

15

Budgeting for future farm development

This chapter introduces the concept of budgets to predict the current costs and future returns. Sensitivity analysis provides an assessment of the impact of major cost items on predicted future earnings.

The main points in this chapter

- Budgets are of two types: full development budgets for major changes in farm management and partial budgets for smaller changes in farm practices.
- Cash development budgets usually involve assessing changes in the entire collection of costs and returns, taking into account that patterns of cash flow may not allow any repayments for the first year or two, leading to increasing debt levels.
- Preparing a partial budget requires the calculation of added returns, reduced costs, added costs and reduced returns arising from the development project. The net benefits can then be determined to decide if the alternative may have economic advantages.
- Another valuable outcome from a partial budget is the prediction of return on marginal capital invested in the project, to decide if this is acceptable when compared to other forms of on-farm and off-farm investments.
- It is possible to quantify the range of likely impacts on predicted profit, of variation in the costs of some of the major input items. Such sensitivity analyses provide realistic measures of 'best' and 'worse' case scenarios.
- Because benefits can occur over many years, discounting procedures can be incorporated into budgets to take into account the fact that today's money is worth more now than in the future.

Budgets are a projection into the future of farming operations using knowledge from the past. They predict the expected profitability of the business, and so whether in the long term, it will remain viable to be able to generate adequate income and repay the farm's

debts. Budgets also help farmers to communicate to others where their business is heading financially.

15.1 Types of budgets

There are two types of budgets, full and partial budgets. A full budget is a detailed financial analysis necessary in the event of significant changes in cash flow or income, such as a large change in milk returns which might lead to major farm management decisions. It can also be routine, say every few years, just to ensure enough cash is available to service ongoing debts and capital purchases. Partial budgets, the major topic of this chapter, estimate the effect on profit of a proposed change affecting only part of the farming operation.

15.1.1 Cash development budgets

Medium-term development requires investment of borrowed capital, with a pay-off which will take several years. Assuming that the physical program has already been planned, the cash flow budget simply tests whether this plan is financially feasible. It is often necessary to test three or four plans before making a final decision on the best program. In many cases, repayments are not planned on loans during the first or second year, thus leading to an increasing debt. Such patterns of cash flow need to be fully comprehended by the creditor. Many development programs have failed because of insufficient credit being provided in the early years.

When considering borrowing money to improve farm income, the return on extra capital is usually calculated using a partial budget. Partial budgets are a quick simple method to assess proposed farm changes. They are designed to only look at the net effect of a change with minimal information required. They are generally used as a first step in analysing a proposed change to the farm. More complex changes require more detailed analyses such as whole farm budgets and cash flow and developmental budgets.

With any major change in farm management practices, a cash flow budget is important. Invariably the change requires some cash outlays up-front and a higher flow of income or reduced cost some time in the future. In this case, the cash flow budget can be extended to a developmental budget to provide a predicted cash flow over an extended period of time. The progression of a developmental budget involves several steps:

1. Decide what change you want to undertake.
2. Decide how long it will take to achieve.
3. Identify the physical and financial aspects of the proposed change, for example, the increase in herd number and the capital required.
4. Construct cash flow budgets covering the start-up period until a 'steady state' is reached.
5. Examine and modify the budget and plan if necessary.

Cash flow budgets are then an integral part of any farm development program, as they can predict money received for the program less the money spent. Bankers and other credit agencies consider them essential, because without them, farmers are unlikely

to be able to borrow for that purpose. Cash flows take into consideration the following questions:

- How much money will the program generate and how much will it cost?
- When will this money be required and when will it yield a return?
- If all the money is not made available, how will the shortfall be covered? Does the farmer have other sources of finance he can use?
- What is the time span for the loan to be fully paid out?

Cash flow budgets then provide continuous feedback or monitoring during the development period. The farmer, adviser or lender can then compare the actual cash income and costs with the original estimates. If they greatly differ, then steps can be taken to modify the program. By regularly tabulating budgeted versus actual moneys, say every month, rapid changes can be made in the program. Cash flow budgets focus on cash whereas other budgets covering longer periods, such as profit budgets, include non-cash items such as inventory valuations and depreciation.

