



DEVELOPMENTS IN FARM MANAGEMENT ANALYSIS

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BUDGETING:

Budgeting is the method of farm management analysis which has stood the test of time. It is likely to remain the most useful method for general farm management work. Previous bulletins in this series have outlined and illustrated the objectives, method, and mechanics of budgeting.

The term "budgeting" can be used in the narrow sense, where it involves working out details of income and expenditure for a particular management plan which has been decided upon previously. The Minister of Finance produces the same kind of budget each year, only his is for rather a bigger business. Such a budget is valuable because it encourages the farmer to plan his operations and this makes him think more deeply than he otherwise would. He can see where he is heading financially, particularly in relation to an investment programme. This is true even where the pattern of farm management is entirely inflexible because of environmental limitations.

Where changes in farm organisation are possible, the term "budgeting" may cover the technique of examining the economics of these changes, which involve adjustments to the pattern of output or the structure of inputs. This is often called comparative budgeting. For example, if we wish to study changes on an arable farm on versatile cropping soils to see if cropping would pay better than sheep, we may set up full budgets for each system and compare profits. We should incorporate similar standards of management for crop yields, livestock performance, levels of inputs, and so on, to make sure we obtained strictly comparable results. Of course, the decision making process does not stop here for the results of the budgets must be

interpreted in the light of other non-financial considerations such as personal preferences. But at least by careful comparative budgeting we can see if farm reorganisation is financially justified, provided we have taken into account in the budgets all the likely constraints, or limiting factors, of alternative systems, such as labour availability and seasonal spread of work, adequacy of plant, and availability of capital.

Partial Budgeting:

Full comparative budgeting is time consuming, often involving tedious arithmetic. When considering small adjustments, only a partial analysis may be necessary. Partial budgeting examines the effect of the proposed change on only the direct costs and income concerned.

On a mixed arable farm, for example, suppose we were considering growing 20 more acres of wheat by reducing the prime lamb ewe flock by 100. If we could do this without changing the basic labour and plant, then the analysis could simply follow this form:—

Additions to costs with 20 acres of wheat	Additions to revenue from 20 acres of wheat
+	+
Reductions in revenue from 100 ewes.	Reductions in costs with 100 ewes.

If the sum on the right hand side exceeded the sum on the left hand side, then the change would pay. The comparison must be fair. In this example extra profit from wheat must not be made at the expense of soil fertility. Farm management considerations such as spread of work have to be taken into account. Partial analysis assumes that we only want to know the cash result of change. It does

not allow for changes in work and worry for instance.

For partial analysis the farm manager must distinguish between those costs which will be directly affected by a proposed change, and those costs which will not be changed. In our simple example, on the right hand side, the cost reductions because of 100 less ewes will be the variable costs such as shearing, crutching, drenching, feed costs, and ewe depreciation. On the left hand side, the additional costs in growing the extra wheat would include the cultivation, seed, fertiliser, spray and harvesting costs. There is no need to worry about fixed costs that will stay the same, like fixed labour costs, machinery depreciation, and other overhead charges. We can disregard these so long as they will remain the same if we change to growing more wheat. We shall be returning to this important distinction between fixed and variable costs in a later section.

Comparative Analysis:

In the United Kingdom farm advisory work for the last 12 years has been based on comparative analysis, and the New Zealand Department of Agriculture appears to be embarking on a similar system. Meanwhile there is some evidence of change away from comparative analysis in the United Kingdom.

This analysis compares the physical and financial performance of a farm under study with the results obtained by a group of similar farms. Diagnosis of weakness in organisation and management is the purpose, and this leads to advice for improvement.

The comparative analyst first needs a sample of farms in a recording scheme which he can fairly compare. They must be reasonably similar. For example, they would need to be similar, in size, system of farming, and environment. Clearly it is invalid to compare a fifty-cow dairy farm with a hundred-cow property, or worse still with a hill country store sheep property.

