEAR CASH EXPENDITURE
      TEXO=XDEX(1)+DEX(1)+PREM
      TEXO=TEXO+R*OD
      COD=0.
      CASH=0.
      JJ=0
98     JJ=JJ+1
11     AOD=0.
      ACS=0.
C      CALCULATE BASE YEAR INTEREST
      BYINT=R*OD
C      CALCULATE OVERDRAFT INTEREST
      ODINT=R*COD
      TDEX=DEX(JJ)+ODINT+BYINT
      TI=GCI(JJ)+SVC(JJ)-DEPN(JJ)-TDEX
      CALL TAXES (TOTAX,TI,PREM,F(15))
      IF (I-1)43,43,44
43     TOT=TOTAX
44     IF (TOTAX)45,46,46
45     IERR=31
      PRINT 103,IERR
      GO TO 100
C      CALCULATE PERSONAL DRAWINGS
46     TRO=GCI(JJ)-TDEX-XDEX(JJ)-TOTAX-PREM
      IF (I-1)47,48,49
47     IERR=32
      PRINT 103,IERR
      GO TO 100
C      CALCULATE BASE YEAR PERSONAL DRAWINGS
48     IF (TRO)51,52,52
51     TRO=0.
52     BRO=TRO
      GO TO 75
C      CALCULATE CASH FLOW
C      CALCULATE OVERDRAFT OR CREDIT BALANCE
49     RO=TRO-BRO

```

```

    IF (TRO-BRO)58,59,60
59 ACS=0.
   AOD=0.
   GO TO 75
58 AOD=BRO-TRO
   ACS=0.
   IF (COD)61,61,63
61 IF (CASH)63,63,64
63 COD=COD+AOD
   GO TO 75
64 IF (CASH-AOD)65,66,67
65 COD=AOD-CASH
66 CASH=0.
   GO TO 75
67 CASH=CASH-AOD
   GO TO 75
60 ACS=TRO-BRO
   AOD=0.
   IF (CASH)68,68,69
68 IF (COD)69,69,70
69 CASH=CASH+ACS
   GO TO 75
70 IF (COD-ACS)72,73,74
72 CASH=CASH+ACS-COD
73 COD=0.
   KN=M-1
   GO TO 75
74 COD=COD-ACS
C  CALCULATE DEVELOPMENT CASH PROFITS
75 V=GCI(JJ)-GCIO
   TEX=XDEX(JJ)+TDEX+PREM
   C=TEX-TEXO
   CT=C+TOTAX-TOT
   PROF(L)=V-CT
C  ADD TO INDICES
211 I=I+1
   IF (I-N)76,76,77
76 M=M+1
   L=L+1
   GO TO 98
77 I=N
   IF (COD)78,78,83
78 IF (ODINT)99,99,83
83 L=L+1
   M=M+1
   IF (M-20)11,11,100
C  DISCOUNT PROFITS
C  CALCULATE PRESENT VALUE
99 L=2

```

```

PV=0.
112 PV=PV+(PROF(L)/((1.+R)**(L-1)))
    IF (L-M)85,86,87
87  IERR=33
    PRINT 103,IERR
    GO TO 100
85  L=L+1
    GO TO 112
86  PV=PV+(PROF(L)/(R*((1.+R)**(L-1))))
    PRINT 104,PV,KN
    PRINT 106,RO
    R=R*100.
    IF (PV)100,100,114
100 CALL EXIT
101 FORMAT (I4,2F10.0,3F7.0)
102 FORMAT (5F8.0)
103 FORMAT (1H ,7H ERROR ,I4/)
104 FORMAT (1H ,15H PRESENT VALUE ,F11.0,9H PAYBACK ,I4/)
105 FORMAT (2F6.2,F6.0,2F8.0)
106 FORMAT (1H ,19H DRAWINGS INCREASE ,F10.0/)
C  PROCEED TO PARAMETRIC EVALUATION PROGRAM
114 CALL LINK (MAIN5)
    END

```

```

C   PARAMETRIC EVALUATION PROGRAM
    DIMENSION F(150),GCI(12),DEX(12),XDEX(12),WOOL(12),SS(12)
    DIMENSION SP(12),TCS(12),CP(12),DEPN(12),SVC(12),PROF(100)
    DIMENSION A(130),B(130)
    COMMON F,GCI,DEX,XDEX,WOOL,SS,SP,TCS,CP,DEPN,SVC
    EQUIVALENCE (PREM,F(44)),(WP,F(13)),(F(40),OD)
    N=F(3)+2.
    R=F(42)/100.
C   READ PERCENTAGE CHANGE IN WOOL PRICE,WOOL PRODUCTION
    READ 107,P,Q
C   CALCULATE BASE YEAR EXPENDITURE
    TEXO=DEX(1)+XDEX(1)+PREM
    TEXO=TEXO+R*OD
    WP=WP/100.
C   INITIALS
    K=1
180  M=1
    JN=0
    L=1
    I=1
    MM=0
    COD=0.
    CASH=0.
    NK=0
    DO 10 J=1,100
10   PROF(J)=0.
    J=0
130  J=J+1
    IF (K-1)1,1,2
C   TRANSFER DATA FROM COMMON STORAGE AREA
    1  JN=JN+1
    A(J)=TCS(JN)
    A(J+1)=CP(JN)
    A(J+2)=SS(JN)
    A(J+3)=SP(JN)
    A(J+4)=GCI(JN)
    A(J+5)=SVC(JN)
    A(J+6)=WOOL(JN)
    A(J+7)=DEX(JN)
    A(J+8)=XDEX(JN)
    A(J+9)=DEPN(JN)
    KK=J+9
    DO 20 NN=J,KK
20   B(NN)=A(NN)
C   RECALCULATE GROSS INCOME FOR DIFFERENT WOOL PARAMETERS
    2  IF (K-3)21,21,22
21   Z=WP*(1.-P)
    GO TO 25
22   IF (K-6)23,23,24

```

```

23 Z=WP
GO TO 25
24 Z=WP*(1.+P)
25 GO TO (27,28,29,27,28,29,27,28,29),K
27 X=B(J+6)*(1.-Q)
GO TO 40
28 X=B(J+6)
GO TO 40
29 X=B(J+6)*(1.+Q)
40 B(J+4)=B(J+4)-WP*B(J+6)
IF (B(J+4))41,42,42
41 IERR=40
PRINT 103,IERR,I,K
GO TO 500
42 B(J+4)=B(J+4)+(X*Z)
IF (I-1)43,43,44
43 BGCIO=B(J+4)
44 ACS=0.
ADD=0.
BYINT=R*OD
ODINT=R*COD
TDEX=ODINT+B(J+7)+BYINT
TI=B(J+4)+B(J+5)-TDEX-B(J+9)
CALL TAXES (TOTAX,TI,PREM,F(15))
IF (I-1)71,71,72
71 TOT=TOTAX
72 IF (TOTAX)73,75,75
73 IERR=41
PRINT 103,IERR,I,K
GO TO 500
C CALCULATE PERSONAL DRAWINGS
75 TRO=B(J+4)-TDEX-TOTAX-B(J+8)-PREM
IF (I-1)76,77,80
76 IERR=42
PRINT 103,IERR,I,K
GO TO 500
77 IF (TRO)78,79,79
78 TRO=0.
79 BRO=TRO
GO TO 100
C CALCULATE OVERDRAFT OR CREDIT LEVEL
80 RO=TRO-BRO
IF (TRO-BRO)84,600,85
600 ACS=0.
ADD=0.
GO TO 100
84 ADD=BRO-TRO
ACS=0.
IF (COD)86,86,87

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```

87 COD=COD+ADD
GO TO 100
86 IF (CASH)87,87,88
88 IF (CASH-ADD)89,90,91
89 COD=ADD-CASH
90 CASH=0
GO TO 100
91 CASH=CASH-ADD
GO TO 100
85 ACS=TRD-BRD
ADD=0.
IF (CASH)93,93,94
94 CASH=CASH+ACS
GO TO 100
93 IF (COD)94,94,96
96 IF (COD-ACS)121,122,123
121 CASH=CASH+ACS-COD
122 COD=0.
NK=M-1
GO TO 100
123 COD=COD-ACS
C CALCULATE DEVELOPMENT CASH PROFITS
100 V=B(J+4)-BGCI0
TEX=TDEX+B(J+8)+PREM
C=TEX-TEX0
CT=C+TOTAX-TOT
PROF(L)=V-CT
I=I+1
IF (I-N)124,124,125
124 L=L+1
M=M+1
J=J+9
GO TO 130
125 I=N
IF (M-20)212,211,211
211 PRINT 108
GO TO 213
212 IF (COD)131,131,136
131 IF (ODINT)135,135,136
136 L=L+1
M=M+1
GO TO 44
C DISCOUNT PROFITS
C CALCULATE PRESENT VALUE
135 L=2
PV=0.
150 PV=PV+(PROF(L)/((1.+R)**(L-1)))
IF (L-M)141,142,143
141 L=L+1

```

