TRAINING MATERIALS FOR AGRICULTURAL MANAGEMENT, MARKETING AND FINANCE

6

Market-oriented farm management for trainers of extension workers

AFRICA

Module 4
FARM MANAGEMENT TOOLS

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Module 4
FARM MANAGEMENT TOOLS

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FARM MANAGEMENT TOOLS

This module includes nine common tools used in farm management. All of the tools can be used at the level of the farm and its individual enterprises to analyse and plan farm management activities. They can be used for diagnosis of an existing situation, planning for the future and for monitoring progress of farmers throughout the year. Here the participants will learn when to apply the different tools and how to use them effectively.

Opening statement

Now that we have explored the place of market-oriented farm management in agriculture, we are in a position to learn tools that farmers can use to make decisions on their farms and households. Just as there are many types of decisions that farmers make, there are many tools that will help the farmer make these decisions. Some of the tools will be basic and simple to use. Others will be specialized and more complex.

Preparing for Session 4.1
Constraints and opportunities analysis

Learning outcomes
Understanding (i) the purpose of the instrument,
(ii) ability to know when to use the method,
(iii) ability to carry out the method

Training aids
Exercise 4.1A (Constraints tree analysis)
Handout 4.1A (Constraints and opportunities analysis)
Handout 4.1B (Worksheet — Constraints tree format)
Handout 4.1C (Worksheet — Constraints and opportunities analysis matrix)
Handout 4.1D (Constraints and opportunities checklist questions)

Notes

Constraints and opportunities analysis

This session explains what a constraints and opportunities analysis is and how it is conducted. It explains that it is an instrument that can be used to identify weaknesses and potentials within the farming system and its parts. The causes of those weaknesses will also be identified as well as strategies for building on potential strengths.

Opening statement

We shall begin this session by reviewing the main points in Handout 4.1A (Constraints and opportunities analysis). This tool will help farmers identify weaknesses (constraints) and potentials (opportunities) within the whole farm system or in its parts. Participants should feel free to ask questions.

The outline on the following page is provided to help the facilitator conduct the review.

Outline of Handout 4.1A (Constraints and opportunities analysis)

What is a constraints and opportunities analysis?

The constraints and opportunities analysis is an instrument intended to:

- identify weaknesses and potentials within the whole farm system or its parts and the causes of those weaknesses;
- develop strategies for building on the potentials.

What is a constraint?

A constraint is a situation that prevents the goals set by the farmer from being attained. Constraints can be physical, climatic, economic, institutional, social and political.

What is an opportunity?

Opportunities are favourable factors such as:

- existing and potential technologies and practices;
- energy and motivation of the human resource base;
- existing and potential new market niches;
- availability of support services.

The opportunities can improve the success of the farm. These opportunities should be identified in relation to the constraints in order to design improvements.

How is the tool applied?

- identify the enterprise;
- identify the constraints (using the "Constraints tree");
- identify objectives and opportunities;
- identify changes to be made to current practices/enterprise;
- what resources are needed (technical, financial and human);
- appraise the improvements on the farming system.

Exercise introduction

Identifying the constraints within a farm system and understanding how they interrelate provides a useful tool to analyse weaknesses and suggest solutions.
In Exercise 4.1A (Constraints tree analysis) we shall learn how to use the tree format illustrated and, then, to make use of the opportunities for improvement that present themselves.

Exercise 4.1A
Constraints tree analysis

Purpose: To identify constraints and possible strategies to overcome them. (Participants should have read Handout 4.1A prior to this exercise.)

Materials: (i) Handouts 4.1B (Worksheet — Constraints tree format) and C (Constraints and opportunities checklist questions), (ii) flip chart paper or newsprint, (iii) thick marking pens.
**Exercise 3.4A from previous module*

Allow 90 minutes for this exercise

Procedure

1. Divide the group into farm teams.

2. Ask the participants to take out Handouts A, B and C, and their record of the analysis done on their virtual farm in Exercise 3.4C.

3. Working with their farm map, each team should choose one enterprise and indicate what is the status of the enterprise in terms of income or profit. Using the constraints tree format given in Handout 4.1B or one of the large sheets of paper, each team should build a tree that traces the constraints that affect the level of income (profit) from their chosen enterprise.

4. Ask each team to present its constraints tree. Walk them through a logic test to 'test' the logical flow of their constraints tree. Does one factor lead to the next? Is the last/lowest block at the bottom of each branch the lowest level constraint?