15.1.2 Partial budgets

Partial budgets provide planning and decision-making frameworks to compare the costs and benefits of alternative farm practices, which focus on the changes in income and expenses resulting from that alternative. Thus, all aspects of farm profits that are unchanged by the decision can be safely ignored. In a nutshell, partial budgeting allows farmers to get a better handle on how a decision will affect the overall profitability of their farm enterprise.

This framework does not account for changes in the value of money over time. If analyses are required to focus on effects that occur for more than a year or two, the net present value approach should be used, which discounts the money in future years to account for its lower value compared to current year values. This is discussed in a later section in this chapter.

Planning includes taking an inventory of farm resources, devising alternative uses of these resources and choosing the best alternative. By employing budgeting principles the farmer can compare costs and returns of a range of alternative actions. Ideally, he should aim to choose a course of action that most clearly matches his long-term goals.

The key principals of budgeting are to prepare for the unexpected and to measure past performance against future profits. Good budgets begin with specific measurable goals that provide clear direction to all involved in the business. These goals can be personal as well as business, such as ‘providing additional income for educating the children over the next ten years’.

Partial budgets are useful to evaluate changes, for example:

- Modifying a current activity, e.g. getting someone else to rear all your heifer replacements off-farm.
- Expanding an activity, e.g. increasing herd size.
- Introducing a new activity, e.g. conserving home-grown forage rather than buying in dry season forages.

- Evaluating a capital investment, e.g. installing a bucket milker instead of hand milking the cows.
- Assessing variations in marketing procedures, e.g. changing from an informal to formal milk market.
- Determining a 'break even' price, namely the unit return for key farm outputs, to ensure that the change in a farm practice is cost neutral, that is, its net benefits are zero.
- Determining a 'break even' yield, namely the yield of key farm outputs at their current returns, to ensure the budget is cost neutral, that is, their net benefits are zero.
- It can be beneficial to use 'best case' and 'worse case' scenarios to establish a range for the partial budget analysis. Such sensitivity analyses are discussed below.

Partial budgets are generally based on predicting gross margins (that is income less variable costs), although they can include overhead costs when the farm change is significant. In that case, there is no differentiation between variable and overhead costs within the budget analysis. If capital costs are involved, the value of their annual depreciation should be factored into the calculations. Even though purchased livestock could be called a capital investment to the farm, their values are not depreciated over time as with other items of capital equipment.

The success of the partial budget is reliant on its predictive accuracy, which depends on the accuracy of the information and estimates it contains. The farmer needs to collect factual data about the proposed change and provide reasonable estimates of such items as future prices, yields and gains. Factual information includes current costs of the production inputs, costs of capital, current commodity prices or other items pertinent to the change.

It is difficult to generate estimates for the unknown, particularly prices. The farmer must then estimate yields and prices to get an idea of what returns will or will not be. Yield and production estimates can be obtained from several sources. The best approach to use is a combination of historical farm data from both his and other nearby farms, predictions from reputable government or cooperative advisers and finally his own intuition. These can be incorporated into a sensitivity analysis (see later in this chapter) using a range of prices and production responses. The unit used to analyse the change can be any size, say per milking cow, with the result multiplied as necessary to show the economic impact on the whole enterprise.

15.2 Steps for a partial budget

There are eight steps to the successful use of partial budgets analyses as a decision-making tool. Each step serves a specific, unique purpose and is vital to an accurate, meaningful analysis:

1. State the proposed change. It is important to have a clear understanding of exactly what alternative is being analysed.
2. List the added returns. Identify new revenue streams or increasing existing streams.
3. List the reduced costs. Identify the general areas where a choice might lower expenses.