```

GO TO 150
143 IERR=44
PRINT 103,IERR,I,K
GO TO 500
142 PV=PV+(PROF(L)/(R*((1.+R)**(L-1))))
PRINT 106,PV,NK
PRINT 104,RO
213 MM=N*10
DO 170 JJ=1,MM
B(JJ)=0.
170 B(JJ)=A(JJ)
K=K+1
IF (K-9)180,180,500
101 FORMAT (I4,2F10.0,3F7.0)
102 FORMAT (4F7.0,F8.0,5F7.0)
103 FORMAT (1H,7H ERROR,3I4/)
104 FORMAT (1H,4F8.0/)
105 FORMAT (1H,7F8.0,3I4/)
106 FORMAT (1H,F8.0,I4/)
107 FORMAT (2F5.2)
108 FORMAT (1H,22HPROGRAMME UNPROFITABLE/)
500 CALL EXIT
END

```

APPENDIX CKEY TO VARIABLES APPEARING IN EXECUTABLE STATEMENTS IN THE SHEEP PROGRAMS

In order to make the programs easier to understand a key to the variables appearing in the programs is given below. The variables are listed as they appear in executable statements. Variables, once listed, are not listed again if they appear subsequently in the same program or in subsequent programs.

Base Year Program

<u>Variable</u>	<u>Description</u>
F (1)	Farm identification number.
F (2)	Percentage rams to ewes.
F (4)	Total number of killers required.
F (5)	Percentage death rate - ewes.
F (6)	Percentage death rate - hoggets.
F (7)	Percentage death rate - lambs.
F (8)	Wool clipped per ram.
F (9)	Wool clipped per lamb.
F (10)	Shearing cost per 100 sheep shorn.
F (11)	Percentage of ewe lambs shorn.
F (12)	Percentage of wether lambs shorn.
F (13)	Wool price (cents per pound).
F (14)	Number of times ewes are shorn.
F (15)	Special taxation exemptions.
F (16)	Overhead costs.
F (17)	Rent and interest.
F (18)	Variable costs per lamb.
F (19)	Variable costs per hogget.

<u>Var-</u> <u>iable</u>	<u>Description</u>
F (20)	Variable costs per ewe.
F (21)	Selling price - wether lambs.
F (22)	Selling price - ewe lambs.
F (23)	Selling price - two-tooth ewes.
F (24)	Selling price - four-tooth, six-tooth and four year old ewes.
F (25)	Selling price - five year old ewes.
F (26)	Selling price - six year and older ewes.
F (27)	Purchase price - rams.
F (28)	Purchase price - two-tooth ewes.
F (29)	Purchase price - five year old ewes.
F (30)	Purchase price - six year old ewes.
F (31)	Selling price - yearling/18 month steers.
F (32)	Selling price - two years/two and a half years old steers.
F (33)	Selling price - three years/three and a half years old steers.
F (34)	Selling price - four years/four and a half years old steers.
F (35)	Purchase price - weaner steers.
F (36)	Purchase price - yearling/18 month steers.
F (37)	Purchase price - two years/two and a half years old steers.
F (38)	Purchase price - three years/three and a half years old steers.
F (39)	Percentage death rate - cattle.
F (40)	Initial bank overdraft level.
F (41)	Initial bank credit level.
F (42)	Interest rate - percent.
F (44)	Life insurance premiums.
F (45)	Mortgage - balance outstanding.
F (46)	Total annual charges.
F (47)	Interest rate - percent.
F (48)	Mortgage - balance outstanding.

<u>Var-</u> <u>iable</u>	<u>Description</u>
F (49)	Total annual charges.
F (50)	Interest rate - percent.
F (51)	Total number of ewes.
F (52)	Culling percentage - ewe lambs.
F (53)	Culling percentage - two-tooth ewes.
F (54)	Culling percentage - four-tooth ewes.
F (55)	Culling percentage - six-tooth ewes.
F (56)	Culling percentage - four year old ewes.
F (57)	Culling percentage - five year old ewes.
F (58)	Culling percentage - six year old ewes.
F (59)	Culling percentage - seven year old ewes.
F (60)	Lambing percentage.
F (61)	Wool clipped per two-tooth ewe.
F (62)	Wool clipped per ewe.
F (63)	Wool clipped per hogget.
F (64)	Wages.
F (65)	Manure and lime.
F (66)	Seeds.
F (67)	Weed and pest control.
F (68)	Vehicle expenses.
F (69)	Fuel and oil.
F (70)	Car expenses.
F (71)	Cartage.
F (72)	Woolpack price (cents).
F (73)	Fodder.
F (74)	Repairs and maintenance.
F (75)	Other income (assessable).

<u>Variable</u>	<u>Description</u>
F (76)	Total number of steers.
F (77)	Purchasing age - steers.
F (78)	Selling percentage - yearling/18 month steers.
F (79)	Selling percentage - two years/two and a half years old steers.
F (80)	Selling percentage - three years/three and a half years old steers.
F (81)	Selling percentage - four years/four and a half years old steers.
F (82)	Depreciation - cost price.
F (83)	Depreciation - 10 percent of diminished value.
F (84)	Depreciation - 15 percent of diminished value.
F (85)	Depreciation - 20 percent of diminished value.
F (86)	Depreciation - 50 percent of diminished value.
S2T	Surplus two-tooth ewes for sale.
T (1)	Number of two-tooth ewes required annually to maintain constant flock numbers.
T (2)	The number of four-tooth ewes.
T (3)	The number of six-tooth ewes.
T (4)	The number of four year old ewes.
T (5)	The number of five year old ewes.
T (6)	The number of six year old ewes.
T (7)	The number of seven year old ewes.
TEWE	Total number of ewes.
IERR	An error has occurred - the program will stop when this happens. "IERR" always indicates an error in the program. A list of possible errors and the action to be taken is given in Appendix D.
P2T	Purchases of two-tooth ewes.
TEL	Total ewe lambs.
TOTE	Total number of ewes.

<u>Var-</u> <u>iable</u>	<u>Description</u>
SEL	Number of ewe lambs to be sold.
TEH	Total number of ewe hoggets.
A2T	Number of two-tooth ewes available as flock replacements.
SWL	Number of wether lambs to sell.
TRAM	Total number of rams required.
PRAM	Number of rams purchased.
"S" ARRAY	The number of ewes to be sold in each age class from two-tooth ewes to seven year old ewes.
TEW	Total ewe wool clipped.
SHNOS	The number of sheep shorn.
CE	Variable ewe costs.
BL	The number of lambs born.
CL	Variable lamb costs.
PELS	The number of ewe lambs shorn.
PWLS	The number of wether lambs shorn.
TLW	The total lambs wool clipped.
THS	The number of hoggets to shear.
THW	The total hogget wool clipped.
CH	Variable hogget costs.
TRW	The total rams wool clipped.
SHGCOS	Shearing costs.
WOOL (1)	Total wool clipped in the base year.
WOOLI	Wool income.
TSP	Total cost of sheep purchases.
TSS	Total value of sheep sales.
T (1)	The number of rising yearling steers.
T (2)	The number of rising two year steers.

<u>Variable</u>	<u>Description</u>
T (3)	The number of rising three year steers.
T (4)	The number of rising four year steers.
TOTC	Total cattle numbers.
"S" ARRAY	The number of cattle to be sold in each age class.
TVCP	The total cost of cattle purchases.
TUCS	The total cost of cattle sales.
GCR	Gross cash income from sales.
DEX (1)	Tax deductible, cash expenditure, in the base year.
DEPN (1)	Depreciation in the base year.
ODINT	Overdraft interest.
OINT1 & OINT2	Interest on mortgages.
REPAY1 & REPAY2	Principal repayments on mortgages.
TI	Taxable income.
CALL TAXES	A subprogram used to calculate tax liability.
TOTAX	Total tax payments.
PREM	Life insurance premiums.
ACS	Cash surplus.
DEBT	Sum of mortgage liabilities.
TDEBT	Sum of mortgage liabilities and bank overdraft.
SVC (1)	The standard value livestock change between the beginning and end of the year which will be zero for the base year.

Financing Program

F (87)	Number of ewe hoggets at the beginning of development.
F (88)	Number of two-tooth ewes at the beginning of development.
F (89)	Number of four-tooth ewes at the beginning of development.
F (90)	Number of six-tooth ewes at the beginning of development.
F (91)	Number of four year old ewes at the beginning of development.

<u>Variable</u>	<u>Description</u>
F (92)	Number of five year old ewes at the beginning of development.
F (93)	Number of six year old ewes at the beginning of development.
F (94)	Number of seven year ewes at the beginning of development.
F (95)	Number of two-tooth rams at the beginning of development.
F (148)	Number of four-tooth rams at the beginning of development.
F (149)	Number of six-tooth rams at the beginning of development.
F (150)	Number of four year old rams at the beginning of development.
F (96)	Number of killers at the beginning of development.
F (97)	Number of rising one year steers at the beginning of development.
F (98)	Number of rising two year steers at the beginning of development.
F (99)	Number of rising three year steers at the beginning of development.
F (100)	Number of rising four year steers at the beginning of development.
F (101)	Standard value - ewe hoggets.
F (102)	Standard value - two-tooth ewes.
F (103)	Standard value - other ewes.
F (104)	Standard value - rams.
F (105)	Standard value - killers.
F (106)	Standard value - rising one year steers.
F (107)	Standard value - rising two year steers.
F (108)	Standard value - rising three year steers.
F (109)	Standard value - rising four year steers.
F (110)	Minimum culling percentage - ewe lambs.
F (111)	Minimum culling percentage - ewe hoggets.
F (112)	Minimum culling percentage - two-tooth ewes.
F (113)	Minimum culling percentage - four-tooth ewes.
F (114)	Minimum culling percentage - six-tooth ewes.
F (115)	Minimum culling percentage - four year old ewes.
F (116)	Minimum culling percentage - five year old ewes.

<u>Variable</u>	<u>Description</u>
F (117)	Minimum culling percentage - six year old ewes.
F (118)	Minimum culling percentage - seven year old ewes.
F (119)	Purchasing age - ewes.
N	The number of years of development.
PWP	The percentage change in wool price for the parametric financial analysis.
Q	The percentage change in wool production used for the parametric financial analysis.
BYIND	Total liabilities at the commencement of development.
COD	Bank overdraft level.
CASH	Bank credit level.
R	The rate of interest payable on the bank overdraft.
F (121)	Target ewe numbers for end of year "I" of development.
F (122)	Purchasing age steers.
F (123)	Selling percentage - yearling/18 month steers.
F (124)	Selling percentage - two years/two and a half years old steers.
F (125)	Selling percentage - three years/three and a half years old steers.
F (126)	Selling percentage - four years/four and a half years old steers.
F (127)	Target steer numbers - end of year.
F (128)	General development expenditure.
F (129)	Fertiliser and lime - development.
F (130)	Wages.
F (131)	Fertiliser and lime.
F (132)	Seeds.
F (133)	Contract cultivation.
F (134)	Vehicle expenses.
F (135)	Fuel and oil.
F (136)	Car expenses.
F (137)	Cartage.

<u>Var-</u> <u>iable</u>	<u>Description</u>
F (138)	Fodder.
F (139)	Repairs and maintenance.
F (140)	Weed and pest control.
F (141)	Other cash costs (deductible).
F (142)	Personal drawings.
F (143)	Other income (assessable).
F (144)	Wool clipped per two-tooth ewe.
F (145)	Wool clipped per ewe.
F (146)	Wool clipped per ewe hogget.
F (147)	Lambing percentage.
DEBT (L)	New Mortgage.
DEBT (L + 1)	Total annual charges on the new mortgage.
DEBT (L + 2)	Interest rate percent on the new mortgage.
CIF	Cash inflow from new mortgage.
AINT (J)	Interest payable on the new mortgage.
PRINC (J)	Principal payable on the new mortgage.
CALL DEPREC	A subprogram which calculates depreciation on existing plant, machinery and buildings and "puts" any new capital items into the correct group for estimating depreciation in future years.
CE	Capital expenditure.
XDEX	Non deductible (for taxation) cash expenditure.
DEPN	Depreciation.
	The next three variables appear in the subprogram "DEPREC".
X (1)	Capital expenditure.
X (2)	Depreciation system.
X (3)	Normal depreciation rate.

<u>Variable</u>	<u>Description</u>
TEWES	Total number of ewes.
TSVBVY	Total standard value of stock on hand at the beginning of the year.
TRAM	Total number of rams.
WL	Wether lambs.
EL	Ewe lambs.
CL	Variable lamb costs.
DWL	Number of deaths in the wether lambs.
WOOLWL	Wool production from the wether lambs.
"S" ARRAY	The value of sheep sales for each age class (S(1) = wether lambs, S(2) = ewe lambs, S(3) = two-tooth ewes, S(4) = four-tooth ewes etc.).
WOOLK	Wool production from the killers.
DEL	Number of deaths in the ewe lambs.
WOOLEL	Wool production from ewe lambs.
"C" ARRAY	The number of sheep sold in each age class. (C(1) = wether lambs, C(2) = ewe lambs, C(3) = two-tooth ewes, C(4) = four-tooth ewes etc.).
DEH	Deaths in the ewe hoggets.
WOOLEH	Wool production from the ewe hoggets.
CPE	Variable ewe costs.
WOOLE	Wool production from the ewes.
CALL SHEEPS	A subprogram which calculates the number of additional old ewes the farmer can sell because the projected ewe total exceeds the target number.
CCP	Cost of buying ewes to raise expected ewe numbers up to the target number.
P (1)	The number of two-tooth ewes purchased.
P (2)	The number of five year old ewes purchased.
P (3)	The number of six year old ewes purchased.

<u>Var- iable</u>	<u>Description</u>
CALL SHEEPB	A subprogram which calculates the number of additional ewes to be purchased to raise ewe numbers up to the target level.
WOOL2T	The wool production from shearing the two-tooth ewes just prior to tugging.
RAMS	The number of rams required for mating.
PRAM	The number of rams to purchase.
CPRAM	The cost of purchasing the required number of rams.
WOOLR	Wool production from the rams.
TSP	The total cost of sheep purchases.
TSS	The total value of sheep sales.
"CS" ARRAY	The number of cattle in each age class to be sold.
"VCS" ARRAY	The value of the cattle sales in each age group.
TVCS	The total value of cattle sales.
TVCP	The total cost of cattle purchases.
"PC" ARRAY	The number of cattle to be purchased in each age group.
CALL CATTLB	A subprogram which calculates the number of cattle to be bought to bring projected cattle numbers up to the target for cattle numbers.
CALL CATTLS	A subprogram which calculates the additional number of cattle to be sold to reduce projected cattle numbers to the target number.
TSVEY	The total standard value of the livestock on hand at the end of the year.
SVCI	The amount by which the standard value of livestock on hand at the end of the year exceeds the standard value of livestock on hand at the beginning of the year.

<u>Var-</u> <u>iable</u>	<u>Description</u>
SVCD	The amount by which the standard value of livestock on hand at the beginning of the year exceeds the standard value of livestock on hand at the end of the year.
TOT	Total cattle numbers on hand at the beginning of the year.
TOTC	Total cattle numbers on hand at the end of the year.
WOOL (I+1)	The total wool production in year "I+1" of development
XDEX (I+1)	The non tax deductible cash expenditure incurred in year "I+1" of development.
AOD	Cash deficit.
CALL FL	A subprogram which calculates the cash flow and the bank overdraft or credit level at the end of the year.
TMORT	The total liabilities.
GCI (I+1)	The gross cash income in year "I+1" of development.
SS (I+1)	The value of sheep sales in year "I+1" of development.
SP (I+1)	The cost of sheep purchases in year "I+1" of development.
TCS (I+1)	The value of cattle sales in year "I+1" of development.
CP (I+1)	The cost of cattle purchases in year "I+1" of development.
ADEBT	The amount by which total liabilities exceeds the liabilities at the beginning of development.
PWPRI	Parametric wool price.
PWOOL	Parametric wool production.
PNI	Parametric net income.

<u>Variable</u>	<u>Description</u>
CALL PFLOW	A subprogram which calculates the cash flow and bank overdraft or credit level when the wool price and wool production are varied from the expected values.

Post Development Program

B (1)	Total number of breeding ewes.
B (2)	Culling percentage - ewe lambs.
B (3)	Culling percentage - two-tooth ewes.
B (4)	Culling percentage - four-tooth ewes.
B (5)	Culling percentage - six-tooth ewes.
B (6)	Culling percentage - four year ewes.
B (7)	Culling percentage - five year ewes.
B (8)	Culling percentage - six year ewes.
B (9)	Culling percentage - seven year ewes.
B (10)	Lambing percentage.
B (11)	Wool per two-tooth ewe.
B (12)	Wool per ewe.
B (13)	Wool per ewe hogget.
B (14)	Wages.
B (15)	Manure and lime.
B (16)	Seeds.
B (17)	Cartage.
B (18)	Vehicle expenses.
B (19)	Fuel and oil.
B (20)	Car expenses.
B (21)	Fodder.
B (22)	Repairs and maintenance.

<u>Variable</u>	<u>Description</u>
B (23)	Weed and pest control.
B (30)	Other income (assessable).
B (24)	Total number of steers.
B (25)	Purchasing age - steers.
B (26)	Selling percentage - yearling/18 month.
B (27)	Selling percentage - two years/two and a half years old.
B (28)	Selling percentage - three years/three and a half years old.
B (29)	Selling percentage - four years/four and a half years old.

Evaluation Program

N	The number of years in the development plan.
TEXO	Total cash expenditure in the base year excluding taxation and personal drawings.
BYINT	Interest on the base year overdraft, which, it is assumed in the program is never repaid.
TDEX	Total tax deductible cash expenditure.
TRO	The sum available for personal drawings.
BRO	Base year personal drawings.
RO	Increase in personal drawings after payback.
V	Additional cash income (above the base year).
TEX	Total cash expenditure (excluding taxation).
C	Additional cash expenditure (above the base year level) excluding taxation.
CT	Additional cash expenditure (above the base year level) including taxation.
"PROF" ARRAY	Development cash profits in each year of the development plan.
PV	Present value of development cash profits.

<u>Variable</u>	<u>Description</u>
KN	The number of years until payback.
<u>Parametric Evaluation Program</u>	
P	Percentage change in wool price.
Q	Percentage change in wool production.
WP	Wool price.
"A" and "B" ARRAYS	These are both temporary storage arrays.
NK	The number of years to payback.

APPENDIX DLIST OF ERROR MESSAGES - SHEEP PROGRAM

The program includes a number of checks on the logic of the input data. The checks that have been included are not exhaustive of all the possible illogical input data that could appear on the input form. When the program detects an error, a message is printed of the form "Error number" or "Error" followed by a number. This appendix lists the numbers that may be printed and indicates the likely source of the error.

When an error does arise, the program will cease after printing the error message and the number. It will be necessary for the error to be located, usually data cards will need to be repunched and the program then run again. A few checks have been included which, if they fail, would indicate malfunctioning in the computer itself.

Error
Number

1. The total of the number of ewes in each age class from the static stock reconciliation does not coincide with the total of the number of ewes for which the reconciliation is being computed. Check variables numbered 49 to 57 in the input form.
2. The number of ewes in an age class is negative. Check variables numbered 49 to 57 in the input form.
3. The program has failed to reconcile the difference between the total of the ewes in each age class with the total for the breeding ewe flock. Check variables numbered four and 49 to 57 in the input form.
4. The death rate in the ewe hoggets exceeds 100 percent. Check

Error
Number

- variable number five in the input form.
5. The percentage of ewe lambs to be culled is greater than 100 percent. Check variable number 50 in the input form.
 6. There is an error of logic in the variables numbered 74 and 75 in the input form ("Total Number of Steers" and "Purchasing Age - Steers").
 7. The total of the number of steers in each age class from the static stock reconciliation does not coincide with the total number of steers for which the reconciliation is being computed. Check variables numbered 76 to 79 in the input form.
 8. The number of steers in an age class is negative. Check variables numbered 76 to 79 in the input form.
 9. The principal repayment on a mortgage is negative. Check variables numbered 43, 44 and 45 in the input form.
 10. The principal repayment on a mortgage is negative. Check variables numbered 46, 47 and 48 in the input form.
 11. An error of logic concerned with an item of capital expenditure. Check variables numbered 154 to 159 inclusive in the input form.
 12. The principal repayment on a new mortgage is negative. Check variables numbered 151 to 153 in the input form.
 13. The principal repayment on a mortgage is negative. Check variables numbered 43 to 48 in the input form. The program will print the year of development in which the error occurs.
 14. The correct number of variables for a year of physical development has not been punched. Check that values for all variables numbered 124 to 160 inclusive have been punched. The program will print the year in which the error occurs.

Error
Number

15. The projected total number of ewes and the target figure for ewes do not agree. Check variable numbered 124. The program will print the year of development when the error occurs.
16. The purchasing age for ewes is not numbered 1, 2 or 3. Check variable number 120 in the input form.
17. The purchasing age for cattle is not 1, 2, 3 or 4. Check variable number 125 in the input form.
18. The projected total number of steers and the target figure for steers do not coincide. Check variable number 130 in the input form.
20. The total of the number of ewes in each age class from the static stock reconciliation does not coincide with the total number of ewes for which the stock reconciliation is being computed. Check variables numbered 161 to 169 in the input form.
21. The number of ewes in an age class is negative. Check variables numbered 161 to 169 in the input form.
22. The program has failed to reconcile the difference between the total of the ewes in each age class with the total for the breeding ewe flock (variable number 161 in the input form). Check variables numbered 161 to 169 in the input form.
23. The death rates in the hoggets exceeds 100 percent. Check variable number five in the input form. (Note - this error should not occur as it should be detected when the base year stock reconciliation is computed).
24. The culling rate in the ewe lambs is greater than 100 percent. Check variable number 162 in the input form.
25. An error of logic in the cattle policy. Check variables numbered

Error
Number

- 185 and 186 in the input form. ("Total number of Steers" and "Purchasing Age of Steers" respectively).
26. The total of the numbers of steers in each age class from the static stock reconciliation does not coincide with the total of the number of steers for which the stock reconciliation is being computed. Check variables numbered 185 to 190 in the input form.
27. The number of steers in an age class is negative. Check variables numbered 186 to 190 in the input form.
31. The tax payments are negative. This error should not occur. If it does occur then there is an error in the taxation subprogram or something has gone wrong with the computer. An error in the taxation subprogram may arise as this will need to be changed whenever taxation rates change.
32. An index "I" is negative. This error should not arise. If it does, something has gone wrong with the computer.
33. An error, similar in principle to error 32 which should only arise if something has gone wrong with the computer.
40. Wool income is greater than the gross cash income. Check that variables numbered 191 and 192 in the input form are both entered as decimals.
41. The tax payments are negative. This error should not arise as it should be found earlier in the program. Either something has gone wrong with the computer or there is an error in the taxation subprogram.
42. and 43. These two errors should only arise if something has gone wrong with the computer.

APPENDIX FDAIRY FARM DEVELOPMENT PROGRAM GUIDE AND DEFINITION OF VARIABLESIntroduction

This appendix is similar in principle to Appendix A and is in two parts:

- (1) The program guide, which outlines general principles in completing the input form.
- (2) A list and the definition, of every variable appearing in the input form.

Program Guide

The purpose of this program guide is to explain the procedure to be followed in completing the input form for the dairy farm development program. It is assumed that readers are already familiar with Chapter 6 of the thesis which describes a computer program designed to analyse and evaluate a dairy farm development proposal. Hence this program guide will not cover in detail those features of the program already described.

The input variables can be broadly classified into four groups as follows:

- (1) Variables which are constant in all years of the development plan (variables numbered one to 21 and variables numbered 46 and 47).
- (2) Variables which refer to the base year (variables numbered 32 to 57).
- (3) Variables which refer to years of development (variables numbered 22 to 31, 33 to 43, and 58 to 108).
- (4) Variables which refer to the post development year (variables

numbered 110 to 135).

For those variables where the adviser is asked to state a price, for example, "Purchase Price - Cows", the price is to be in dollars unless otherwise stated.

If any variable is left blank, the program will treat that variable as zero. For example, if the farmer pays no life insurance premiums that are deductible for taxation, then variable number 25 can be left blank and the program will treat this item as zero.

DAIRY FARM DEVELOPMENT PROGRAM - INPUT FORMDEFINITION OF VARIABLES

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1. Farm Identification Number: Any single digit number which will be printed on the output form and thus provide a reference for checking on the identity of the input data.
2. Purchase Price - Heifer Calves: The landed cost of buying heifer calves at one week of age.
3. Purchase Price - Weaner Heifers: The landed cost of purchasing weaner heifers at eight to nine months of age.
4. Purchase Price - Yearling Heifers: The landed cost of purchasing yearling heifers at 12 to 14 months of age.
5. Purchase Price - 2 Year Heifers: The landed cost of buying two year old heifers at about 22 months of age.
6. Purchase Price - Cows: The landed cost of buying cows just prior to calving (June).
7. Sale Price - Bobby Calves: The expected selling price for bobby calves. It is assumed in the program that all bull calves together with all heifer calves surplus to herd requirements, are sold as bobbies.
8. Sale Price - Boner Cows: The expected net selling price for cows and two year heifers culled from the herd, and for any yearling heifers culled.
9. Expected Butterfat Price (cents/lb): The expected price for butterfat in cents per pound.
10. Special Taxation Exemptions: The sum of the value of the personal, wife and child exemption, e.g., a married man with two children, the total value of the exemption is \$785. i.e.:

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	\$
Personal	275
Wife	240
Two children	270
	<u>\$785</u>

11. Overhead Costs: These are costs which it is assumed are constant in all years of the development plan. This item would be expected to include the following individual expenditure items - rates, insurance premiums (but not life insurance premiums), accountancy fees, bank charges such as cheque books (but not interest on the bank overdraft, if any, which the program will calculate), newspaper subscriptions, telephone rental and rural mail delivery charges.
12. Rent and Interest: This item is also assumed to be constant in all years of the development plan. Interest payments which are constant from year to year and which should be included here are interest payments on flat mortgages (if any).
13. Electricity/Cow: The cost of electricity per cow. The program multiplies this number by the total number of cows and two year old heifers on hand at the commencement of the year, for each year of the development plan.
14. Shed Expenses/Cow: Total shed expenses per cow. The program as with item 13 above multiplies this number by the total number of cows and two year old heifers on hand at the commencement of the year, for each year of the development plan.
15. Animal Health/Cow: Total animal health expenses per cow. This variable is treated in the same way as 13 and 14 above.
16. A.I. Cost per Cow: The cost of artificial insemination (A.I.) per cow to those cows mated artificially. This variable is treated in

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the same way as 13 and 14 above.

17. % of Herd Mated by A.I.: The proportion of the herd mated by artificial insemination. The program multiplies variable number 16 by variable number 17 by the number of cows and two year old heifers on hand at the beginning of the year, for each year of the development plan.
18. Calving Percentage: The number of calves born alive per 100 cows and two year old heifers on hand at the commencement of the year.
19. % Deaths - Calf to Yearling: The percentage of the heifer calves retained that die before becoming yearlings (i.e. that die before the end of the year).
20. % Deaths - Yearling to 2-Year Heifers: The percentage of yearling heifers, on hand at the beginning of the year, that die before becoming two year old heifers.
21. % Deaths - 2 Year Heifers and Cows: The proportion of the herd on hand at the beginning of the year that die before the end of the year. This figure must be positive.
22. Initial Bank Overdraft Level: Indicate the level of the bank overdraft (if any) at the commencement of development. The program will calculate the interest payable on the overdraft.
23. Initial Bank Credit Level: If the bank account is not overdrawn, then it will usually be in credit. Indicate here the credit in the bank account at the commencement of development. Variable number 22 must be zero and variable number 23 positive or vice versa. (Both may be zero.)
24. Interest Rate - (%): The interest rate charged on any bank over-

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- draft. The normal interest rate, charged by the bank, must be entered here.
25. Life Insurance Premiums: Indicate the amount to be spent on life insurance premiums which it is assumed in the program are a special exemption for calculating taxation liability. Expenditure on life insurance premiums over and above the maximum tax deductible limit must be included under personal drawings (see variable number 108).
26. Mortgage - Balance Outstanding: Indicate the mortgage balance outstanding on any one mortgage at the commencement of development.
27. Total Annual Charges: The total principal and interest charge payable annually on the above mortgage.
28. Interest Rate - (%): The rate of interest charged on the above mortgage. Variables numbered 27 and 28 permit the program to calculate interest and principal payments for each year of the development plan on the above mortgage.
- 29, 30. These items permit the adviser to complete the details for a second and 31. mortgage (if any). The program can then calculate the interest and principal payments for each year of the development plan on this second mortgage.
32. Total Herd Size: The total number of cows and two year old heifers carried in the base year. The program will calculate either, the number of heifer calves to be retained annually to maintain the herd numbers at this level (variable number 32), or the number of yearling or two year old heifers which must be purchased annually to maintain this herd size. (See variable number 33.)
33. Stock Increase Option: The program permits the adviser to build up herd numbers in any one of nine different ways. These are as follows:

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- (1) Retention of heifer calves.
- (2) Retention of heifer calves plus the purchase of heifer calves.
- (3) Retention of heifer calves plus the purchase of weaner heifers.
- (4) Retention of heifer calves plus the purchase of yearling heifers.
- (5) Retention of heifer calves plus the purchase of two year old heifers.
- (6) Retention of heifer calves plus the purchase of cows.
- (7) Sale of all heifer calves and the purchase of yearling heifers.
- (8) Sale of all heifer calves and the purchase of two year old heifers.
- (9) Sale of all heifer calves and the purchase of cows.

The adviser must indicate which of these policies is to be followed in building up herd numbers by indicating opposite variable number 33 the number corresponding to the preferred policy. For example, if herd numbers are to be increased by retaining heifers with no purchases of stock permitted, then "1" is to be entered opposite variable number 33. The program not only uses the policy nominated here in building up herd numbers, but also uses this same policy in calculating the static stock reconciliation for the base year. (Variable number 32.)

34. to Culling Policy: Variables numbered 35 to 43 refer to the proportion
43. of each age class on hand at the beginning of the year which must be culled at the end of that year. For example, variable number 35 refers to the proportion of yearlings on hand at the beginning of the year which must be culled at the end of that year (because of failure to concieve, etc.). The culling rate must be 100 percent in the year stock are finally sold. Thus, for example, if cows are kept for no longer than six lactations, then 100 must be entered opposite "Culling % - 6th Calvers".

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- Variable number 34 refers to the percentage of heifer calves that must be culled (e.g., born late in the season, unsuitable in some way etc.). These calves are assumed to be sold as bobby calves.
44. Expected B'fat/Heifer: The expected butterfat production per heifer in the base year. The program multiplies this figure by the number of two year old heifers carried in the base year as determined by the static stock reconciliation.
45. Expected B'fat/Cow: The expected butterfat production per cow in the base year. The program multiplies this figure by the number of cows carried in the base year as determined by the static stock reconciliation.
46. Expenses/Calf: The variable costs incurred in rearing a heifer calf to the yearling age. This might include expenditure on hay, drenches, vaccination and milk powders. The program multiplies this cost by the number of heifer calves retained, in all years of the development plan.
47. Expenses/Yearling: The variable costs incurred in rearing a yearling heifer to the two year old heifer stage. The program multiplies this cost by the number of yearling heifers on hand at the beginning of the year, in all years of the development plan.
48. to 56. Costs: The items 48 to 56 cover the main items of expenditure for the base year budget other than those calculated directly by the program such as electricity costs, etc. Items 48 to 56 are simply summed and added to the other expenditure items.
48. Seeds, Manure and Lime: The cost of seeds, manure and lime in the base year. The fertiliser costs (manure and lime) should include transport to the farm (less subsidy) and application costs. Any

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rebates or discounts should also be excluded.

49. Wages: The cash costs of labour required to maintain base year carrying capacity. This could include wages paid to permanent labour, casual labour or labour required annually for contract work.
50. Vehicle Expenses: The cost of repairs and maintenance to farm vehicles other than the car.
51. Cartage: The cost of cartage on any sundry inward items.
52. Fuel and Oil: Include all fuel and oil expenditure other than that expenditure associated with the car.
53. Car Expenses: Include all the tax deductible car expenses of repairs and maintenance, fuel etc. The non deductible proportion of car expenses must be paid out of personal drawings. For the base year, this is determined by the program.
54. Fodder: The cost of any bought in foodstuffs (meals etc.,) together with the cost of making any hay and/or silage.
55. Repairs and Maintenance: The cost of repairs and maintenance to farm buildings and plant. Only the tax deductible portion of any house repairs should be included here. The balance (i.e. the non-deductible portion) must be paid out of personal drawings.
56. Other Cash Costs (Deductible): Include any other cash costs not previously included under variables numbered 48 to 55 or calculated directly by the program.
57. Other Income (Assessable): This variable allows the adviser to include any income other than that from sales of dairy stock, butterfat etc., in the base year. This item would include income from the sale of hay, rent or cash crop income. It is assumed in the program that

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this is cash income and is assessable for taxation.

58. Depreciation - Cost Price: The depreciation allowance, in general, for plant and machinery, is assessed for taxation purposes as a percentage of diminished value but is assessed as a percentage of cost price for buildings. The depreciation deduction on items for which the allowance is a percentage of the cost price, will be constant over the term of the development plan. Therefore, for this item calculate the total depreciation on those items for which the depreciation allowance is a percentage of cost price. Enter this figure here.
59. Depreciation - 10% Diminished Value: Enter the total book value,¹ at the commencement of development, of those items of plant and machinery for which the depreciation allowance is 10 percent of diminished value. The program calculates the annual depreciation deduction.
60. Depreciation - 15% D.V.: Enter the total book value, at the commencement of development, of those items of plant and machinery for which the depreciation allowance is 15 percent of diminished value (D.V.). The program will calculate the annual depreciation deduction.
- 61.and These two items are, in principle, exactly the same as the above
62. except that they refer to the book value of items for which the depreciation allowance is 20 percent and 50 percent of diminished value respectively.
63. to Initial Stock Numbers: Enter the numbers in each age class on hand
71.

1. Book value refers to the value of these items in the balance sheet.

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at the commencement of development.

72. to Standard Values: Enter the standard value used by the farmer
74. for yearling heifers, two year old heifers and cows respectively.
75. Code - Office Use Only: An item to be completed by the computer centre staff. (It refers to the total number of years of development).
76. to Target Herd Size: Enter the target herd size (two year old heifers
81. and cows) required to be on hand at the end of each year of development.
82. % Change in B'fat Production: The program will calculate not only the expected butterfat production but also the butterfat production at values that differ from those expected. If, for example, the adviser wants to know the butterfat output at a 10 percent deviation from the expected output, 0.10 should be entered here. This figure must be entered as a decimal.
83. % Change in B'fat Price: The program will also calculate, for each year of development, the cash flow at a butterfat price that differs from the expected value. Enter here the percentage change in the butterfat price for which the cash flow is to be calculated. Enter this figure as a decimal also.
- Variables 84 to 108 must be completed for each year of development.
84. Expected B'fat/Heifer: The expected butterfat production per heifer. The program multiplies this figure by the number of two year heifers on hand at the beginning of each year of development.
85. Expected B'fat/Cow: The expected butterfat production per cow. Similar to the previous item.
86. to Costs: Items 86 to 97 cover items of expenditure. These will not
97. all be defined in detail here as they have been defined previously.

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It is assumed in the program that the costs included under 86 to 97 are all cash costs. Items 86 to 97 are simply summed for each year of development and, together with expenditure on stock purchases etc. used in the calculation of assessable income, cash flow, overdraft level, etc. The expenditure included in 86 - 97 is all assumed to be deductible for taxation. That proportion of car expenses and repairs to house which is not deductible for tax assessment must be included under personal drawings. (See variable number 108).

97. Other Cash Costs (Deductible): This item permits the adviser to include any other cash deductible expenditure not already included above (86 - 96 and 11 - 12) or calculated by the program (stock purchases, electricity, etc.).
98. Other Income (Assessable): Include any assessable income other than that from dairy sales or produce (e.g., grain crops, etc.). It is assumed in the program that this is cash income and is assessable for taxation.
99. New Mortgage: The farmer may, after seeing the financial implications of development wish to finance it by raising a mortgage at some point during the development. The inclusion of this item permits this, and the two following items enable the program to calculate associated interest and principal charges for each year.
100. Total Annual Charges: The amount that must be paid annually by way of interest and principal on the above mortgage.
101. Interest Rate - (%): The interest rate on the new mortgage.
102. Capital Expenditure: Capital expenditure in this context is defined as expenditure which is not tax deductible in the year in which the expenditure is incurred. "Capital" items are those on which deprec-

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iation is claimed annually - buildings, plant and machinery.

The program permits up to two items of capital expenditure to be purchased in each year of development. Include under variable 102 the cost of any one item of capital expenditure.

103. Depreciation System: Any item of capital expenditure will be depreciated (for taxation) on either a diminishing value basis or on a percentage of cost price basis. If the item in question (variable 102) is a new building and the depreciation allowance is thus a percentage of the cost price, enter "1" opposite 103. If, however, the capital expenditure is on some plant and machinery item, then the depreciation allowance is a percentage of the diminishing value and "2" must be entered opposite 103.
104. Normal Depreciation Rate - (%): Enter the normal depreciation allowance for the particular item (variable 102). The program will then calculate the depreciation deduction for each year of development.
- 105.to 107. These variables are defined in the same way as 102 to 104. They enable the adviser to include a further item of capital expenditure.
108. Personal Drawings: Include the amount required for personal expenditure, together with the non-deductible components of car expenses and repairs to house.

The variables numbered 110 to 135 refer to the post development situation. They are required in order to evaluate the profitability of the development plan. Nearly all of the items have been defined before and will not be re-defined here.

Variables numbered 110 to 121 enable the program to calculate a static stock reconciliation showing, either the number of heifer calves to be

Var-
iable
No.

retained annually to maintain herd numbers constant or the number of yearling or two year old heifers that must be purchased annually to maintain herd numbers constant (as per variable 110).

110. Total Herd Size: The number of cows and two year old heifers carried in the post development situation.
- Variables numbered 111 to 121 are as defined previously.
- 122.& 123. These items refer to the expected butterfat per heifer and per cow in the post development situation.
- 124.to 134. These items refer to the costs in the post development situation.
135. Other Income (Assessable): Include any cash income, assessable for tax, other than that from dairy sales, etc.
136. % Change in B'fat Price: The program calculates the profitability of development over a range of values for both butterfat price and butterfat production. Enter here the percentage change from the expected butterfat price (variable number 9) for which the profitability of development is to be calculated. Enter this figure as a decimal.
137. % Change in B'fat Production: Enter the percentage change in butterfat production (from that expected) for which the profitability of development is to be calculated. Enter this figure as a decimal.

APPENDIX GSOURCE PROGRAM LISTINGS - DAIRY PROGRAMS

This appendix includes the source program listings for each of the seven programs and the two subprograms. The source program listings should be read in conjunction with Appendix H which defines the variables appearing in executable statements in the programs. The programs and subprograms in this appendix appear in the following sequence:

- (1) Base year program.
- (2) Financing program for stock policy numbers one, two and three.
- (3) Financing program for stock policy numbers four, five and six.
- (4) Financing program for stock policy numbers seven, eight and nine.
- (5) Subprogram CARET.
- (6) Subprogram CFLOW.
- (7) Post development program.
- (8) Evaluation program.
- (9) Parametric evaluation program.