It follows that the comparative analyst needs a comprehensive coverage of farms throughout the country in an extremely large farm recording scheme. The United Kingdom has such a scheme in operation. About 2800 farmers provide full physical and financial details of their farms for the Provincial Agricultural Economic Service centred at the Universities. The information is

also used for the annual price review which sets guaranteed prices for the following year.

Comparative farm management work requires a great many professional and clerical workers to process the farm data. For example, in one provincial agricultural economics centre responsible for 250 farm records, there could be five to seven clerical workers and six or seven qualified research economists who spend a considerable proportion of their time on this work.

Even with a large survey like this, there remains the considerable problem of establishing groups of comparable farms. Sometimes a farm when compared with its appropriate group average seems to be performing well, but if the farm runs another cow or two, it goes into another group, where its performance does not compare so well!

Basically comparative analysis establishes for each group certain coefficients of physical and financial performance such as gallons of milk sold per acre, or fertiliser expenses per acre. The coefficients for the farm under review are compared with those for the group. Normally "premium" standards are set such as the average of the group's top 25 per cent or top 10 per cent of farms. Of course it is first necessary to find some way of deciding what constitutes a top farm and the analyst has to choose some criterion of performance. Such a criterion may be profit per acre if the acres are sufficiently alike, or interest earned on the total capital. It is interesting, and significant, that farms may rank differently depending on what criterion is used.

Many different kinds of coefficients of performance are used. For example, in the United Kingdom there is a "system" index which reflects the intensity of the farming system, a "livestock yield" index which shows the livestock performance (e.g., wool clip and lamb survival, or milk yield per cow), or a "crop yield" index. On the input side, there are standards for labour and machinery inputs per £100 of output and so on.

With this method the vital question is whether diagnosis with the aid of comparative analysis can lead to prescription of an optimum course of action. Even presupposing that all the sampling and grouping difficulties of farms can be met—a doubtful supposition—calculating premium standards and indexes will not necessarily show what

course of action is needed to help a low performing farm. Indeed, the managerial factors lying behind the standards of performance are crucial, and an analysis which overlooks these factors may be of little value if any for prescribing positive courses of action. The trouble with averages is that they obscure important variations. For example, rather than base farm decisions upon the fact that farms in a group produce 120lb prime lamb per acre, it would probably be much more useful to know why some farms are producing 170lb per acre. Even after a comprehensive comparative analysis of the kind described, the important farm management work has still to be done. One thing is certain, farm management ability will not be the same for all the farms in a group and this is a vital factor. A recommended course of action has to be within the ability of the farmer.

Perhaps comparative studies can be thought of as a "limbering up" exercise in farm management, but it is doubtful if a lot of resources should be devoted to this work. It is better to do farm management work of more positive and prescriptive kind.

However comparative data is not altogether valueless. On the contrary, full physical and managerial data on high performing farms is invaluable, both to the professional farm advisor, and to the operating manager. Records from a large number of farms may be more useful if they record the management methods of high performing farms on different farm types as well as the inputs and outputs.

Gross Margin Analysis:

In the section on partial budgeting a distinction was made between variable costs of particular enterprises, and those which are fixed no matter what the pattern of production is. This distinction is relevant only in the short term. In the long term all costs are variable. Land and plant can be bought or sold, additional permanent labour can be hired or existing labour sacked. But at any one moment an array of fixed costs encumbers the farm—interest or rent, mortgage repayments, rates and land tax, insurances and other standing charges, administration expenses, wages of fixed labour, drawings of the owner occupier, and the maintenance and depreciation of the plant and implements. In the short term the farmer

has to make decisions so as to meet these fixed costs as well as making a profit over and above them. These fixed costs make over one-half of the total costs on some types of farms. Clearly, in the short term, whatever decision is made, these fixed costs will remain the same.

Thus, it is logical to develop a system which emphasises those products which make the largest contribution to meeting these fixed costs, in relation to the land, labour and capital which they use. The per acre contribution made by a particular crop is the margin in excess of the direct variable costs necessary for producing it. This margin is being called the "gross margin" by farm management advisors who use this system of analysis.