Figure 15.1 A well-designed milking parlour in Pakistan where summer temperatures can reach 40°C

4. List the added costs. In the situation of capital purchases, a depreciated cost must be claimed annually, not the total purchase cost.
5. List the reduced returns. Will revenues be decreased as a result of choosing a particular alternative? Will it decrease yields?
6. Summarise the net effects. Once the individual positive (steps 2 and 3) and negative (steps 4 and 5) aspects of the alternative have been identified, they should be aggregated to determine a total cost and total benefit of the alternative. The net benefit is found by subtracting total costs from total benefits. If the result is positive, then that alternative may have some economic advantages. However, if it is negative, the business would be better off staying with the current situation, or analysing a different alternative.
7. If capital is invested in the development, it is useful to calculate the return on that marginal capital. The question must then be asked, ‘What is an acceptable return on this marginal capital?’ It certainly should be more than current interest rates for investing that money in other ventures, either off-farm or on-farm. In making a value judgement, advisers often seek a value of at least 25–30% to take into account the risk and uncertainty of the calculated net benefits (step 6) actually being realised.
8. Consider non-economic and other factors. These must be taken into account but are difficult to quantify. If the alternative involves increasing herd size, it is important to



Figure 15.2 A well-designed cow shed in Pakistan where summer temperatures can reach 40°C

consider the existing farm infrastructure, such as the capacity of the dairy sheds and the milking parlour; if these are already stocked to near full capacity, they may have to be enlarged, thus requiring additional capital investment. Other considerations may include the social aspects of having less labour on the farm, increased or decreased leisure time, the need for increased or specialised knowledge and safety and/or ease of use of new equipment. Placing a monetary value on some of these subjective factors may be nigh impossible.

15.2.1 A case study for partial budgeting

A Malaysian dairy farmer with 30 milking cows wants to increase his herd size to 40 milking cows by contracting the local dairy cooperative to rear his eight replacement heifers (from three until 27 months of age). His farm is seven hectares in size and he currently uses no fertilisers to grow his forages, depending entirely on dairy shed effluent. His dairy shed will house the additional 10 cows, partly because he will rear eight less heifers. Each heifer consumes 1000 kg DM forage/yr and 500 kg/yr of formulated concentrate during rearing. As well as removing his eight heifers, he plans to introduce urea fertiliser onto his existing forage production area to increase forage production by 25%, so he will not have to purchase more forage for his extra cows, just additional concentrates. Milking cows consume 2500 kg/yr forage DM plus 1800 kg/yr concentrate and produce 13 kg/d or 4000 kg/yr milk. Because he currently doesn't use



Figure 15.3 A well-designed storage facility for milking machine equipment (southern Thailand)

any inorganic fertiliser and only has a stocking capacity of 6.2 cows/ha forage, he can expect the marginal response to urea fertiliser to be 10 kg forage DM per kg urea applied. The time saved from not having to feed the eight heifers will be spent on growing and harvesting his extra home-grown forage.

Many of the assumptions listed above originated from *Tropical dairy farming* (Moran 2005) together with recent (2007) personal discussions on farm costs with Malaysian dairy farmers and advisers in MR (Malaysian ringgits).

- Cows cost 5000 MR each to purchase
- Milk returns: 2.00 MR/kg
- Stock income: 900 MR/cow/yr (sale of bull calves and cull cows)
- Formulated concentrates: 0.80 MR/kg or 800 MR/t
- Urea fertiliser: 1.20 MR/kg or 120 MR/t forage DM grown
- Contract heifer rearing charges: 3.00 MR/heifer/d
- Reduced heifer rearing costs on-farm: 10 MR/heifer/yr. These do not include feed for young stock
- Herd and shed costs for cows (mating, veterinary, milk harvesting): 100 MR/cow/yr. These do not include feed for young stock.
- Feed cost (such as running costs for grass chopper, fuel and oil, repairs and maintenance), 50 MR/cow/yr.

Using the approach described above, the eight steps are detailed below then summarised in Table 15.1:

1. The partial budget is to increase the size of his milking herd by 33%, contract rear eight replacement heifers and apply extra urea fertiliser to farm
2. Added returns per cow:
 - 4000 kg milk @ 2.00 MR/kg or 8000 MR/yr
 - Stock income @ 900 MR/yr
 - Total is 8900 MR/cow/yr or 89 000 MR/yr for 10 cows.
3. Reduced costs for not rearing heifers on the farm, on a per heifer basis
 - 1 t DM forage @ 120 MR fertiliser cost/t DM or 120 MR/yr
 - 0.5 t concentrate @ 800 MR/t or 400 MR/yr
 - Veterinary etc. costs @ 10 MR/heifer/yr
 - Total is 530 MR/heifer/yr or 4240 MR/yr for 8 heifers.
4. Added costs amount to:
 - a) 10 cows @ 5000 MR/cow or 50 000 MR. This is a once-off investment so is not part of the annual budget
 - b) Cost per cow;
 - 2.5 t DM/cow forage @120 MR fertiliser cost/t DM or 300 MR/yr
 - 1.8 t concentrate @ 800 MR/t or 1440 MR/yr
 - Herd and shed costs @ 100 MR/yr
 - Feed costs (excl. forage and concentrates) @ 50 MR/cow
 - Total cost is 1890 MR/cow/yr or 18 900 MR/yr for 10 cows.
 - c) Cost for contract rearing heifers;
 - Annual contract @ 3.00 MR/heifer/d or 8760 MR/yr for 8 heifers
 - Total additional costs are 27 660 MR/yr.
5. Reduced returns. This development program will not adversely affect farm returns.
6. Net benefit. This is (added return + reduced costs) – (added costs + reduced returns) or

$$(89\ 000 + 4240) - (27\ 660 + 0) = 65\ 580\ \text{MR/yr.}$$

Table 15.1 Annual partial budget (in MR/yr) for increasing herd size on a Malaysian smallholder farm

Positive effects	Negative effects
Added returns Extra milk = 89 000	Added costs (Cow purchases = 50 000) Cow variable costs = 18 900 Contract heifer rearing costs = 8760 Total annual costs = 27 660
Reduced costs On-farm heifer rearing costs = 4240	Reduced returns Nil
Net benefit	65 580
Return on marginal capital	131.2%

7. Return on marginal capital. For an investment of 50 000 MR, the annual net benefit is 65 580 MR which yields a 131.2% return on marginal capital.
8. Non-economic factors. There are no capital investments in sheds or farm equipment while labour inputs have not changed. There are no interest charges because all payments are made frequently, so do not require any large one-off payments.

The main advantage of partial budgeting is that it provides a procedure to consider each cost item in turn, asking the question ‘In what way will this cost item change as a result of other changes on the farm?’ The main disadvantage is that it is a cumbersome and time consuming way of considering several alternatives. It is, however, by far the best way of objectively assessing the effect of any proposed changes in farm management strategies on the likely profit.

One of the problems, as with all planning, is the need to make decisions without really having the knowledge or time to work out the effect of the proposed change on the profit. For example, in the above example, you could pose the question ‘Will it pay me to purchase this forage for the extra milking cows rather than grow it on-farm with higher fertiliser inputs?’

In practice there is not enough time to evaluate all the alternatives. Computers can be used to calculate ‘What if’ situations. The danger then is that the issues become too confusing. ‘Back of the envelope’ calculations, despite modern technology, are still often the best way to make decisions, particularly if one has to back one’s hunches as to possible future trends in profitability. For example, in the above case study, if the demand for contract rearing increases in the region, so might prices for its cost. Budgeting is only part of the decision-making process. Anticipating the future is of equal, if not greater, importance.

15.3 Sensitivity analysis

When varying the level or costs of farm inputs and monitoring their effects on outputs, it is apparent that some inputs have a large influence on profits while others have very little influence. In addition, farm inputs often do not operate in isolation, but interact with others. For example, if concentrate prices increase, so might the cost of contract heifer rearing. This can be quantified using a sensitivity analysis. With the above case study, two of the major cost items are milk returns and concentrate prices.

Table 15.2 presents a sensitivity analysis on changes in the net benefits and the return on marginal capital for the case study farm above as milk returns and concentrate prices vary by 10% above or below their values in Table 15.1’s partial budget.

Table 15.2 highlights the importance of unit milk returns on the profits arising from increasing herd size. A change of 10% in milk return influenced net benefit by 10% whereas a change of 10% in concentrate prices influenced net benefits by less than 2%. The return on marginal capital always exceeded 100%, indicating that the investment of 50 000 MR to purchase 10 cows will be recouped within the first 12 months.