```

C   DAIRY BASE YEAR PROGRAM
    DIMENSION F(96),GCI(8),SVC(8),BF(8),XDEX(8),DEX(8),DEPN(8)
    DIMENSION V(7),T(8),S(8)
    COMMON F,GCI,SVC,BF,XDEX,DEX,DEPN
    EQUIVALENCE (TOTE,F(32)),(F(25),PREM)
    Y=0.
    DO 306 J=1,8
      GCI(J)=0.
      DEX(J)=0.
      XDEX(J)=0.
      SVC(J)=0.
      BF(J)=0.
C 306  DEPN(J)=0.
C   READ CONSTANTS
C   READ BASE YEAR DATA
    READ 101,(F(J),J=1,62)
    IF (F(21))1,1,2
    1  F(21)=1.
    2  F(21)=(100.-F(21))/100.
C   CALCULATE STATIC STOCK RECONCILIATION
    DO 3 I=1,7
    3  V(I)=0.
      B=1.
      Z=1.
      DO 4 I=1,7
        X=Z*F(21)
        Y=X*F(I+35)/100.
        Z=X-Y
        V(I)=Z
    4  B=B+Z
      DO 5 I=1,8
    5  T(I)=0.
        T(1)=TOTE/B
        DO 99 I=2,8
    99 T(I)=T(1)*V(I-1)
        TEWE=0.
        DO 6 I=1,8
    6  TEWE=TEWE+T(I)
C   CHECK STOCK RECONCILIATION
    IF (TEWE-TOTE)37,45,39
    37 TEST=TEWE+5.
      IF (TEST-TOTE)40,41,41
    39 TEST=TEWE-5.
      IF (TEST-TOTE)41,41,40
    40 IERR=1
      PRINT 105,IERR
      GO TO 100
    41 DIFF=TEWE-TOTE
      DO 42 I=1,8

```

```

      K=9-I
      IF (T(K))42,42,44
44  T(K)=T(K)-DIFF
      GO TO 45
42  CONTINUE
      IERR=2
      PRINT 103,IERR
      CALL EXIT
C     SET NK EQUAL TO STOCK REPLACEMENT POLICY
C     CHECK LOGIC IN STOCK POLICY
45  IF (F(34)-100.)7,8,9
      IERR=3
      PRINT 103,IERR
      CALL EXIT
      8  NK=F(33)
      IF (F(33)-7.)9,186,186
186  IF (F(33)-9.)168,168,9
      7  IF (F(33)-6.)11,11,9
      11 NK=F(33)
C     CALCULATE NUMBER OF HEIFER CALVES NEEDED TO MAINTAIN HERD SIZE
166  ML=1
      JJ=100
      JK=1000
      36 DO 20 J=JJ,JK,JJ
          X=JK-J
          Z=X
          X=X-(X*F(34)/100.)
          X=X-(X*F(19)/100.)
          X=X-(X*F(20)/100.)
          X=X-(X*F(35)/100.)
          IF (X-T(1))161,168,20
      20 CONTINUE
161  IF (ML-2)169,163,168
169  ML=ML+1
      JK=Z+100.
      JJ=10
      GO TO 36
163  ML=ML+1
      JK=Z+10.
      JJ=1
      GO TO 36
168  CB=TOTE*F(18)/200.
      GO TO (21,22,23,23,24,24,25,26,26),NK
C     REPLACEMENT POLICY RETAIN HFR CALVES
      21 IF (CB-Z)31,32,33
      31 IF (F(34))34,34,35
      35 F(34)=0.
      GO TO 166
      34 IF(F(35))301,301,38

```

```

38 F(35)=0.
   GO TO 166
301 IERR=4
   PRINT 105,IERR
   CALL EXIT
32 CS=Z*F(34)/100.
   Z=Z-CS
   CC=F(46)*Z
51 DC=Z*F(19)/100.
   PHC=0.
   PYH=0.
   P2YR=0.
   Z=Z-DC
   YH=Z
   CY=Z*F(47)
   DY=Z*F(20)/100.
   Z=Z-DY
   THC=Z*F(35)/100.
   GO TO 82
33 P=CB-Z
   CS=Z*F(34)/100.
   Z=Z-CS
   CC=F(46)*Z
   CS=CS+P
   GO TO 51 610
C 22 REPLACEMENT POLICY RETAIN HFR CALVES-BUY HFR CALVES
C 22 PYH=0.
   P2YR=0
   IF (CB-Z)61,32,33
C 61 INSUFFICIENT HFR CALVES
C 61 CALC NO OF HFR CALVES TO BUY
61 CS=CB*F(34)/100.
   CB=CB-CS
   Z=Z-(Z*F(34)/100.)
   PHC=Z-CB
   Z=CB+PHC
   CC=F(46)*Z
   PYH=0.
   P2YR=0.
   Z=Z-(Z*F(19)/100.)
   YH=Z
   CY=YH*F(47)
   Z=Z-(Z*F(20)/100.)
   THC=Z*F(35)/100.
   GO TO 82
C 23 RETAIN HFR CALVES-BUY WNR YRLG HFRS
C 23 IF (CB-Z)62,32,33
C 23 INSUFFICIENT HFR CALVES
C 23 CALC NO OF WNR YLGS TO BUY

```

```

62 CS=CB*F(34)/100.
   CB=CB-CS
   DC=CB*F(19)/100.
   CB=CB-DC
   PHC=0.
   P2YR=0.
   ML=1
   JJ=100
   JK=1000
175 DO 70 J=JJ,JK,JK
   X=JK-J
   P=X
   DY=X*F(20)/100.
   X=X-DY
   THC=X*F(35)/100.
   X=X-THC
   IF (X-T(1))171,174,70
70 CONTINUE
171 IF (ML-2)172,173,174
172 ML=ML+1
   JJ=10
   JK=P+100.
   GO TO 175
173 ML=ML+1
   JJ=1
   JK=P+10.
   GO TO 175
174 PYH=P-CB
   YH=P
   CY=YH*F(47)
   GO TO 82
C   RETAIN HFR CALVES-BUY 2YR HFRS
C 24 IF (CB-Z)66,32,33
C   INSUFFICIENT HFR CALVES
C   CALC NO OF 2YR HFRS TO BUY
66 CS=CB*F(34)/100.
   CB=CB-CS
   CC=CB*F(46)
   CB=CB-(CB*F(19)/100.)
   YH=CB
   CY=YH*F(47)
   CB=CB-(CB*F(20)/100.)
   THC=CB*F(35)/100.
   CB=CB-THC
   P2YR=T(1)-CB
   PHC=0.
   PYH=0.
   GO TO 82
C   SELL HFR CALVES BUY YRLGS

```

```

C   CALC NO OF YRLGS TO BUY
25  CS=CB
    PHC=0.
    CC=0.
    P2YR=0.
    ML=1
    JJ=100
    JK=1000
185 DO 80 J=JJ,JK,JJ
    X=JK-JJ
    Z=X
    X=X-(X*F(20)/100.)
    THC=X*F(35)/100.
    X=X-THC
    IF (X-T(1))181,81,80
80  CONTINUE
181 IF (ML-2)183,184,81
183 ML=ML+1
    JK=Z+100.
    JJ=10
    GO TO 185
184 ML=ML+1
    JK=Z+10.
    JJ=1.
    GO TO 185
81  PYH=Z
    YH=Z
    CY=YH*F(47)
    GO TO 82
C   SELL HFR CALVES BUY 2YR HFRS
26  CS=CB
    PYH=0.
    CC=0.
    CY=0.
    PHC=0.
    THC=0
    YH=0.
    P2YR=T(1)
C   CALCULATE SALES PURCHASES
82  CS=CS+TOTE*F(18)/200.
    DO 90 I=1,8
90  S(I)=0.
    DO 110 I=1,8
110 S(I)=T(I)*F(21)*F(I+35)/100.
    TCS=0.
    DO 120 I=1,8
120 TCS=TCS+S(I)
    VTCS=TCS*F(8)+THC*F(8)
    VCS=CS*F(7)

```