For example, the gross margin per acre for wheat would be calculated as follows. Take the total revenue per acre, expected yield multiplied by price, and subtract the costs per acre of cultivation, seed, fertiliser, spray, harvesting and freight. A 55 bushel crop on medium land might give the following results.

Total Revenue per acre £37	-	Variable Costs Cultivation, Seed, etc., £8/5/0	=	Gross Margin per acre £28/15/0
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Although there will always be difficulties in allocating some variable costs, it ought to be possible on most mixed cropping farms to calculate these gross margins with reasonable accuracy. They are the logical guide to developing the most profitable farming system.

After calculating the gross margins for each crop or enterprise that might suit a particular farm, they are arranged in descending order of gross margin per acre. There are various methods for selecting a combination of enterprises to suit the farm to give the greatest profit. We will not deal with these here. Obviously one selects a system which has as large an acreage as possible of the profitable enterprises but the pattern must be compatible with fertility maintenance, practicable rotations, availability of labour at seasonal bottlenecks, availability of plant, and perhaps seasonal capital. For example, where labour is the most limiting factor, it may be necessary to substitute in the system an enterprise that does not use much labour but on the other hand has a low profit per acre. This system is being widely used in the

United Kingdom, where there is quite a lot of information on the labour needed for various enterprises at different times throughout the year. This supplementary information is helpful for planning farm programmes based on gross margins analysis.

When there are a host of factors to take into consideration as well as the profit per acre from each enterprise, the arithmetic involved in finding the best farming programme based on analysis of gross margins becomes a very ponderous job for experts only. On the other hand, a knowledge of the gross margins of the possible enterprises on the farm is an extremely valuable guide for farmers and their advisers when making decisions on the best combination of enterprises.

Mr H. E. Garrett and Mr J. W. Guise of the Farm Management Department at Lincoln College have recently completed some preliminary systematic work on gross margins for Canterbury cropping soils and will expand this work.

Linear Programming:

Linear programming is a mathematical method which can be used to find the best farming plan. The planner needs to know the alternative activities which are possible for the farm, and he has to work out precisely their needs for land, labour and capital. An "activity" does not necessarily mean the same thing as an enterprise in the sense we have used the word before. An "activity" is any direct or indirect productive process. For example, on a mixed cropping and fat lamb farm there may be the following possible activities.

- (1) Wheat production
- (2) Barley production
- (3) Garden peas production
- (4) Grass seed production
- (5) White clover seed production
- (6) Prime lamb ewes
- (7) Wintering hoggets
- (8) Fattening store lambs
- (9) Grazing pasture
- (10) Rape
- (11) Lucerne

Now activities (1) to (8) are direct productive activities. Activities (9) to (11) are intermediate processes because while they are required by the production activities, they do not produce a final product.

By using expected yields and costs, revenue for each of these

activities is calculated by using an index similar to gross margins. Because intermediate activities are not sold there will be nothing on the revenue side so their gross margins will be negative—they will show a loss.

Providing one knows the quantitative relationships between intermediate and productive activities and one knows the requirements of all activities for land, labour and capital, then it is possible to frame the problem in the form of a series of mathematical equations. Subjected to mathematical analysis, the combination of activities is determined which gives maximum total revenue, and at the same time conforms to all the limiting factors on the farm.

Linear programming gives useful subsidiary information. It shows how stable the optimum programme will be in the face of price changes. It can tell the farmer the value of acquiring more land labour and capital. Electronic computers speed up and simplify the work.

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

SUMMARY:

It is not likely that mathematical methods will displace budgeting in general farm management work. Except in Canterbury with its cropping, the soils, climate and topography of New Zealand limits productive alternatives. Therefore budgeting will continue to be the most useful, and generally applicable method of farm management planning. But the more advanced mathematical methods may be used more widely where the range of alternatives is wide, or alternatively where it is wished to carry out a thorough exploration of some particular element in the economy of a farm, or group of farms. This is only possible where there is access to electronic computers, and where there are trained people to carry out the analysis.

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