Exercise 4.1A (continued)

5. After the discussion, each team should now work on a constraints and opportunities matrix. This is given in Handout 4.1C. Alternatively each team should draw a constraints and opportunities analysis matrix on the second large sheet of paper. Teams should first capture the key constraints and the lowest level constraints (see the example in Handout 4.1A). A checklist of constraints and opportunities questions is provided in Handout 4.1C.

6. Then each team should discuss and agree on opportunities emerging from the constraints. They should enter these in the matrix.

7. For each of the opportunities, the teams should identify and agree on changes that could be made. They should write these into the matrix.

8. For each of the agreed changes, the teams should identify the resources needed and who is responsible to implement the changes. They should enter these in the matrix.

9. Each team should then discuss, identify and note any effects they expect these changes will have on the enterprise or the whole farm. This is to test that the change actually does address the constraint.

10. Have each team present their matrices. Encourage discussion.
    The following questions may help guide the discussion:

- Do the changes planned address the lowest level constraints?
- What commonality of actions can be seen where two or more constraints can be addressed by the same change?
- Are the changes practical; are they within the power of the farmer?
- What about opportunities that may present themselves that are not related to a constraint? Can you use a similar approach to analyse the farm's resources and identify opportunities for improvement (without necessarily fixing something that is wrong)?

Space for notes and questions for the facilitator

Constraints and opportunities analysis

The constraints and opportunities analysis is an instrument used to identify specific problems within the farming system as a whole or within individual enterprises. The instrument helps a farmer identify weaknesses and potentials within the whole system or its parts. It also helps identify the causes of those weaknesses. And it helps the farmer develop strategies for overcoming the weaknesses and building on the potentials identified.

The instrument may not necessarily solve all the problems, but it will identify what the farmers can do by themselves and where they will need help from outside.

In short, the constraints and opportunities analysis is used to diagnose the situation of the farm or selected enterprises. It is used most effectively with groups of farmers.

Constraints

In order to use a constraints analysis, one must first understand what a constraint is. A constraint is a situation or factor that prevents the goals set by the farmer being attained. Constraints can be physical, climatic, economic, institutional, social and political. Some of them may fall within the control of the farmer while others may not.

A farmer uses a constraints analysis to trace the source or cause of a problem. Most problems are symptoms of other problems. While they may be a real constraint, they may in turn come from another problem. It is important that farmers are aware of the cause of their problems so that they do not waste resources treating a symptom alone.

Constraints and opportunities analysis (continued)

For example, let us say a farmer identifies low income as a constraint in an enterprise. Is this the cause of the problem? What is the cause of the low income? Low income may be because of low yield, low price or both. Low yields may be because of low input use, which may occur as a result of high costs or non-availability of inputs, lack of technology, attack of pests and diseases, or lack of irrigation water. On the other side, low prices may be because of poor quality of production, seasonality of the produce, oversupplies of produce in the market, lack of market information, poor quality of produce, lack of storage facilities, lack of drying facilities and others.

The constraints analysis takes into account all factors so that proposed actions could be taken to address the constraints.

Constraints may also be related to the physical factors (such as soil type, climate), or to socio-cultural, policy and institutions over which farmers have no control. These constraints are not always obvious, thus they need to be pointed out. For example, a lack of market is often considered a constraint, but lack of market may be because of poor infrastructure over which the farmers have no control. Poor infrastructure is the real constraint. In cases such as this, production of products that are highly perishable, bulky and that require transport need to be examined in the light of these constraints.

When the farmers know what the real constraints are, they will know which they can change and those they cannot change. Then they will be in a position to make decisions about how to improve farm profitability by addressing those constraints that they can influence.

Constraints and opportunities analysis (continued)

Opportunities

In planning for improvements of the farm, opportunities need to be considered in the light of the identified constraints. Favourable factors include existing technologies and practices, the energy and high motivation of the human resource base, existing market niches and the availability of support services that could enhance the success of the farm. These opportunities should be identified in relation to the constraints in order to design improved farm plans.