```

CPHC=PHC*F(2)
IF (NK-3)83,83,84
83 CPYH=PYH*F(3)
GO TO 85
84 CPYH=PYH*F(4)
85 CP2YR=P2YR*F(5)
BF(1)=T(1)*F(44)+((TOTE-T(1))*F(45))
BFI=BF(1)*F(9)/100.
GCR=VTCS+VCS+BFI+F(57)
C CALCULATE EXPENDITURE
DEPN(1)=F(58)+0.1*F(59)+0.15*F(60)+0.2*F(61)+0.5*F(62)
PCX=0.
DO 303 J=13,15
303 PCX=PCX+F(J)
PC=PCX*TOTE+F(17)/100.*TOTE*F(16)
DEX(1)=0.
DO 140 J=48,56
140 DEX(1)=DEX(1)+F(J)
ODINT=F(22)*F(24)/100.
OINT=F(28)/100.*F(26)
IF (F(27)-OINT)141,142,142
141 IERR=5
PRINT 105,IERR
GO TO 100
142 PRI1=F(27)-OINT
AINT=F(29)*F(31)/100.
IF (F(30)-AINT)141,144,144
144 PRI2=F(30)-AINT
SINT=AINT+OINT
DEX(1)=DEX(1)+F(11)+F(12)+PC+SINT
DEX(1)=DEX(1)+CPHC+CPYH+CP2YR+CC+CY
SPRI=PRI1+PRI2
TI=GCR-DEPN(1)-ODINT-DEX(1)
CALL TAXES (TOTAX,TI,F(25),F(10))
ACS=GCR-DEX(1)-ODINT-SPRI-TOTAX-F(25)
DEBT=F(26)+F(29)
TDEBT=DEBT+F(22)
PRINT 9876,F(1)
COWS=TOTE-T(1)
PRINT 106,Y,YH,T(1),COWS,TOTE
PRINT 106,PHC,PYH,P2YR
PRINT 106,CS,THC,Y,TCS
PRINT 106,Y,YH,T(1),COWS,TOTE
PRINT 106,BF(1),BFI,VTCS,VCS,F(57),GCR
PRINT 106,CPHC,Y,CPYH,CP2YR,Y,Y,Y
PRINT 106,DEX(1),Y,ODINT,SPRI,Y,ACS
PRINT 106,PREM,DEPN(1),TI,TOTAX
PRINT 106,ACS,Y,F(23),F(22),DEBT,TDEBT,Y
GCI(1)=GCR

```

```
SVC(1)=0.  
XDEX(1)=SPRI  
F(21)=(1.-F(21))*100.  
C PROCEED TO FINANCING PROGRAM  
GO TO (311,311,311,313,313,313,312,312,312),NK  
311 CALL LINK (D13FIN)  
313 CALL LINK (D46FIN)  
312 CALL LINK (D79FIN)  
101 FORMAT (7F9.1)  
103 FORMAT (1H ,5H IERR,I4/)  
105 FORMAT (1H ,6H ERROR,I4/)  
106 FORMAT (1H ,12F10.0/)  
9876 FORMAT (1H1,F8.0,I4/)  
100 CALL EXIT  
END
```

```

C   DAIRY FINANCING PROGRAM
    DIMENSION F(96),GCI(8),SVC(8),BF(8),XDEX(8),DEX(8),DEPN(8)
    DIMENSION DEBT(18),A(9),AINT(18),PRINC(18),CE(3)
    COMMON F,GCI,SVC,BF,XDEX,DEX,DEPN
    EQUIVALENCE (PREM,F(25)),(R,F(24))
C   STOCK INCREASE POLICY 1,2 OR 3
C   INITIALS
    COD=F(22)
    CASH=F(23)
    K=1
    I=1
    M=3
    Y=0
    DO 20 J=1,18
20  DEBT(J)=0.
C   READ INITIAL STOCK NUMBERS
C   READ TARGET HERD SIZES
    READ 101,(F(L),L=63,81)
C   READ PERCENT FALL IN BFAT PRODUCTION PRICE
    READ 109,PBFO,PBFP
C   NUMBER OF YEARS IN THE DEVELOPMENT PLAN
    N=F(75)
    IF (COD)1,1,2
    2 IF (CASH)1,1,3
    3 IF (COD-CASH)4,5,6
    4 CASH=CASH-COD
    COD=0.
    GO TO 1
    5 COD=0.
    CASH=0.
    GO TO 1
    6 COD=COD-CASH
    CASH=0.
C   TOTAL INITIAL DEBT
    1 BYIND=F(26)+F(29)+COD
C   CALCULATE OVERDRAFT INTEREST
404 ODINT=R/100.*COD
    DO 10 MN=1,18
    AINT(MN)=0.
    10 PRINC(MN)=0.
    YCASH=CASH
    YCOD=COD
    IF (1-N)7,7,100
C   READ DATA FOR DEVELOPMENT YEAR I
    7 READ 101,(F(L),L=82,96)
C   INTEREST PRINCIPAL CHARGES ON NEW DEBTS
    L=K
    READ 102,DEBT(L),DEBT(L+1),DEBT(L+2)
    CIF=DEBT(K)

```

```

DO 701 J=1,M,3
IF(DEBT(J))8,701,1002
1002 AINT(J)=DEBT(J+2)/100.*DEBT(J)
PRINC(J)=DEBT(J+1)-AINT(J)
IF(PRINC(J))8,1003,1003
1003 DEBT(J)=DEBT(J)-PRINC(J)
701 CONTINUE
GO TO 11
8 IERR=10
PRINT 103,IERR,I
CALL EXIT
11 SPRINM=0
SINTNM=0
DO 30 J=1,18
SPRINM=SPRINM+PRINC(J)
30 SINTNM=SINTNM+AINT(J)
K=K+3
M=K+2
C READ NEW CAPITAL EXPENDITURE
C CALCULATE DEPRECIATION
XDEX(I+1)=0
J=I+1
CALL DEPREC (CE,XDEX,DEPN,F(58),F(59),F(60),F(61),F(62),J)
OINT1=F(26)*F(28)/100.
REPAY1=F(27)-OINT1
IF(F(26))29,29,31
31 IF(REPAY1)1231,1232,1232
1231 IERR=14
PRINT 103,IERR,I
CALL EXIT
1232 F(26)=F(26)-REPAY1
GO TO 1233
29 REPAY1=0
1233 OINT2=F(29)*F(31)/100.
REPAY2=F(30)-OINT2
IF(F(29))1234,1234,1235
1234 REPAY2=0
GO TO 32
1235 IF(REPAY2)1231,32,32
32 F(29)=F(29)-REPAY2
OINT=OINT1+OINT2
REPAY=REPAY1+REPAY2
C READ PERSONAL DRAWINGS
C CHECK FOR CORRECT INPUT DATA
READ 101,DWGS,CODE
IF (CODE-99.)33,34,33
33 IERR=12
PRINT 103,IERR,I
CALL EXIT

```

```

34 NK=F(33)
C CALCULATE BFAT
  BF(I+1)=F(64)*F(82)
  TOTH=0
  DO 50 J=65,71
50 TOTH=TOTH+F(J)
  BF(I+1)=BF(I+1)+TOTH*F(83)
C CALCULATE STANDARD VALUE BEGINNING OF YEAR
  SVBY=F(63)*F(72)+F(64)*F(73)+F(74)*TOTH
C CALCULATE VARIABLE COSTS
  PCX=0.
  DO 60 J=13,15
60 PCX=PCX+F(J)
  PC=PCX*TOTH
  PC=PC+F(64)*PCX
  PC=PC+F(16)*F(17)/100.*F(64)+F(16)*F(17)/100.*TOTH
C CALC NO OF HFR CALVES TO KEEP TO ATTAIN TARGET 2 YEARS HENCE
61 CALL CARET (F,A,DIFF,I,N)
91 IF (DIFF)92,92,93
C NO HEIFER CALVES NEEDED
C SELL ALL CALVES
92 TOTH=0.
  DO 150 J=64,71
150 TOTH=TOTH+F(J)
  CS=TOTH*F(18)/100.
  HC=0.
  CC=0.
  PHC=0.
  PWH=0.
  GO TO 127
C RETAIN HFR CALVES
93 TOTH=0.
  DO 702 J=64,71
702 TOTH=TOTH+F(J)
  HC=TOTH*F(18)/200.
  CS=HC*F(34)/100.
  HC=HC-CS
  CS=CS+TOTH*F(18)/200.
  GO TO (94,94,216),NK
C NO PURCHASES OR BUY HFR CALVES
94 PWH=0.
  ML=1
  JJ=100.
  JK=1000.
715 DO 601 J=JJ,JK,JJ
  Z=JK-J
  ZZ=Z
  Z=Z-(Z*F(19)/100.)
  Z=Z-(Z*F(20)/100.)

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```

        Z=Z-(Z*F(35)/100.)
        IF (Z-DIFF)602,712,601
601 CONTINUE
602 IF (ML-2)713,714,712
713 ML=ML+1
        JK=ZZ+100.
        JJ=10
        GO TO 715
714 ML=ML+1
        JK=ZZ+10.
        JJ=1
        GO TO 715
712 DIFF=ZZ
        IF (HC-DIFF)215,95,96
C ADDITIONAL HFR CALVES TO SELL
96 CS=CS+HC-DIFF
        HC=DIFF
95 PHC=0.
        CC=HC*F(46)
121 HC=HC-(HC*F(19)/100.)
        GO TO 127
215 GO TO (97,98),NK
C INSUFFICIENT HFR CALVES TO ATTAIN TARGET HERD SIZE
C NO PURCHASES ALLOWED
97 LL=I+1
        PRINT 104,LL
        GO TO 95
C PURCHASE HEIFER CALVES
98 PHC=DIFF-HC
        HC=HC+PHC
        CC=HC*F(46)
        GO TO 121
C CALCULATE NO OF REPLACEMENTS NEEDED
C PURCHASE WNR HFRS IF REQUIRED
216 PHC=0
        CC=HC*F(46)
        ML=1
        JJ=100
        JK=1000.
719 DO 603 J=JJ,JK,JJ
        Z=JK-J
        ZZ=Z
        Z=Z-(Z*F(20)/100.)
        Z=Z-(Z*F(35)/100.)
        IF (Z-DIFF)604,716,603
603 CONTINUE
604 IF (ML-2)717,718,716
717 ML=ML+1
        JK=ZZ+100.

```

```

JJ=10
GO TO 719
718 ML=ML+1
JK=ZZ+10.
JJ=1
GO TO 719
716 DIFF=ZZ
X=HC*F(19)/100.
HC=HC-X
IF (DIFF-HC)124,125,126
C NO WNR HFRS NEEDED
125 PWH=0.
GO TO 127
C ADDITIONAL CALVES CAN BE SOLD
126 PWH=DIFF-HC
HC=HC+PWH
GO TO 127
C CALCULATE NO OF WNRS TO PURCHASE
124 PWH=0.
Z=0
HC=HC+X
KL=HC
DO 605 J=1,KL
Z=Z+1.
HC=HC-1.
ZZ=HC
P=ZZ*F(19)/100.
ZZ=ZZ-P
IF (ZZ-DIFF)607,607,605
605 CONTINUE
607 CS=CS+Z
HC=DIFF
127 THS=TOTH-F(64)
CY=F(63)*F(47)
CC=ZZ*F(46)
C PRINT INITIAL STOCK NUMBERS
PRINT 105,Y,F(63),F(64),THS,TOTH
C CALCULATE DEATHS SALES
TCS=0
DO 160 J=36,43
F(J+28)=F(J+28)-(F(J+28)*F(21)/100.)
TCS=TCS+F(J+28)*F(J)/100.
160 F(J+28)=F(J+28)-(F(J+28)*F(J)/100.)
IF (PHC)128,128,129
129 PRINT 105,PHC,Y,Y
GO TO 131
128 PRINT 105,PWH,Y,Y
131 F(63)=F(63)-(F(63)*F(20)/100.)
THC=F(63)*F(35)/100.

```

```

C      F(63)=F(63)-THC
      UPDATE AGES
      DO 170 J=63,70
      L=134-J
      F(L)=0.
170    F(L)=F(L-1)
      F(63)=0.
      F(63)=HC
C      COMPARE TOTAL HERD WITH TARGET
      TOTL=0.
      DO 180 J=64,71
180    TOTL=TOTL+F(J)
      DIFF=TOTL-F(I+75)
      IF (DIFF)139,139,141
C      CALCULATE ADDITIONAL COW SALES
141    DO 190 J=63,70
      L=134-J
      IF (F(L)-DIFF)142,143,144
142    TCS=TCS+F(L)
      DIFF=DIFF-F(L)
      F(L)=0.
190    CONTINUE
      GO TO 139
143    TCS=TCS+F(L)
      F(L)=0.
      GO TO 139
144    TCS=TCS+DIFF
      F(L)=F(L)-DIFF
139    PRINT 105,CS,THC,Y,TCS
      PYH=0
      PMC=0.
      P2YR=0.
168    TOTL=0.
      DO 200 J=64,71
200    TOTL=TOTL+F(J)
      THS=TOTL-F(64)
      PRINT 9876,F(1),I
C      PRINT END OF YEAR STOCK
      PRINT 105,Y,F(63),F(64),THS,TOTL
C      STANDARD VALUE END OF YEAR
      SVEY=F(63)*F(72)+F(64)*F(73)+THS*F(74)
      IF (SVEY-SVBY)145,146,147
145    SVCI=0
      SVCD=SVBY-SVEY
      GO TO 148
146    SVCI=0.
      SVCD=0.
      GO TO 148
147    SVCD=0.

```

```

SVC I=SVEY-SVBY
GO TO 148
C 148 COMMENCE BUDGET
CPHC=PHC*F(2)
CPMC=PMC*F(6)
CPWH=PWH*F(3)
CPYH=PYH*F(4)
CP2YR=P2YR*F(5)
VCS=CS*F(7)
VTHC=THC*F(8)
VTCS=TCS*F(8)+VTHC
BFI=BF(I+1)*F(9)/100.
GCR=BFI+VTCS+VCS+F(96)
DEX(I+1)=CPHC+CPWH+CPYH+CP2YR+CPMC+CC+CY
DO 301 J=84,95
301 DEX(I+1)=DEX(I+1)+F(J)
DEX(I+1)=DEX(I+1)+F(11)+F(12)+PC+ODINT+SINTNM+OINT
C COMPUTE TAXATION
TI=GCR+SVC I-SVCD-DEX(I+1)-DEPN(I+1)
CALL TAXES (TOTAX,TI,PREM,F(10))
XDEX(I+1)=XDEX(I+1)+REPAY
TEXP=DEX(I+1)+XDEX(I+1)+ODINT+SINTNM+SPRINM+DWGS+PREM+TOTAX
TEXP=DEX(I+1)+XDEX(I+1)+SPRINM+DWGS+PREM+TOTAX
ECS=GCR+CIF-TEXP
323 CALL CFLOW(ECS,ECD,COD,CASH,TEXP,GCR,CIF)
PRINT 107,BF(I+1),BFI,VTCS,VCS,F(96)
PRINT 107,CPHC,CPWH,CPYH,CP2YR,CPMC,SVC I,SVCD
PRINT 107,DEX(I+1),SINTNM,ODINT,XDEX(I+1),SPRINM,DWGS
PRINT 107,PREM,DEPN(I+1),TI,TOTAX
DEX(I+1)=DEX(I+1)-ODINT-SINTNM
TMORT=0.
DO 401 J=1,18,3
401 TMORT=TMORT+DEBT(J)
TMORT=TMORT+F(26)+F(29)
TDEBT=TMORT+COD
ADEBT=TDEBT-BYIND
IF (ADEBT)402,403,403
402 ADEBT=0.
403 PRINT 107,ECS,ECD,CASH,COD,TMORT,TDEBT,ADEBT
C PARAMETRIC FINANCIAL ANALYSIS
KPAR=0
PP=(1.-PBFP)*F(9)/100.
PB=BF(I+1)*(1.+PBFO)
360 PNI=PP*PB+VTCS+VCS+VTHC+F(96)-DEPN(I+1)-DEX(I+1)-ODINT-SINTNM
PNI=PNI+SVC I-SVCD
CALL TAXES (TOTAX,PNI,PREM,F(10))
ACS=PNI+DEPN(I+1)+CIF+SVCD-SVC I-TOTAX-PREM-XDEX(I+1)-DWGS-SPRINM
IF (ACS)351,352,352
351 ACS=0.