The predicted milk yield of the new cows (13 kg/d) was based on feeding each cow a total of 1.8 t concentrate over 300 days lactation or an average of 6 kg/cow/day. This is

Table 15.2 The effects of a 10% change in milk returns or concentrate prices on net benefits (in MR) and return on marginal capital (% in italics) derived from the partial budget for increasing herd size on a Malaysian smallholder farm

		Concentrate price (MR/t)		
		720	800	880
Milk return (MR/kg)	1.80	58 700 (117)	59 580 (119)	60 460 (121)
	2.00	64 700 (129)	65 580 (131)	66 460 (133)
	2.20	70 700 (141)	71 580 (143)	72 460 (145)

similar to the milk response depicted in Table 5.3 (page 65) of Chapter 5. However, milk yields are dependent on the forage quality as much as level of concentrate fed. Cow genetics can also be important particularly if there is a shortage of available cows for sale, thus limiting the opportunity for the farmer to select good quality cows. Contract heifer rearing costs could also have an important influence on farm profits. The effects of milk yield (valued at 2.00 MR/L) and contract heifer rearing costs are presented in the sensitivity analyses in Table 15.3.

A drop in 250 kg milk over the entire lactation would lead to a 8–9% decrease in net benefits while an increase of 0.50 MR in daily contract heifer rearing costs would decrease net benefits by 2–3%. These two tables (15.2 and 15.3) highlight the ease with which the relative impact of costs for farm inputs can be quantified using a sensitivity analysis approach. Greatest attention should be given to the ‘high impact’ ones to ensure they are predicted most accurately.

15.4 Accounting for time in a budget

Budgets involve investing finance to improve farm performance over time. The finances are normally invested in a relatively short period whereas the benefits occur over a much longer time period. Because of inflation, a dollar today is worth more to a farmer now than it will be some time in the future, since that dollar can be invested to earn income. For example, investing a dollar today in a bank will return us more than a dollar in six years’ time. One dollar invested today at 5% interest will in fact return \$1.34 in six years’ time.

A good example of this is spending money today on improving the feeding and management of dairy replacement heifers. They are the future of the dairy herd, so any improvement in their management today will show up as improved production when

Table 15.3 The effects of milk yield and heifer rearing costs on net benefits (in MR) and return on marginal capital (% in italics) derived from the partial budget for increasing herd size on a Malaysian smallholder farm

		Contract heifer rearing cost (MR/heifer/d)		
		2.50	3.00	3.50
Milk yield (kg/lactation)	3500	57 040 (114)	55 580 (111)	54 120 (108)
	3750	62 040 (124)	60 580 (121)	59 120 (118)
	4000	67 040 (134)	65 580 (131)	64 120 (128)

they first calve down in two years' time. These benefits will continue for their entire life in the milking herd. Therefore, when predicting cash flows from heifer development schemes into the future, say over five years, budgets should be based on what is called 'discounted cash flows'. Discounting means deducting from the scheme's expected earnings, the maximum amount that investment could earn if it was invested elsewhere. This then involves budgeting all the annual costs and returns, and adjusting these cash flows back to their equivalent present value over the 5-year-period that the benefits would flow. This is called the net present value (NPV) of the benefits from the investment. These economic benefits are also expressed in terms of their internal rate of return (IRR), which is the discount rate that will result in a zero NPV to the investment. The IRR can be interpreted as the maximum interest rate farmers could afford to pay for the heifer rearing enterprise if they borrowed all the funds required and were still able to refund the capital borrowed, plus interest. A discount rate of 10% is the usual one to use in such discounted cash flows.

For every year that the benefits from the initial investment is made, the NPV has to be calculated annually so the final added returns (as in the partial budget in Table 15.1) can be summed to decide if the initial investment was a good decision. Rather than present a detailed example of the calculations involved, which would normally be done by a lending agent, it is sufficient to say that when investments in farm practices require a long period of time to reap their benefits, their ultimate return must take into account their discounted monetary value compared to what it would be worth today.

One other problem with medium- and long-term dairy enterprise budgets is obtaining a realistic estimate of the ability of the milking herd to multiply in size. As well as buying replacement cows and selling cull cows, the natural increase of the herd needs to be predicted. Calving rates, inter-calving intervals, number of services (inseminations) per successful conception are notoriously difficult to predict as are pre-weaning calf mortality rates and herd wastage rates (that is the proportion of heifer calves born and reared that remain in the herd for their second calving). Using sexed semen in future years will introduce another unknown, the percentage of heifer calves in each year's calf drop. Recommended KPIs have been presented in Chapter 14.