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ADD=SVCI+TOTAX+PREM+XDEX(I+1)+SPRINM+DWGS-PNI-DEPN(I+1)-CIF-SVCD
GO TO 353
352 ADD=0
353 ACASH=YCASH
ACOD=YCOD
CALL PFLOW (ACS,ADD,ACASH,ACOD)
POP=PP*100.
PRINT 107,ACS,ADD,ACASH,ACOD,POP,PB
KPAR=KPAR+1
GO TO (361,362,363,364,365),KPAR
361 PP=F(9)/100.*(1.-PBFP)
PB=BF(I+1)
GO TO 360
362 PP=(1.-PBFP)*F(9)/100.
PB=(1.-PBFO)*BF(I+1)
GO TO 360
363 PP=F(9)/100.
PB=(1.-PBFO)*BF(I+1)
GO TO 360
364 PP=F(9)/100.*(1.+PBFP)
PB=BF(I+1)*(1.-PBFO)
GO TO 360
365 SVC(I+1)=SVCI-SVCD
GCI(I+1)=GCR
C INCREMENT YEAR COUNT
I=I+1
GO TO 404
101 FORMAT (8F7.1)
102 FORMAT (3F10.1)
103 FORMAT (1H ,13HERROR IN DATA,I4,4HYEAR,I4/)
104 FORMAT (1H ,14HTARGET IN YEAR,I4,11HUNATTAIABLE/)
105 FORMAT (1H ,5F8.0/)
106 FORMAT (1H ,4F10.0/)
107 FORMAT (1H ,7F10.1/)
108 FORMAT (1H ,9F8.1/)
109 FORMAT (2F5.2)
9876 FORMAT (1H ,F8.0,I4/)
1000 FORMAT (1H ,5HDIFF1,F10.0/)
C PROCEED TO THE POST DEVELOPMENT PROGRAM
100 CALL LINK (DPOSTD)
END

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C   DAIRY FINANCING PROGRAM
    DIMENSION F(96),GCI(8),SVC(8),BF(8),XDEX(8),DEX(8),DEPN(8)
    DIMENSION DEBT(18),A(9),AINT(18),PRINC(18),CE(3)
    COMMON F,GCI,SVC,BF,XDEX,DEX,DEPN
    EQUIVALENCE (PREM,F(25)),(R,F(24))
C   STOCK INCREASE POLICY 4,5 OR 6
C   INITIALS
    COD=F(22)
    CASH=F(23)
    K=1
    I=1
    M=3
    Y=0
    DO 20 J=1,18
20  DEBT(J)=0.
C   READ INITIAL STOCK NUMBERS
C   READ TARGET HERD SIZES
    READ 101,(F(L),L=63,81)
C   READ PERCENT FALL IN BFAT PRODUCTION PRICE
    READ 109,PBFO,PBFP
C   NUMBER OF YEARS IN THE DEVELOPMENT PLAN
    N=F(75)
    IF (COD)1,1,2
    2 IF (CASH)1,1,3
    3 IF (COD-CASH)4,5,6
    4 CASH=CASH-COD
    COD=0.
    GO TO 1
    5 COD=0.
    CASH=0.
    GO TO 1
    6 COD=COD-CASH
    CASH=0.
C   TOTAL INITIAL DEBT
    1 BYIND=F(26)+F(29)+COD
C   CALCULATE OVERDRAFT INTEREST
404 ODINT=R/100.*COD
    DO 10 MN=1,18
    AINT(MN)=0.
    10 PRINC(MN)=0.
    YCASH=CASH
    YCOD=COD
    IF (I-N)7,7,100
C   READ DATA FOR DEVELOPMENT YEAR I
    7 READ 101,(F(L),L=82,96)
C   INTEREST PRINCIPAL CHARGES ON NEW DEBTS
    L=K
    READ 102,DEBT(L),DEBT(L+1),DEBT(L+2)
    CIF=DEBT(K)

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DO 701 J=1,M,3
IF(DEBT(J))8,701,1002
1002 AINT(J)=DEBT(J+2)/100.*DEBT(J)
PRINC(J)=DEBT(J+1)-AINT(J)
IF(PRINC(J))8,1003,1003
1003 DEBT(J)=DEBT(J)-PRINC(J)
701 CONTINUE
GO TO 11
8 IERR=10
PRINT 103,IERR,I
CALL EXIT
11 SPRINM=0
SINTNM=0
DO 30 J=1,18
SPRINM=SPRINM+PRINC(J)
30 SINTNM=SINTNM+AINT(J)
K=K+3
M=K+2
C READ NEW CAPITAL EXPENDITURE
C CALCULATE DEPRECIATION
XDEX(I+1)=0
J=I+1
CALL DEPREC (CE,XDEX,DEPN,F(58),F(59),F(60),F(61),F(62),J)
OINT1=F(26)*F(28)/100.
REPAY1=F(27)-OINT1
IF(F(26))29,29,31
31 IF(REPAY1)1231,1232,1232
1231 IERR=14
PRINT 103,IERR,I
CALL EXIT
1232 F(26)=F(26)-REPAY1
GO TO 1233
29 REPAY1=0
1233 OINT2=F(29)*F(31)/100.
REPAY2=F(30)-OINT2
IF(F(29))1234,1234,1235
1234 REPAY2=0
GO TO 32
1235 IF(REPAY2)1231,32,32
32 F(29)=F(29)-REPAY2
OINT=OINT1+OINT2
REPAY=REPAY1+REPAY2
C READ PERSONAL DRAWINGS
C CHECK FOR CORRECT INPUT DATA
READ 101,DWGS,CODE
IF (CODE-99.)33,34,33
33 IERR=12
PRINT 103,IERR,I
CALL EXIT

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34 NK=F(33)
C CALCULATE BFAT
  BF(I+1)=F(64)*F(82)
  TOTH=0
  DO 50 J=65,71
50 TOTH=TOTH+F(J)
  BF(I+1)=BF(I+1)+TOTH*F(83)
C CALCULATE STANDARD VALUE BEGINNING OF YEAR
  SVBY=F(63)*F(72)+F(64)*F(73)+F(74)*TOTH
C CALCULATE VARIABLE COSTS
  PCX=0.
  DO 60 J=13,15
60 PCX=PCX+F(J)
  PC=PCX*TOTH
  PC=PC+F(64)*PCX
  PC=PC+F(16)*F(17)/100.*F(64)+F(16)*F(17)/100.*TOTH
  GO TO 224
168 TOTH=0.
  DO 200 J=64,71
200 TOTH=TOTH+F(J)
  THS=TOTH-F(64)
  PRINT 9876,F(1),I
C PRINT END OF YEAR STOCK
  PRINT 105,Y,F(63),F(64),THS,TOTH
C STANDARD VALUE END OF YEAR
  SVEY=F(63)*F(72)+F(64)*F(73)+THS*F(74)
  IF (SVEY-SVBY)145,146,147
145 SVCI=0
  SVCD=SVBY-SVEY
  GO TO 148
146 SVCI=0.
  SVCD=0.
  GO TO 148
147 SVCD=0.
  SVCI=SVEY-SVBY
  GO TO 148
C RETAIN HFR CALVES BUY YRLGS OR 2YR HFRS OR COWS
224 DO 250 J=1,9
250 A(J)=0.
  KK=1
  DO 260 J=1,9
260 A(J)=F(J+62)
187 DO 270 J=2,9
  A(J)=A(J)-(A(J)*F(21)/100.)
270 A(J)=A(J)-(A(J)*F(J+34)/100.)
  A(1)=A(1)-(A(1)*F(20)/100.)
  A(1)=A(1)-(A(1)*F(35)/100.)
  DO 280 J=1,8
  L=10-J

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280 A(L)=0.
A(L)=A(L-1)
A(1)=0.
IF (KK-1)171,171,172
171 TOTH=0.
DO 290 J=2,9
290 TOTH=TOTH+A(J)
DIFF=TOTH-F(I+75)
IF (DIFF)181,172,183
C CALCULATE ANTICIPATED PURCHASES
181 DIFF=F(I+75)-TOTH
JK=NK-3
GO TO (976,976,977),JK
976 A(2)=A(2)+DIFF
GO TO 172
977 KF=DIFF
POC=0.
DO 978 KL=1,KF
DO 978 J=3,9
A(J)=A(J)+1.
POC=POC+1.
IF (A(J)-1.)991,991,979
991 A(J)=A(J)-1.
POC=POC-1.
979 IF (POC-DIFF)978,172,172
978 CONTINUE
C CALCULATE ANTICIPATED SALES
183 DO 300 J=1,8
L=10-J
IF (A(L)-DIFF)184,185,186
184 DIFF=DIFF-A(L)
A(L)=0.
300 CONTINUE
185 A(L)=0.
GO TO 172
186 A(L)=A(L)-DIFF
172 KK=KK+1
IF (KK-2)187,187,188
188 TOTH=0.
DO 310 J=2,9
310 TOTH=TOTH+A(J)
JK=I
IF (JK-N)189,191,441
441 IERR=13
PRINT 103,IERR,I
CALL EXIT
191 JK=I-1
189 DIFF=F(JK+76)-TOTH
IF (DIFF)199,199,201

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C HEIFER CALVES RETAINED
C CALCULATE HFR CALVES REQUIRED
201 ML=1
    JJ=100
    JK=1000
724 DO 611 J=JJ, JK, JJ
    X=JK-J
    Z=X
    X=X-(X*F(19)/100.)
    X=X-(X*F(20)/100.)
    X=X-(X*F(35)/100.)
    IF (X-DIFF)612,721,611
611 CONTINUE
612 IF (ML-2)722,723,721
722 ML=ML+1
    JK=Z+100.
    JJ=10
    GO TO 724
723 ML=ML+1
    JK=Z+10.
    JJ=1
    GO TO 724
721 DIFF=Z
    TOTH=0.
    DO 320 J=64,71
320 TOTH=TOTH+F(J)
C CALCULATE CALF SALES
    HC=TOTH*F(18)/200.
    CS=HC*F(34)/100.
    HC=HC-CS
    CS=CS+TOTH*F(18)/200.
    IF (HC-DIFF)202,203,203
C NO PURCHASES
C CALCULATE EXTRA CALF SALES
203 CS=CS+HC-DIFF
    HC=DIFF
202 THS=TOTH-F(64)
    CC=HC*F(46)
    GO TO 231
C SELL ALL HFR CALVES
199 TOTH=0.
    DO 330 J=64,71
330 TOTH=TOTH+F(J)
    CS=TOTH*F(18)/100.
    HC=0.
    GO TO 202
231 PRINT 105,Y,F(63),F(64),THS,TOTH
    CY=F(63)*F(47)
C CALCULATE DEATHS SALES

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TCS=0.
DO 340 J=36,43
F(J+28)=F(J+28)-(F(J+28)*F(21)/100.)
TCS=TCS+F(J+28)*F(J)/100.
340 F(J+28)=F(J+28)-(F(J+28)*F(J)/100.)
F(63)=F(63)-(F(63)*F(20)/100.)
THC=F(63)*F(35)/100.
F(63)=F(63)-THC
C UPDATE AGES
DO 350 J=63,70
L=134-J
F(L)=0.
350 F(L)=F(L-1)
F(63)=0.
HC=HC-(HC*F(19)/100.)
F(63)=HC
TOTH=0.
DO 888 J=64,71
888 TOTH=TOTH+F(J)
C COMPARE TOTAL WITH TARGET
IF (F(I+75)-TOTH)204,204,205
C NO PURCHASES
204 P2YR=0.
PYH=0.
PMC=0.
DIFF=TOTH-F(I+75)
IF (DIFF)206,206,207
C ADJUST SALES
207 DO 370 J=63,70
L=134-J
IF (F(L)-DIFF)208,209,211
208 TCS=TCS+F(L)
DIFF=DIFF-F(L)
F(L)=0.
370 CONTINUE
209 TCS=TCS+F(L)
F(L)=0.
GO TO 206
211 TCS=TCS+DIFF
F(L)=F(L)-DIFF
GO TO 206
C TARGET EXCEEDS FORECAST TOTAL
C COMPUTE DEFICIT
C BUY YRLGS OR 2YR HEIFERS OR COWS
205 JK=NK-3
GO TO (212,213,981),JK
C PURCHASE YEARLINGS
212 DIFF=F(I+75)-TOTH
ML=1

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JJ=100
JK=1000
734 DO 613 J=JJ,JK,JJ
X=JK-J
Z=X
X=X-(X*F(20)/100.)
X=X-(X*F(35)/100.)
IF (X-DIFF)614,731,613
613 CONTINUE
614 IF (ML-2)732,733,731
732 ML=ML+1
JK=Z+100.
JJ=10
GO TO 734
733 ML=ML+1
JK=Z+10.
JJ=1
GO TO 734
731 DIFF=Z
PYH=DIFF
CY=CY+PYH*F(47)
DIFF=DIFF-(DIFF*F(20)/100.)
P=DIFF*F(35)/100.
DIFF=DIFF-P
THC=THC+P
F(64)=F(64)+DIFF
P2YR=0.
PMC=0.
PRINT 105,Y,PYH,Y
GO TO 214
C PURCHASE 2YEAR HEIFERS
213 P2YR=F(I+75)-TOTH
F(64)=F(64)+P2YR
206 PRINT 105,Y,Y,P2YR
PYH=0.
PMC=0.
GO TO 214
C PURCHASE COWS
981 DIFF=F(I+75)-TOTH
KK=DIFF
PMC=0.
DO 982 KL=1,KK
DO 982 J=65,71
F(J)=F(J)+1.
PMC=PMC+1.
IF (F(J)-1.)983,983,984
983 PMC=PMC-1.
F(J)=F(J)-1.
984 IF (PMC-DIFF)982,985,985

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982 CONTINUE
985 PRINT 105,Y,Y,Y,PMC
    PYH=0.
    P2YR=0.
214 PRINT 105,CS,THC,Y,TCS
    PHC=0.
    PWH=0.
    GO TO 168
C 148 COMMENCE BUDGET
    CPHC=PHC*F(2)
    CPMC=PMC*F(6)
    CPWH=PWH*F(3)
    CPYH=PYH*F(4)
    CP2YR=P2YR*F(5)
    VCS=CS*F(7)
    VTHC=THC*F(8)
    VTCS=TCS*F(8)+VTHC
    BFI=BF(I+1)*F(9)/100.
    GCR=BFI+VTCS+VCS+F(96)
    DEX(I+1)=CPHC+CPWH+CPYH+CP2YR+CPMC+CC+CY
    DO 301 J=84,95
301 DEX(I+1)=DEX(I+1)+F(J)
    DEX(I+1)=DEX(I+1)+F(11)+F(12)+PC+ODINT+SINTNM+OINT
C COMPUTE TAXATION
    TI=GCR+SVC I-SVCD-DEX(I+1)-DEPN(I+1)
    CALL TAXES (TOTAX,TI,PREM,F(10))
    XDEX(I+1)=XDEX(I+1)+REPAY
    TEXP=DEX(I+1)+XDEX(I+1)+ODINT+SINTNM+SPRINM+DWGS+PREM+TOTAX
    TEXP=DEX(I+1)+XDEX(I+1)+SPRINM+DWGS+PREM+TOTAX
    ECS=GCR+CIF-TEXP
    CALL CFLOW(ECS,ECD,COD,CASH,TEXP,GCR,CIF)
323 PRINT 107,BF(I+1),BFI,VTCS,VCS,F(96)
    PRINT 107,CPHC,CPWH,CPYH,CP2YR,CPMC,SVC I,SVCD
    PRINT 107,DEX(I+1),SINTNM,ODINT,XDEX(I+1),SPRINM,DWGS
    PRINT 107,PREM,DEPN(I+1),TI,TOTAX
    DEX(I+1)=DEX(I+1)-ODINT-SINTNM
    TMORT=0.
    DO 401 J=1,18,3
401 TMORT=TMORT+DEBT(J)
    TMORT=TMORT+F(26)+F(29)
    TDEBT=TMORT+COD
    ADEBT=TDEBT-BYIND
    IF (ADEBT)402,403,403
402 ADEBT=0.
403 PRINT 107,ECS,ECD,CASH,COD,TMORT,TDEBT,ADEBT
C PARAMETRIC FINANCIAL ANALYSIS
    KPAR=0
    PP=(1.-PBFP)*F(9)/100.
    PB=BF(I+1)*(1.+PBFO)

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360 PNI=PP*PB+VTCS+VCS+VTHC+F(96)-DEPN(I+1)-DEX(I+1)-ODINT-SINTNM
PNI=PNI+SVCI-SVCD
CALL TAXES (TOTAX,PNI,PREM,F(10))
ACS=PNI+DEPN(I+1)+CIF+SVCD-SVCI-TOTAX-PREM-XDEX(I+1)-DWGS-SPRINM
IF (ACS)351,352,352
351 ACS=0.
ADD=SVCI+TOTAX+PREM+XDEX(I+1)+SPRINM+DWGS-PNI-DEPN(I+1)-CIF-SVCD
GO TO 353
352 AOD=0
353 ACASH=YCASH
ACOD=YCOD
CALL PFLOW (ACS,AOD,ACASH,ACOD)
POP=PP*100.
PRINT 107,ACS,AOD,ACASH,ACOD,POP,PB
KPAR=KPAR+1
GO TO (361,362,363,364,365),KPAR
361 PP=F(9)/100.*(1.-PBFP)
PB=BF(I+1)
GO TO 360
362 PP=(1.-PBFP)*F(9)/100.
PB=(1.-PBFO)*BF(I+1)
GO TO 360
363 PP=F(9)/100.
PB=(1.-PBFO)*BF(I+1)
GO TO 360
364 PP=F(9)/100.*(1.+PBFP)
PB=BF(I+1)*(1.-PBFO)
GO TO 360
365 SVC(I+1)=SVCI-SVCD
GCI(I+1)=GCR
C INCREMENT YEAR COUNT
I=I+1
GO TO 404
101 FORMAT (8F7.1)
102 FORMAT (3F10.1)
103 FORMAT (1H,13HERROR IN DATA,I4,4HYEAR,I4/)
104 FORMAT (1H,14HTARGET IN YEAR,I4,11HUNATTA IABLE/)
105 FORMAT (1H,5F8.0/)
106 FORMAT (1H,4F10.0/)
107 FORMAT (1H,7F10.1/)
108 FORMAT (1H,9F8.1/)
109 FORMAT (2F5.2)
9876 FORMAT (1H,F8.0,I4/)
1000 FORMAT (1H,5HDIFF1,F10.0/)
C PROCEED TO THE POST DEVELOPMENT PROGRAM
100 CALL LINK (DPOSTD)
END

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C   DAIRY FINANCING PROGRAM
    DIMENSION F(96),GCI(8),SVC(8),BF(8),XDEX(8),DEX(8),DEPN(8)
    DIMENSION DEBT(18),A(9),AINT(18),PRINC(18),CE(3)
    COMMON F,GCI,SVC,BF,XDEX,DEX,DEPN
    EQUIVALENCE (PREM,F(25)),(R,F(24))
C   STOCK INCREASE POLICY 7,8 OR 9
C   INITIALS
    COD=F(22)
    CASH=F(23)
    K=1
    I=1
    M=3
    Y=0
    DO 20 J=1,18
20  DEBT(J)=0.
C   READ INITIAL STOCK NUMBERS
C   READ TARGET HERD SIZES
    READ 101,(F(L),L=63,81)
C   READ PERCENT FALL IN BFAT PRODUCTION PRICE
    READ 109,PBFO,PBFP
C   NUMBER OF YEARS IN THE DEVELOPMENT PLAN
    N=F(75)
    IF (COD)1,1,2
    2 IF (CASH)1,1,3
    3 IF (COD-CASH)4,5,6
    4 CASH=CASH-COD
    COD=0.
    GO TO 1
    5 COD=0.
    CASH=0.
    GO TO 1
    6 COD=COD-CASH
    CASH=0.
C   TOTAL INITIAL DEBT
    1 BYIND=F(26)+F(29)+COD
C   CALCULATE OVERDRAFT INTEREST
404 ODINT=R/100.*COD
    DO 10 MN=1,18
    AINT(MN)=0.
    10 PRINC(MN)=0.
    YCASH=CASH
    YCOD=COD
    IF (I-N)7,7,100
C   READ DATA FOR DEVELOPMENT YEAR I
    7 READ 101,(F(L),L=82,96)
C   INTEREST PRINCIPAL CHARGES ON NEW DEBTS
    L=K
    READ 102,DEBT(L),DEBT(L+1),DEBT(L+2)
    CIF=DEBT(K)

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DO 701 J=1,M,3
IF(DEBT(J))8,701,1002
1002 AINT(J)=DEBT(J+2)/100.*DEBT(J)
PRINC(J)=DEBT(J+1)-AINT(J)
IF(PRINC(J))8,1003,1003
1003 DEBT(J)=DEBT(J)-PRINC(J)
701 CONTINUE
GO TO 11
8 IERR=10
PRINT 103,IERR,I
CALL EXIT
11 SPRINM=0
SINTNM=0
DO 30 J=1,18
SPRINM=SPRINM+PRINC(J)
30 SINTNM=SINTNM+AINT(J)
K=K+3
M=K+2
C READ NEW CAPITAL EXPENDITURE
C CALCULATE DEPRECIATION
XDEX(I+1)=0
J=I+1
CALL DEPREC (CE,XDEX,DEPN,F(58),F(59),F(60),F(61),F(62),J)
OINT1=F(26)*F(28)/100.
REPAY1=F(27)-OINT1
IF(F(26))29,29,31
31 IF(REPAY1)1231,1232,1232
1231 IERR=14
PRINT 103,IERR,I
CALL EXIT
1232 F(26)=F(26)-REPAY1
GO TO 1233
29 REPAY1=0
1233 OINT2=F(29)*F(31)/100.
REPAY2=F(30)-OINT2
IF(F(29))1234,1234,1235
1234 REPAY2=0
GO TO 32
1235 IF(REPAY2)1231,32,32
32 F(29)=F(29)-REPAY2
OINT=OINT1+OINT2
REPAY=REPAY1+REPAY2
C READ PERSONAL DRAWINGS
C CHECK FOR CORRECT INPUT DATA
READ 101,DWGS,CODE
IF (CODE-99.)33,34,33
33 IERR=12
PRINT 103,IERR,I
CALL EXIT

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34 NK=F(33)
C CALCULATE BFAT
  BF(I+1)=F(64)*F(82)
  TOTH=0
  DO 50 J=65,71
50 TOTH=TOTH+F(J)
  BF(I+1)=BF(I+1)+TOTH*F(83)
C CALCULATE STANDARD VALUE BEGINNING OF YEAR
  SVBY=F(63)*F(72)+F(64)*F(73)+F(74)*TOTH
C CALCULATE VARIABLE COSTS
  PCX=0.
  DO 60 J=13,15
60 PCX=PCX+F(J)
  PC=PCX*TOTH
  PC=PC+F(64)*PCX
  PC=PC+F(16)*F(17)/100.*F(64)+F(16)*F(17)/100.*TOTH
  GO TO 62
168 TOTH=0.
  DO 200 J=64,71
200 TOTH=TOTH+F(J)
  THS=TOTH-F(64)
  PRINT 9876,F(1),I
C PRINT END OF YEAR STOCK
  PRINT 105,Y,F(63),F(64),THS,TOTH
C STANDARD VALUE END OF YEAR
  SVEY=F(63)*F(72)+F(64)*F(73)+THS*F(74)
  IF (SVEY-SVBY)145,146,147
145 SVCI=0
  SVCD=SVBY-SVEY
  GO TO 148
146 SVCI=0.
  SVCD=0.
  GO TO 148
147 SVCD=0.
  SVCI=SVEY-SVBY
  GO TO 148
C REPLACE WITH YEARLING OR 2YR HFR OR COWS
C ALL CALVES SOLD
C CALCULATE NUMBER TO SELL
62 TOTH=TOTH+F(64)
  PHC=0.
  PWH=0.
  CC=0.
  CY=F(63)*F(47)
  CS=TOTH*F(18)/100.
  THS=TOTH-F(64)
  PRINT 105,Y,F(63),F(64),THS,TOTH
  TCS=0.
  DO 210 J=36,43

```

```

F(J+28)=F(J+28)-(F(J+28)*F(21)/100.)
TCS=TCS+F(J+28)*F(J)/100.
210 F(J+28)=F(J+28)-(F(J+28)*F(J)/100.)
F(63)=F(63)-(F(63)*F(20)/100.)
THC=F(63)*F(35)/100.
F(63)=F(63)-THC
TOTH=0.
DO 220 J=63,71
C 220 TOTH=TOTH+F(J)
DIFFERENCE BETWEEN TOTAL FORECAST AND TARGET
DIFF=TOTH-F(I+75)
IF (DIFF)157,158,159
C 158 TOTAL EQUALS TARGET FOR HERD SIZE
P2YR=0.
PYH=0.
PMC=0.
PRINT 105,Y,Y,Y
GO TO 167
C 157 TOTAL LESS THAN TARGET HERD SIZE
JK=NK-6
GO TO (161,162,971),JK
C 161 PURCHASE YEARLINGS
DIFF=F(I+75)-TOTH
ML=1
JJ=100
JK=1000
121 DO 608 J=JJ,JK,JJ
X=JK-J
Z=X
P=X*F(20)/100.
X=X-P
Q=X*F(35)/100.
X=X-Q
IF (X-DIFF)605,609,608
608 CONTINUE
605 IF (ML-2)96,95,609
96 ML=ML+1
JK=Z+100.
JJ=10.
GO TO 121
95 ML=ML+1
JK=Z+10.
JJ=1
GO TO 121
609 PYH=Z
CY=CY+PYH*F(47)
X=F(20)/100.*Z
Z=Z-X
P=Z*F(35)/100.

```

```

THC=THC+P
Z=Z-P
F(63)=F(63)+Z
PMC=0.
P2YR=0.
PRINT 105,Y,PYH,Y
GO TO 167
C 162 DIFF=F(I+75)-TOTR
PURCHASE 2YR HEIFERS
P2YR=DIFF
F(63)=F(63)+P2YR
PYH=0.
PMC=0.
PRINT 105,Y,Y,P2YR
GO TO 167
C 971 PURCHASE COWS
DIFF=F(I+75)-TOTR
C PURCHASE MATURE COWS
PMC=0.
KK=DIFF
DO 972 KL=1, KK
DO 972 J=64,70
F(J)=F(J)+1.
PMC=PMC+1.
973 IF (F(J)-1.)973,973,974
PMC=PMC-1.
F(J)=F(J)-1.
974 IF (PMC-DIFF)972,975,975
972 CONTINUE
975 PYH=0.
P2YR=0.
PRINT 105,Y,Y,Y,PMC
GO TO 167
C TOTAL EXCEEDS TARGET
159 PYH=0
P2YR=0
PMC=0.
DO 230 J=63,70
L=134-J
IF (F(L)-DIFF)163,164,165
163 TCS=TCS+F(L)
DIFF=DIFF-F(L)
F(L)=0.
230 CONTINUE
164 TCS=TCS+F(L)
F(L)=0.
GO TO 166
165 TCS=TCS+DIFF
F(L)=F(L)-DIFF

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```

166 PRINT 105,Y,Y,Y
167 PRINT 105,CS,THC,Y,TCS
DO 240 J=63,70
L=134-J
F(L)=0.
240 F(L)=F(L-1)
F(63)=0.
GO TO 168
C 148 COMMENCE BUDGET
CPHC=PHC*F(2)
CPMC=PMC*F(6)
CPWH=PWH*F(3)
CPYH=PYH*F(4)
CP2YR=P2YR*F(5)
VCS=CS*F(7)
VTHC=THC*F(8)
VTCS=TCS*F(8)+VTHC
BFI=BF(I+1)*F(9)/100.
GCR=BFI+VTCS+VCS+F(96)
DEX(I+1)=CPHC+CPWH+CPYH+CP2YR+CPMC+CC+CY
DO 301 J=84,95
301 DEX(I+1)=DEX(I+1)+F(J)
DEX(I+1)=DEX(I+1)+F(11)+F(12)+PC+ODINT+SINTNM+OINT
C COMPUTE TAXATION
TI=GCR+SVCI-SVCD-DEX(I+1)-DEPN(I+1)
CALL TAXES (TOTAX,TI,PREM,F(10))
XDEX(I+1)=XDEX(I+1)+REPAY
TEXP=DEX(I+1)+XDEX(I+1)+ODINT+SINTNM+SPRINM+DWGS+PREM+TOTAX
TEXP=DEX(I+1)+XDEX(I+1)+SPRINM+DWGS+PREM+TOTAX
ECS=GCR+CIF-TEXP
CALL CFLOW(ECS,ECD,COD,CASH,TEXP,GCR,CIF)
323 PRINT 107,BF(I+1),BFI,VTCS,VCS,F(96)
PRINT 107,CPHC,CPWH,CPYH,CP2YR,CPMC,SVCI,SVCD
PRINT 107,DEX(I+1),SINTNM,ODINT,XDEX(I+1),SPRINM,DWGS
PRINT 107,PREM,DEPN(I+1),TI,TOTAX
DEX(I+1)=DEX(I+1)-ODINT-SINTNM
TMORT=0.
DO 401 J=1,18,3
401 TMORT=TMORT+DEBT(J)
TMORT=TMORT+F(26)+F(29)
TDEBT=TMORT+COD
ADEBT=TDEBT-BYIND
IF (ADEBT)402,403,403
402 ADEBT=0.
403 PRINT 107,ECS,ECD,CASH,COD,TMORT,TDEBT,ADEBT
C PARAMETRIC FINANCIAL ANALYSIS
KPAR=0
PP=(1.-PBFP)*F(9)/100.
PB=BF(I+1)*(1.+PBFO)

```

```

360 PNI=PP*PB+VTCS+VCS+VTHC+F(96)-DEPN(I+1)-DEX(I+1)-ODINT-SINTNM
PNI=PNI+SVCI-SVCD
CALL TAXES (TOTAX,PNI,PREM,F(10))
ACS=PNI+DEPN(I+1)+CIF+SVCD-SVCI-TOTAX-PREM-XDEX(I+1)-DWGS-SPRINM
IF (ACS)351,352,352
351 ACS=0.
ADD=SVCI+TOTAX+PREM+XDEX(I+1)+SPRINM+DWGS-PNI-DEPN(I+1)-CIF-SVCD
GO TO 353
352 ADD=0
353 ACASH=YCASH
ACOD=YCOD
CALL PFLOW (ACS,ADD,ACASH,ACOD)
POP=PP*100.
PRINT 107,ACS,ADD,ACASH,ACOD,POP,PB
KPAR=KPAR+1
GO TO (361,362,363,364,365),KPAR
361 PP=F(9)/100.*(1.-PBFP)
PB=BF(I+1)
GO TO 360
362 PP=(1.-PBFP)*F(9)/100.
PB=(1.-PBFO)*BF(I+1)
GO TO 360
363 PP=F(9)/100.
PB=(1.-PBFO)*BF(I+1)
GO TO 360
364 PP=F(9)/100.*(1.+PBFP)
PB=BF(I+1)*(1.-PBFO)
GO TO 360
365 SVC(I+1)=SVCI-SYCD
GCI(I+1)=GCR
C INCREMENT YEAR COUNT
I=I+1
GO TO 404
101 FORMAT (8F7.1)
102 FORMAT (3F10.1)
103 FORMAT (1H ,13HERROR IN DATA,I4,4HYEAR,I4/)
104 FORMAT (1H ,14HTARGET IN YEAR,I4,11HUNATTAIABLE/)
105 FORMAT (1H ,5F8.0/)
106 FORMAT (1H ,4F10.0/)
107 FORMAT (1H ,7F10.1/)
108 FORMAT (1H ,9F8.1/)
109 FORMAT (2F5.2)
9876 FORMAT (1H ,F8.0,I4/)
1000 FORMAT (1H ,5HDIFF1,F10.0/)
C PROCEED TO THE POST DEVELOPMENT PROGRAM
100 CALL LINK (DPOSTD)
END

```

```

SUBROUTINE CARET (F,A,DIFF,I,N)
DIMENSION F(96),A(9)
61 DO 70 J=1,9
70 A(J)=0.
   KK=1
   DO 80 J=1,9
80 A(J)=F(J+62)
81 DO 90 J=2,9
   A(J)=A(J)-(A(J)*F(21)/100.)
90 A(J)=A(J)-(A(J)*F(J+34)/100.)
   A(1)=A(1)-(A(1)*F(20)/100.)
   A(1)=A(1)-(A(1)*F(35)/100.)
   DO 110 J=1,8
   L=10-J
   A(L)=0.
110 A(L)=A(L-1)
   A(1)=0
   IF (KK-1)64,64,65
64 TOTH=0
   DO 120 J=2,9
120 TOTH=TOTH+A(J)
   DIFF=TOTH-F(I+75)
   IF (DIFF)65,65,75
75 DO 130 J=1,9
   L=10-J
   IF (A(L)-DIFF)76,77,78
76 DIFF=DIFF-A(L)
   A(L)=0
130 CONTINUE
77 A(L)=0.
   GO TO 65
78 A(L)=A(L)-DIFF
65 KK=KK+1
   IF (KK-2)81,81,82
82 TOTH=0.
   DO 140 J=2,9
140 TOTH=TOTH+A(J)
   JK=I
   IF (JK-N)83,84,84
84 JK=I-1
83 DIFF=F(JK+76)-TOTH
RETURN
END

```

```
SUBROUTINE CFLOW(ECS,ECD,COD,CASH,TEXP,GCR,CIF)
IF (ECS) 321, 321, 322
321 ECS=0
ECD=TEXP-GCR-CIF
IF (COD) 405, 405, 406
406 COD=COD+ECD
GO TO 323
405 IF (CASH) 406, 406, 407
407 IF (CASH-ECD) 408, 409, 411
408 COD=ECD-CASH
409 CASH=0
GO TO 323
411 CASH=CASH-ECD
GO TO 323
322 ECD=0.
IF (CASH) 412, 412, 413
413 CASH=CASH+ECS
GO TO 323
412 IF (COD) 413, 413, 415
415 IF (COD-ECS) 416, 417, 418
416 CASH=ECS-COD
417 COD=0.
GO TO 323
418 COD=COD-ECS
323 RETURN
END
```

```

C   DAIRY POST DEVELOPMENT PROGRAM
    DIMENSION F(96),GCI(8),SVC(8),BF(8),XDEX(8),DEX(8),DEPN(8)
    DIMENSION V(7),T(8),S(8),B(26)
    COMMON F,GCI,SVC,BF,XDEX,DEX,DEPN
C   READ DATA FOR POST DEVELOPMENT YEAR
    Y=0.
    READ 101,(B(J),J=1,26)
    EQUIVALENCE (TOTE,B(1))
    JFK=F(75)+2.
    IF (F(21))1,1,2
1   F(21)=1.
2   F(21)=(100.-F(21))/100.
C   CALCULATE STATIC STOCK RECONCILIATION
    DO 3 I=1,7
3   V(I)=0.
    A=1.
    Z=1.
    DO 4 I=1,7
    X=Z*F(21)
    Y=X*B(I+4)/100.
    Z=X-Y
    V(I)=Z
4   A=A+Z
    DO 5 I=1,8
5   T(I)=0.
    T(1)=TOTE/A
    DO 606 I=2,8
606  T(I)=T(1)*V(I-1)
    TEWE=0.
    DO 6 I=1,8
6   TEWE=TEWE+T(I)
C   CHECK TEST STOCK RECONCILIATION
    IF (TEWE-TOTE)37,45,39
37  TEST=TEWE+5.
    IF (TEST-TOTE)40,41,41
39  TEST=TEWE-5.
    IF (TEST-TOTE)41,41,40
40  IERR=20
    PRINT 103,IERR
    GO TO 100
41  DIFF=TEWE-TOTE
    DO 42 I=1,8
    K=9-I
    IF (T(K))42,42,44
44  T(K)=T(K)-DIFF
    GO TO 45
42  CONTINUE
    IERR=21
    PRINT 103,IERR

```

```

CALL EXIT
C SET NK EQUAL TO STOCK REPLACEMENT POLICY
C CHECK LOGIC IN STOCK POLICY
45 IF (B(3)-100.)7,8,9
9 IERR=22
PRINT 103,IERR
CALL EXIT
7 IF (B(2)-6.)11,11,9
11 NK=B(2)
GO TO 166
8 NK=B(2)
IF(B(2)-7.)9,186,186
186 IF (B(2)-9.)168,168,9
C CALCULATE HFR CALVES NEEDED TO MAINTAIN HERD SIZE
166 ML=1
JJ=100
JK=1000
36 DO 20 J=JJ,JK,JJ
X=JK-J
Z=X
X=X-(B(3)/100.*X)
X=X-(F(19)/100.*X)
X=X-(F(20)/100.*X)
X=X-(B(4)/100.*X)
IF (X-T(1))161,168,20
20 CONTINUE
161 IF (ML-2)201,202,168
201 ML=ML+1
JJ=10
JK=Z+100.
GO TO 36
202 ML=ML+1
JK=Z+10.
JJ=1
GO TO 36
168 CB=TOTE*F(18)/200.
GO TO (21,22,23,23,24,24,25,26,26),NK
C REPLACEMENT POLICY RETAIN HFR CALVES
21 IF (CB-Z)31,32,33
31 IF (B(3))34,34,35
35 B(3)=0.
GO TO 166
34 IF (B(4))401,401,38
38 B(4)=0.
GO TO 166
401 PRINT 104
CALL EXIT
32 CS=Z*B(3)/100.
Z=Z-CS

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```

51  CC=F(46)*Z
    DC=Z*F(19)/100.
    PHC=0.
    PYH=0.
    P2YR=0.
    Z=Z-DC
    YH=Z
    CY=YH*F(47)
    Z=Z-(Z*F(20)/100.)
    THC=Z*B(4)/100.
    GO TO 82
33  P=CB-Z
    CS=Z*B(3)/100.
    Z=Z-CS
    CC=F(46)*Z
    CS=CS+P
    GO TO 51
C   REPLACEMENT POLICY RETAIN HFR CALVES-BUY HFR CALVES
22  PYH=0.
    P2YR=0.
    IF (CB-Z)61,32,33
61  CS=CB*B(3)/100.
    INSUFFICIENT HFR CALVES
C   CALC NO OF HFR CALVES TO BUY
    CB=CB-CS
    Z=Z-(Z*B(3)/100.)
    PHC=Z-CB
    Z=CB+PHC
    CC=F(46)*Z
    Z=Z-(Z*F(19)/100.)
    YH=Z
    CY=YH*F(47)
    Z=Z-(Z*F(20)/100.)
    THC=Z*B(4)/100.
    GO TO 82
C   RETAIN HFR CALVES BUY WNR YRLG HFRS
23  IF (CB-Z)62,32,33
    INSUFFICIENT HFR CALVES
C   CALC NO OF WEANERS YRLGS TO BUY
62  CS=CB*B(3)/100.
    CB=CB-CS
    CC=CB*F(46)
    CB=CB-(CB*F(19)/100.)
    PHC=0
    P2YR=0
    ML=1
    JJ=100
    JK=1000
175 DO 70 J=JJ,JK,JJ

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```

X=JK-J
P=X
X=X-(X*F(20)/100.)
THC=X*B(4)/100.
X=X-THC
IF (X-T(1))171,174,70
70 CONTINUE
171 IF (ML-2)172,173,174
172 ML=ML+1
JJ=10
JK=100.+P
GO TO 175
173 ML=ML+1
JJ=1
JK=10.+P
GO TO 175
174 PYH=P-CB
YH=P
CY=YH*F(47)
GO TO 82
C 24 RETAIN HFR CALVES BUY 2YR HFRS
PHC=0
PYH=0.
IF (CB-Z)66,32,33
C INSUFFICIENT HFR CALVES
C CALC NO OF 2YR HFRS TO BUY
66 CS=CB*B(3)/100.
CB=CB-CS
CC=CB*F(46)
CB=CB-(CB*F(19)/100.)
YH=CB
CY=YH*F(47)
CB=CB-(CB*F(20)/100.)
THC=CB*B(4)/100.
CB=CB-THC
P2YR=T(1)-CB
GO TO 82
C SELL ALL HFR CALVES
C CALC NO OF YRLGS TO BUY
25 CS=CB
CC=0.
PHC=0.
PYH=0
P2YR=0.
ML=1
JJ=100
JK=1000
185 DO 80 J=JJ,JK,JJ
X=JK-J

```

```

Z=X
X=X-(X*F(20)/100.)
THC=X*B(4)/100.
X=X-THC
IF (X-T(1))181,81,80
80 CONTINUE
181 IF (ML-2)183,184,81
183 ML=ML+1
JK=Z+100.
JJ=10
GO TO 185
184 ML=ML+1
JK=Z+10.
JJ=1
GO TO 185
81 PYH=Z
YH=PYH
CY=YH*F(47)
GO TO 82
C SELL ALL HFR CALVES
C CALC NO OF 2YR HFRS TO BUY
26 CS=CB
CC=0.
CY=0.
PYH=0.
PHC=0.
THC=0.
YH=0.
P2YR=T(1)
82 CS=CS+TOTE*F(18)/200.
DO 90 I=1,8
90 S(I)=0.
DO 110 I=1,8
110 S(I)=T(I)*F(21)*B(I+4)/100.
TCS=0.
DO 120 I=1,8
120 TCS=TCS+S(I)
VTCS=TCS*F(8)+THC*F(8)
VCS=CS*F(7)
CPHC=PHC*F(2)
IF (NK-3)83,83,84
83 CPYH=PYH*F(3)
GO TO 85
84 CPYH=PYH*F(4)
85 CP2YR=P2YR*F(5)
BF(JFK)=T(1)*B(13)+((TOTE-T(1))*B(14))
BFI=BF(JFK)*F(9)/100.
GCR=VTCS+VCS+BFI+B(26)
DEPN(JFK)=F(58)+0.1*F(59)+0.15*F(60)+0.2*F(61)+0.5*F(62)

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```

PCX=0.
DO 140 J=13,15
140 PCX=PCX+F(J)
PC=PCX*TOTE+F(17)/100.*TOTE*F(16)
DEX(JFK)=0
DO 404 J=15,25
404 DEX(JFK)=DEX(JFK)+B(J)
ODINT=F(22)*F(24)/100.
OINT=F(28)/100.*F(26)
IF (F(27)-OINT)141,142,142
141 IERR=1
PRINT 105,IERR
CALL EXIT
142 PRI1=F(27)-OINT
AINT=F(29)*F(31)/100.
IF (F(30)-AINT)141,144,144
144 PRI2=F(30)-AINT
SINT=AINT+OINT
SPRI=PRI1+PRI2
DEX(JFK)=DEX(JFK)+F(11)+F(12)+SINT+PC
DEX(JFK)=DEX(JFK)+CPHC+CPYH+CP2YR+CC+CY
TI=GCR-DEX(JFK)-ODINT-DEPN(JFK)
CALL TAXES (TOTAX,TI,F(25),F(10))
ECS=GCR-DEX(JFK)-ODINT-SPRI-TOTAX-F(25)
DEBT=F(26)+F(29)
TDEBT=DEBT+F(22)
PRINT 9876,F(1)
COWS=TOTE-T(1)
PRINT 106,Y,YH,T(1),COWS,TOTE
PRINT 106,PHC,PYH,P2YR,Y
PRINT 106,CS,THC,Y,TCS
PRINT 106,Y,YH,T(1),COWS,TOTE
PRINT 106,BF(JFK),BFI,VTCS,VCS,B(26),GCR
PRINT 106,CPHC,Y,CPYH,CP2YR,Y,Y,Y
PRINT 106,DEX(JFK),Y,ODINT,SPRI,Y,ECS
PRINT 106,F(25),DEPN(JFK),TI,TOTAX
PRINT 106,ECS,Y,F(23),F(22),DEBT,TDEBT,Y
XDEX(JFK)=SPRI
GCI(JFK)=GCR
SVC(JFK)=0.
C PROCEED TO THE EVALUATION PROGRAM
CALL LINK (DEVAL)
101 FORMAT (7F9.1)
103 FORMAT (1H ,5H IERR,I4/)
104 FORMAT (1H ,20HCALVING RATE TOO LOW/)
105 FORMAT (1H ,6H ERROR,I4/)
106 FORMAT (1H ,12F10.0/)
9876 FORMAT (1H1,F8.0,I4/)
100 CALL EXIT

```



```

C      EVALUATION PROGRAM
      DIMENSION F(96),GCI(8),SVC(8),BF(8),XDEX(8),DEX(8),DEPN(8)
      DIMENSION PROF(100)
      COMMON F,GCI,SVC,BF,XDEX,DEX,DEPN
      EQUIVALENCE (OD,F(22)),(PREM,F(25)),(R,F(24))
C      INITIALS
115    M=1
      N=F(75)+2.
      I=1
      L=1
      KN=0
      R=R/100.
      GCIO=GCI(1)
C      TOTAL BASE YEAR CASH EXPENDITURE
      TEXO=XDEX(1)+DEX(1)+PREM
      TEXO=TEXO+R*OD
      COD=0.
      CASH=0.
      JJ=0
98     JJ=JJ+1
11     AOD=0.
      ACS=0.
C      CALCULATE BASE YEAR INTEREST
      BYINT=R*OD
C      CALCULATE OVERDRAFT INTEREST
      ODINT=R*COD
      TDEX=DEX(JJ)+ODINT+BYINT
      TI=GCI(JJ)+SVC(JJ)-DEPN(JJ)-TDEX
      CALL TAXES (TOTAX,TI,PREM,F(10))
      IF (I-1)43,43,44
43     TOT=TOTAX
44     IF (TOTAX)45,46,46
45     IERR=31
      PRINT 103,IERR
      GO TO 100
C      CALCULATE PERSONAL DRAWINGS
46     TRO=GCI(JJ)-TDEX-XDEX(JJ)-TOTAX-PREM
      IF (I-1)47,48,49
47     IERR=32
      PRINT 103,IERR
      GO TO 100
C      CALCULATE BASE YEAR PERSONAL DRAWINGS
48     IF (TRO)51,52,52
51     TRO=0.
52     BRO=TRO
      GO TO 75
C      CALCULATE CASH FLOW
C      CALCULATE OVERDRAFT OR CREDIT BALANCE
49     RO=TRO-BRO

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```

IF (TRO-BRO)58,59,60
59 ACS=0.
   AOD=0.
   GO TO 75
58 AOD=BRO-TRO
   ACS=0.
   IF (COD)61,61,63
61 IF (CASH)63,63,64
63 COD=COD+AOD
   GO TO 75
64 IF (CASH-AOD)65,66,67
65 COD=ADD-CASH
66 CASH=0.
   GO TO 75
67 CASH=CASH-AOD
   GO TO 75
60 ACS=TRO-BRO
   AOD=0.
   IF (CASH)68,68,69
68 IF (COD)69,69,70
69 CASH=CASH+ACS
   GO TO 75
70 IF (COD-ACS)72,73,74
72 CASH=CASH+ACS-COD
73 COD=0.
   KN=M-1
   GO TO 75
74 COD=COD-ACS
C  CALCULATE DEVELOPMENT CASH PROFITS
75 V=GCI(JJ)-GCIO
   TEX=XDEX(JJ)+TDEX+PREM
   C=TEX-TEXO
   CT=C+TOTAX-TOT
   PROF(L)=V-CT
C  ADD TO INDICES
211 I=I+1
   IF (I-N)76,76,77
76 M=M+1
   L=L+1
   GO TO 98
77 I=N
   IF (COD)78,78,83
78 IF (ODINT)99,99,83
83 L=L+1
   M=M+1
   IF (M-20)11,11,100
C  DISCOUNT PROFITS
C  CALCULATE PRESENT VALUE
99 L=2

```

```

PV=0.
112 PV=PV+(PROF(L)/((1.+R)**(L-1)))
    IF (L-M)85,86,87
87 IERR=33
    PRINT 103,IERR
    GO TO 100
85 L=L+1
    GO TO 112
86 PV=PV+(PROF(L)/(R*((1.+R)**(L-1))))
    PRINT 104,PV,KN
    PRINT 106,RO
    R=R*100.
    IF (PV)100,100,114
100 CALL EXIT
101 FORMAT (I4,2F10.0,3F7.0)
102 FORMAT (5F8.0)
103 FORMAT (1H ,7H ERROR ,I4/)
104 FORMAT (1H ,15H PRESENT VALUE ,F11.0,9H PAYBACK ,I4/)
105 FORMAT (2F6.2,F6.0,2F8.0)
106 FORMAT (1H ,19H DRAWINGS INCREASE ,F10.0/)
C PROCEED TO PARAMETRIC EVALUATION PROGRAM
114 CALL LINK (DPARA)
    END

```

```

C      DAIRY PARAMETRIC EVALUATION PROGRAM
      DIMENSION F(96),GCI(8),SVC(8),BF(8),XDEX(8),DEX(8),DEPN(8)
      DIMENSION PROF(100),A(36),B(36)
      COMMON F,GCI,SVC,BF,XDEX,DEX,DEPN
      EQUIVALENCE (BFP,F(9)),(OD,F(22)),(PREM,F(25)),(R,F(24))
C      READ PERCENTAGE CHANGE IN BFAT PRICE,BFAT PRODUCTION
      READ 107,P,Q
      N=F(75)+2.
      R=R/100.
C      CALCULATE BASE YEAR EXPENDITURE
      TEXO=XDEX(1)+DEX(1)+PREM
      TEXO=TEXO+R*OD
      BFP=BFP/100.
C      INITIALS
      K=1
180    M=1
      JN=0
      L=1
      I=1
      MM=0
      COD=0.
      CASH=0.
      NK=0
      DO 10 J=1,100
10     PROF(J)=0.
      J=0
130    J=J+1
      IF (K-1)1,1,2
C      TRANSFER DATA FROM COMMON STORAGE AREA
      1  JN=JN+1
      A(J)=GCI(JN)
      A(J+1)=SVC(JN)
      A(J+2)=BF(JN)
      A(J+3)=DEX(JN)
      A(J+4)=XDEX(JN)
      A(J+5)=DEPN(JN)
      KK=J+5
      DO 20 NN=J,KK
20     B(NN)=A(NN)
C      RECALCULATE GROSS INCOME FOR DIFFERENT BFAT PARAMETERS
      2  IF (K-3)21,21,22
21     Z=BFP*(1.-P)
      GO TO 25
22     IF (K-6)23,23,24
23     Z=BFP
      GO TO 25
24     Z=BFP*(1.+P)
25     GO TO (27,28,29,27,28,29),K
27     X=B(J+2)*(1.-Q)

```

```

GO TO 40
28 X=B(J+2)
GO TO 40
29 X=B(J+2)*(1.+Q)
40 B(J)=B(J)-B(J+2)*BFP
IF (B(J))41,42,42
41 IERR=41
PRINT 103,IERR,I,K
GO TO 500
42 B(J)=B(J)+(X*Z)
IF (I-1)43,43,44
43 BGCIO=B(J)
44 ACS=0.
AOD=0.
BYINT=R*OD
ODINT=R*COD
TDEX=ODINT+B(J+3)+BYINT
TI=B(J)+B(J+1)-TDEX-B(J+5)
CALL TAXES (TOTAX,TI,PREM,F(10))
IF (I-1)71,71,72
71 TOT=TOTAX
72 IF (TOTAX)73,75,75
73 IERR=42
PRINT 103,IERR,I,K
GO TO 500
C CALCULATE PERSONAL DRAWINGS
75 TRO=B(J)-TDEX-TOTAX-B(J+4)-PREM
IF (I-1)76,77,80
76 IERR=43
PRINT 103,IERR,I,K
GO TO 500
77 IF (TRO)78,79,79
78 TRO=0.
79 BRO=TRO
GO TO 100
80 RO=TRO-BRO
C CALCULATE OVERDRAFT OR CREDIT LEVEL
IF (TRO-BRO)84,600,85
600 ACS=0.
AOD=0.
GO TO 100
84 AOD=BRO-TRO
ACS=0.
IF (COD)86,86,87
87 COD=COD+AOD
GO TO 100
86 IF (CASH)87,87,88
88 IF (CASH-AOD)89,90,91
89 COD=AOD-CASH

```

```

90 CASH=0.
   GO TO 100
91 CASH=CASH-ADD
   GO TO 100
85 ACS=TRD-BRD
   ADD=0.
   IF (CASH)93,93,94
94 CASH=CASH+ACS
   GO TO 100
93 IF (COD)94,94,96
96 IF (COD-ACS)121,122,123
121 CASH=CASH+ACS-COD
122 COD=0.
   NK=M-1
   GO TO 100
123 COD=COD-ACS
C  CALCULATE DEVELOPMENT CASH PROFITS
100 V=B(J)-BGCIO
   TEX=TDEX+B(J+4)+PREM
   C=TEX-TEXO
   CT=C+TOTAX-TOT
   PROF(L)=V-CT
   I=I+1
   IF (I-N)124,124,125
124 L=L+1
   M=M+1
   J=J+5
   GO TO 130
125 I=N
   IF (M-20)212,211,211
211 PRINT 108
   GO TO 213
212 IF (COD)131,131,136
131 IF (ODINT)135,135,136
136 L=L+1
   M=M+1
   GO TO 44
C  CALCULATE PRESENT VALUE
C  DISCOUNT PROFITS
135 L=2
   PV=0.
150 PV=PV+(PROF(L)/((1.+R)**(L-1)))
   IF (L-M)141,142,143
141 L=L+1
   GO TO 150
143 IERR=44
   PRINT 103,IERR,I,K
   GO TO 500
142 PV=PV+(PROF(L)/(R*((1.+R)**(L-1))))

```

```
PRINT 106,PV,NK
PRINT 104,RO
213 MM=N*6
DO 170 JJ=1,MM
B(JJ)=0.
170 B(JJ)=A(JJ)
K=K+1
IF (K-9) 180,180,500
103 FORMAT (1H,7H ERROR,3I4/)
104 FORMAT (1H,18H DRAWINGS INCREASE,F9.0/)
105 FORMAT (1H,7F8.0,3I4/)
106 FORMAT (1H,F10.0,I4/)
107 FORMAT (2F5.2)
108 FORMAT (1H,22HPROGRAMME UNPROFITABLE/)
109 FORMAT (1H,17H YEARS TO PAYBACK,I6/)
500 CALL EXIT
END
```

APPENDIX HKEY TO VARIABLES APPEARING IN EXECUTABLE STATEMENTS IN THE DAIRY PROGRAMS

In order to make the programs easier to follow a key to the variables in the programs is given below. The variables are listed in the order that they appear in executable statements. Variables, once listed, are not listed again if they appear again in the same program or in subsequent programs.

Base Year Program

<u>Var-</u> <u>iable</u> <u>No.</u>	<u>Description</u>
F (1)	Farm identification number.
F (2)	Purchase price - heifer calves.
F (3)	Purchase price - weaner heifers.
F (4)	Purchase price - yearling heifers.
F (5)	Purchase price - two year old heifers.
F (6)	Purchase price - cows.
F (7)	Sale price - bobby calves.
F (8)	Sale price - boner cows.
F (9)	Butterfat price - (cents per lb.).
F (10)	Special taxation exemptions.
F (11)	Overhead costs.
F (12)	Rent and interest.
F (13)	Electricity/cow.
F (14)	Shed expenses/cow.
F (15)	Animal health/cow.
F (16)	Artificial insemination/cow.
F (17)	Percentage of herd mated by artificial insemination.

<u>Variable No.</u>	<u>Description</u>
F (18)	Calving percentage.
F (19)	Percentage deaths - calf to yearling.
F (20)	Percentage deaths - yearling to two year heifer.
F (21)	Percentage deaths - two year heifers and cows.
F (22)	Initial bank overdraft level.
F (23)	Initial bank credit level.
F (24)	Interest rate percent.
F (25)	Life insurance premiums.
F (26)	Mortgage - balance outstanding.
F (27)	Total annual charges.
F (28)	Interest rate percent.
F (29)	Mortgage - balance outstanding.
F (30)	Total annual charges.
F (31)	Interest rate percent.
F (32)	Total herd size.
F (33)	Stock increase option.
F (34)	Culling percentage - heifer calves.
F (35)	Culling percentage - yearling heifers.
F (36)	Culling percentage - two year heifers.
F (37)	Culling percentage - 2nd calvers.
F (38)	Culling percentage - 3rd calvers.
F (39)	Culling percentage - 4th calvers.
F (40)	Culling percentage - 5th calvers.
F (41)	Culling percentage - 6th calvers.
F (42)	Culling percentage - 7th calvers.
F (43)	Culling percentage - 8th calvers.
F (44)	Expected butterfat per heifer.

<u>Var-</u> <u>iable</u> <u>No.</u>	<u>Description</u>
F (45)	Expected butterfat per cow.
F (46)	Expenses per calf.
F (47)	Expenses per yearling.
F (48)	Seeds, manure and lime.
F (49)	Wages.
F (50)	Vehicle expenses.
F (51)	Cartage.
F (52)	Fuel and oil.
F (53)	Car expenses.
F (54)	Fodder.
F (55)	Repairs and maintenance.
F (56)	Other cash costs.
F (57)	Other income (assessable).
F (58)	Depreciation - cost price.
F (59)	Depreciation - 10 percent diminished value.
F (60)	Depreciation - 15 percent diminished value.
F (61)	Depreciation - 20 percent diminished value.
F (62)	Depreciation - 50 percent diminished value.
T (1)	The number of two year old heifers.
"T" ARRAY	The number of cows in each age class from second calvers (T(2)) to eighth calvers (T(8)).
TEWE	Total herd size (cows and two year old heifers).
NK	The stock increase policy number - this must be between one and nine.
IERR	Error number. (See Appendix I for a list of the error messages.)
CB	The number of calves born.
CS	The number of calves sold.

<u>Var-</u> <u>iable</u> <u>No.</u>	<u>Description</u>
CC	Calf costs.
DC	Deaths in calves.
PHC	The number of heifer calves purchased.
PYH	The number of yearling heifers purchased.
P2YR	The number of two year heifers purchased.
YH	Yearling heifers.
CY	Yearling costs.
DY	Deaths in yearlings.
THC	Total yearling heifers culled.
"S" ARRAY	The number of cows to be sold in each age class.
TCS	The total number of cows to be sold.
VTCS	The value of cow sales.
VCS	The value of calf sales.
CPHC	The cost of purchasing heifer calves.
CPYH	The cost of purchasing yearling heifers.
CP2YR	The cost of purchasing two year old heifers.
BF(1)	Base year butterfat production.
BFI	Butterfat income.
GCR	Gross cash income.
DEPN(1)	Base year depreciation.
PCX	Per cow expenses.
DEX(1)	Base year, tax deductible cash expenses.
ODINT	Overdraft interest.
OINT	Interest on mortgage.
PRI1	Principal repayment on a mortgage.
AINI	Interest on mortgage.
PRI2	Principal repayment on mortgage.

<u>Var-</u> <u>iable</u> <u>No.</u>	<u>Description</u>
TI	Taxable income.
ACS	Cash surplus.
SVC(1)	The change in livestock standard value between the beginning and end of the year in the base year.
XDEX (1)	Base year, non deductible cash expenditure.

Financing Program

F (63)	Number of yearling heifers.
F (64)	Number of two year heifers.
F (65)	Number of second calvers.
F (66)	Number of third calvers.
F (67)	Number of fourth calvers.
F (68)	Number of fifth calvers.
F (69)	Number of sixth calvers.
F (70)	Number of seventh calvers.
F (71)	Number of eighth calvers.
F (72)	Standard value - yearling heifers.
F (73)	Standard value - two year heifers.
F (74)	Standard value - cows.
F (75)	Code - office use only.
F (76)	Target herd size - end of year one.
F (77)	Target herd size - end of year two.
F (78)	Target herd size - end of year three.
F (79)	Target herd size - end of year four.
F (80)	Target herd size - end of year five.
F (81)	Target herd size - end of year six.
PBFO	Percentage fall in butterfat production.

<u>Var-</u> <u>iable</u> <u>No.</u>	<u>Description</u>
PEFP	Percentage fall in butterfat price.
N	The number of years of development.
COD	The bank overdraft level.
CASH	The bank credit level.
BYIND	Total indebtedness at the commencement of development.
"AINT" ARRAY	Interest payments on any new mortgage taken up during development.
"PRINC" ARRAY	Principal repayments on any new mortgage taken up during the development plan.
F (82)	Expected butterfat per heifer.
F (83)	Expected butterfat per cow.
F (84)	General development expenditure.
F (85)	Wages.
F (86)	Manure and lime.
F (87)	Seeds.
F (88)	Contract cultivation.
F (89)	Vehicle expenses.
F (90)	Fuel and oil.
F (91)	Car expenses.
F (92)	Cartage.
F (93)	Fodder.
F (94)	Repairs and maintenance.
F (95)	Other cash costs.
F (96)	Other income (assessable).
DEBT (L)	The amount of a new mortgage.
DEBT (L+1)	Total annual charges.
DEBT (L+2)	Interest rate percent.

<u>Var-</u> <u>iable</u> <u>No.</u>	<u>Description</u>
CALL DEPREC	A subprogram which calculates depreciation and allocates new capital items to the correct category for calculating depreciation in subsequent years of development.
CE (1)	The cost of a capital item.
CE (2)	Depreciation system.
CE (3)	Normal depreciation allowance.
REPAY	Principal repayments on mortgages.
DWGS	Personal drawings.
CODE	A check to ensure the correct input data is "read in".
BF (I+1)	Butterfat production in year "I+1" of development.
SVBY	The standard value of the livestock on hand at the beginning of the year.
CALL CARET	A subprogram which determines if calves must be kept now so that the target herd size, two years hence, can be attained.
HC	Heifer calves.
PWH	The number of weaner heifers to purchase.
PMC	The number of cows to purchase.
SVEY	The standard value of livestock on hand at the end of the year.
SVCI	The change in livestock standard value between the beginning and end of the year, if the value of the stock on hand at the end of the year exceeds the value of stock on hand at the beginning of the year.
SVCD	The change in livestock standard value between the beginning and end of the year if the value of the stock on hand at the beginning of the year exceeds that on hand at the end of the year.
CPMC	The cost of purchasing cows.

<u>Variable No.</u>	<u>Description</u>
CPWH	The cost of purchasing weaner heifers.
BF (I+1)	The butterfat production in year "I+1" of development.
TEXP	Total cash expenditure.
ECS	Cash surplus.
ECD	Cash deficit.
CALL CFLOW	A subprogram which calculates the cash flow and bank overdraft/credit level at the end of the year.
TMORT	Total mortgage liabilities.
TDEBT	Total liabilities (mortgage and overdraft).
ADEBT	Additional debt above that level existing at the beginning of development.
PP	Parametric butterfat price.
PB	Parametric butterfat production.
PNI	Parametric net income.
ACS	Cash surplus.
AOD	Cash deficit.

Post Development Program

B (1)	Total herd size.
B (2)	Stock increase option.
B (3)	Culling percentage - heifer calves.
B (4)	Culling percentage - yearling heifers.
B (5)	Culling percentage - two year heifers.
B (6)	Culling percentage - 2nd calvers.
B (7)	Culling percentage - 3rd calvers.
B (8)	Culling percentage - 4th calvers.
B (9)	Culling percentage - 5th calvers.
B (10)	Culling percentage - 6th calvers.
B (11)	Culling percentage - 7th calvers.

<u>Var-</u> <u>iable</u> <u>No.</u>	<u>Description</u>
B (12)	Culling percentage - 8th calvers.
B (13)	Expected butterfat/heifer.
B (14)	Expected butterfat/cow.
B (15)	Wages.
B (16)	Manure and lime.
B (17)	Seeds.
B (18)	Contract cultivation.
B (19)	Vehicle expenses.
B (20)	Cartage.
B (21)	Fuel and oil.
B (22)	Car expenses.
B (23)	Fodder.
B (24)	Repairs and maintenance.
B (25)	Other cash costs (deductible).
B (26)	Other income (assessable).

Evaluation Program

TEXO	Total cash expenditure in the base year excluding taxation and personal drawings.
BYINT	Interest on base year overdraft which it is assumed in the program is never repaid.
TDEX	Total tax deductible cash expenditure.
TRO	The sum available for personal drawings.
BRO	Base year personal drawings.
RO	Increase in personal drawings after payback.
V	Additional cash income (above the base year level).
TEX	Total cash expenditure (excluding taxation).

<u>Var-</u> <u>iable</u> <u>No.</u>	<u>Description</u>
C	Additional cash expenditure (above the base year level) excluding taxation.
CT	Additional cash expenditure (above the base year level) including taxation.
"PROF" ARRAY	The development cash profits in each year of the development plan.
PV	Present value of development cash profits.
KN	The number of years until payback.

Parametric Evaluation Program

P	Percentage change in butterfat price.
Q	Percentage change in butterfat production.
BFP	Butterfat price.
"A" and "B" ARRAYS	These are both temporary storage arrays.
NK	The number of years to payback.

APPENDIX ILIST OF ERROR MESSAGES - DAIRY PROGRAM

The program includes, as does the sheep program, a number of checks on the logic of the input data. The comments made there (Appendix D) apply here. This appendix lists the errors that may arise and the action to take in each case.

Error
Number

1. The total of the number of cows in each age group does not agree with the figure for total herd size. Check variables numbered 33 to 43.
2. The program has failed to reconcile the difference between the total of the cows in each age class with the figure for total herd size. Check variables numbered 34 to 43.
3. An error in the logic concerned with the stock replacement policy. Check variables numbered 33 and 34.
4. The calving percentage is too low to provide sufficient two year old heifers to maintain constant herd numbers and the farmer is not prepared to purchase any stock.
5. The principal repayment on a mortgage is negative. Check variables numbered 26 to 31.
10. The principal repayment on a new mortgage is negative. Check variables numbered 99 to 101. The program will print the year of development in which the error occurs.
11. An error of logic in relation to an item of capital expenditure. Check variables 102 to 107.
12. The correct number of variables in a year of development has not

Error
Number

been punched. Check that values for variables 84 to 103 have been punched. The program will print the year of development that the error occurs.

13. A count of the number of years of development exceeds variable number 75 which is the total number of years of development. Check variable number 75.
 14. The principal repayment on a mortgage is negative - check variables numbered 26 to 31.
 20. The total of the number of cows in each age group does not agree with the figure for total herd size. Check variables numbered 112 to 121.
 21. The program has failed to reconcile the difference between the total of the number of cows in each age group with the figure for total herd size. Check variables numbered 112 to 121.
- Error numbers 31, 32, 33, have already been listed in Appendix D.
41. Butterfat income exceeds gross cash income. Check variables 136 and 137.

Error numbers 42, 43 and 44 correspond to error numbers 41, 42 and 43 listed in Appendix D.

APPENDIX KSHEEP FARM DEVELOPMENT CASE STUDY - EXPLANATION OF VALUES APPEARING INTHE INPUT AND OUTPUT FORMS

This appendix explains the values assigned to some of the variables in the input form (Tables 5.5, 5.6, 5.7 and 5.8) for the sheep farm development plan case study.

Constants In All Years of The Development Plan

- (1) Special taxation exemptions (variable number 14).

	<u>\$</u>
Wife exemption	240
Personal exemption	275
Exemption for two children	270
	<u>\$785</u>

- (2) Overhead costs (variable number 15).

	<u>\$</u>
Rates	150
Insurance Premiums	100
Accountancy	70
Telephone	60
Sundry	20
	<u>\$400</u>

- (3) Rent and interest (variable number 16).

The sum of \$1500 is the interest charge on a flat mortgage of \$20,000 at an interest rate of 7.5 percent.

- (4) Variable costs per lamb (variable number 17).

	<u>c.</u>
Crutching	5
Drench	8
Sundry	2
	<u>15</u> cents

(5) Variable costs per hogget (variable number 18).

	<u>c.</u>
Crutching	5
Dipping	3
Sundry	2
	<u>10 cents</u>

(6) Variable costs per ewe (variable number 19).

	c.
Vaccines	8
Crutching	5
Dipping	3
Sundry	4
	<u>20 cents</u>

Base
Year

- (1) Weed and pest control (variable number 65) at \$100 is an allowance for the control of gorse on the area in pasture at the commencement of development.
- (2) Vehicle expenses at \$50 (variable number 66) is an allowance for repairs to the farm tractor.
- (3) Fuel and oil at \$150 (variable number 67) refers to the cost of petrol and oil for the tractor.
- (4) The cost of \$250 for car expenses (variable number 68) includes the cost of repairs, insurance, licensing, petrol and oil for the farmers car.
- (5) Cartage (variable number 69) is an estimate of the cost of carrying sundry inward items to the farm. Cartage of outward items (stock and wool) has been allowed for in the stock and wool prices. Cartage has also been allowed for in the cost of manure, cattle and other major inward items.

Base
Year

- (6) Fodder (variable number 71) is \$200. This is made up of the purchase of 500 bales of hay at 40 cents per bale.
- (7) Repairs and maintenance (variable number 72) includes an allowance of \$100 for the repairs and maintenance of buildings and \$200 for the repairs and maintenance of the existing fences.
- (8) Depreciation - Cost Price (variable number 80). At \$225 this is the 2.5 percent depreciation allowance on the house, shearing shed and hay barn (total cost price of \$9000).
- (9) Depreciation - 10 percent of Diminished Value (variable number 81). At \$1200 this refers to the book value of shearing plant, machinery etc., for which the depreciation allowance is 10 percent of diminished value per year.
- (10) Depreciation - 20 percent of Diminished Value (variable number 83). At \$2300 this is the total book value of the car (\$1500) and tractor (\$800) on hand at the beginning of development. The depreciation allowance on these items is 20 percent of diminished value per year.

First
Year

- (1) General development expenditure in the first year of development (variable number 131) is made of:
- | | |
|-------------|---------------|
| | \$ |
| Root-raking | 1200 |
| Fencing | 600 |
| | <u>\$1800</u> |
- (2) Fertiliser and lime for development (variable number 132) at \$324 in this year refers to the expenditure on fertiliser for the 60 acres to be cleared and sown into grass.
- (3) Fertiliser and lime (variable number 134) at \$2376 includes the cost of topdressing the 240 acres in good pasture and the 200 acres in poor

First
Year

- pasture at three hundredweight of superphosphate per acre.
- (4) Seeds expenditure at \$800 refers to the \$600 to be spent on grassing the area in scrub at the commencement of development and the \$200 to be spent on oversowing the 200 acres in poor pasture (variable number 135).
 - (5) Vehicle expenses and fuel and oil at \$100 and \$250 are both higher than the base year values of \$50 and \$150 due to the expected increased use of the tractor associated with higher stock numbers (variables numbered 137 and 138).
 - (6) Fodder (variable number 141) at \$400 refers to the purchase of 1000 bales of hay at 40 cents per bale.
 - (7) Weed and pest control (variable number 143) at \$200 has been increased from \$100 in the base year to \$200 to allow for some spot spraying of regrowth gorse on the 60 acres cleared of scrub.

Second
Year

- (1) General development expenditure at \$2400 (variable number 131) refers to the cost of root-raking the 120 acre block in scrub.
- (2) Fertiliser and lime for development at \$648 (variable number 132) refers to the topdressing of the 120 acre scrub block, that is root-raked in the second year of development.
- (3) Fertiliser and lime (variable number 134) at \$1800 is the cost of topdressing the 440 acres in grass at the beginning of development plus the cost of topdressing of the 60 acres cleared in the first year, both at two hundredweight of superphosphate per acre.
- (4) Seeds at \$1200 (variable number 135) is the cost of seed at \$10 per acre for the 120 acres to be cleared in the second year of development.

Second
Year

- (5) Fodder at \$600 (variable number 141) refers to the cost of buying 1500 bales of hay at 40 cents per bale.
- (6) Weed and pest control (variable number 143) at \$300 is \$100 higher than in the first year of development. This has been increased because of the larger area to control against gorse regrowth.

APPENDIX LDAIRY FARM DEVELOPMENT CASE STUDY - EXPLANATION OF VALUES APPEARING IN
THE INPUT AND OUTPUT FORMS

This appendix explains the values assigned to some of the variables in the case study of the dairy farm development plan.

Constants in All Years of The Development Plan

- (1) Special taxation exemptions (variable number 10) is calculated as follows:

	<u>\$</u>
Personal exemption	275
Wife exemption	240
Exemption for two children	270
	<u>\$785</u>

- (2) Overhead costs (variable number 11) is made up of the following items:

	<u>\$</u>
Rates	467
Insurance	104
Accountancy	60
Telephone	60
Sundry	20
	<u>\$711</u>

Base
Year

- (1) Seeds, manure and lime (variable number 48) at \$640 is the cost of applying 20 tons of superphosphate at \$32 per ton.
- (2) Vehicle expenses at \$100 is the anticipated cost of repairs to the farm tractor (variable number 50).
- (3) Cartage at \$50 is a nominal amount for the inward cartage on sundry items (variable number 51).
- (4) Fuel and oil at \$400 (variable number 52) is the expected net cost of fuel and oil for the tractor, milking machine, etc.

Base
Year

- (5) Car expenses at \$250 (variable number 53) includes the cost of insurance, repairs, petrol etc., for the farmer's car.
- (6) Fodder at \$200 is the cost of buying in 500 bales at 40 cents per bale (variable number 54).
- (7) Repairs and maintenance at \$350 is an allowance for the repairs of fences, buildings and farm plant (milking machines). (Variable number 55.)
- (8) Depreciation - Cost Price. The cost price of the buildings at the beginning of development is \$7000. The depreciation allowance on this sum at 2.5 percent of cost price is \$175 (variable number 58).
- (9) Depreciation - 10 percent of diminished value. At \$568 this is the value in the balance sheet of those items of plant on which the depreciation allowance is 10 percent of diminished value per year (variable number 59).
- (10) Depreciation - 20 percent of diminished value. At \$2300 this is the total balance sheet value of the car (\$1500) and tractor (\$800). (Variable number 61.)

First
Year

- (1) General development expenditure (variable number 86) is made up of the following items:

	\$
Drainage	300
Metal for the central race, bridges over the Catchment	
Board drain	1000
Fencing	200
	<u>\$1500</u>

First
Year

- (2) Manure and lime at \$1280 (variable number 86) is the cost of applying four hundredweight of superphosphate per acre at \$32 per ton applied.
- (3) Fodder at \$220 is the cost of buying 550 bales of hay (variable number 95).
- (4) Capital expenditure at \$4000 is the cost of converting the shed to a herringbone (variable number 102). The "1" opposite variable number 103 indicates that the depreciation allowance is to be calculated as a percentage of cost price and variable number 104 shows the depreciation allowance is 10 percent of cost price per year.
- (5) Capital expenditure at \$1000 is the cost for the new milking machine, "2" opposite variable number 106 indicates that the depreciation allowance is calculated on the diminished value and the normal depreciation allowance is 10 percent (variables numbered 105, 106 and 107).

Second
Year

- (1) General development expenditure (variable number 131) is made up of:
- | | |
|--------------|--------------|
| | \$ |
| Fencing | 300 |
| Water supply | 500 |
| | <u>\$800</u> |
- (2) Wages at \$1300 (variable number 87) is the anticipated cost of employing a youth in this year.
- (3) Fodder at \$260 (variable number 95) is for the purchase of 650 bales of hay at 40 cents per bale.
- (4) Capital expenditure at \$400 (variable number 102) refers to the cost of the new haybarn, on which the depreciation allowance is 2.5 percent (variable number 104) of cost price (variable number 103).

Second
Year

- (5) Capital expenditure at \$400 (variable number 105) refers to the cost of erecting an additional room on to the house. The depreciation allowance on this is 2.5 percent per year of the cost price (variables numbered 106 and 107).