Conducting a constraints and opportunities analysis

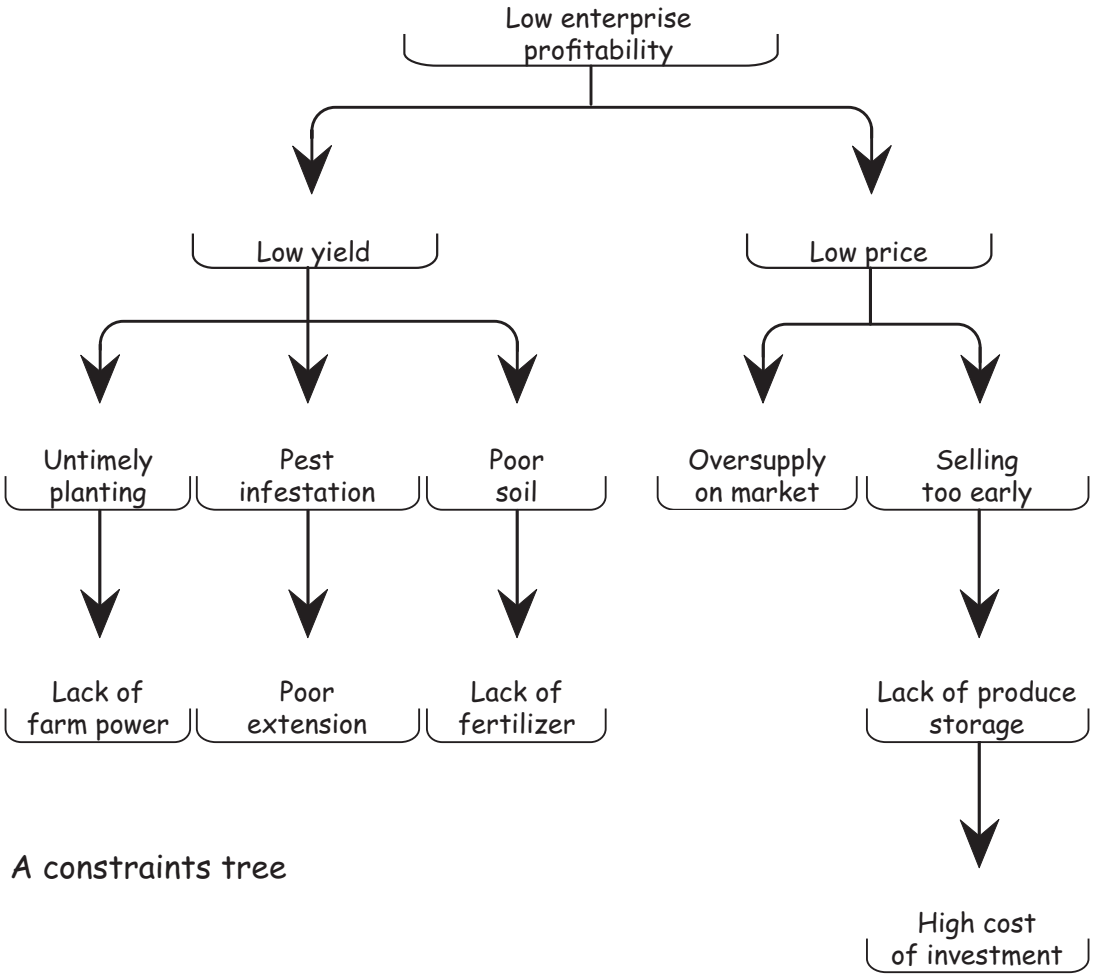
To conduct a constraints analysis requires two tools: a constraints tree and a constraints analysis matrix.

A constraints tree helps the farmer trace the actual constraint by refining and digging deeper into the issue. In the example given in figure on the next page, the farmer experiences low enterprise profitability. Low profitability is found to be caused by low yield and low price. In this example, low yield is found to be caused by three different factors: untimely planting, pest infestation and poor soil. Low price is found to be caused by two factors: poor quality produce and selling early. Each of these factors is in turn caused by another factor. This process of identifying the causal constraints continues until it reaches a logical conclusion within the immediate knowledge of the farmer.

Note

It is important that the constraints identified must be real and not just possible. In other words, they must be things the farmer knows or believes to be true about the farm or farm situation.

Constraints and opportunities analysis (continued)



A constraints tree

Constraints and opportunities analysis

After a constraints tree has been completed, list the constraints and identify the opportunities that present themselves. A format and instructions are shown on the next page and worksheets for both a constraints tree and an analysis matrix are provided in Handouts 4.1B and C.

Constraints and opportunities analysis (continued)

Constraints and opportunities analysis matrix

Enterprise:					
Key constraints	Lowest level constraints	Opportunities	Changes to be made to current practice	Resources needed	Who is responsible

Steps for completing the matrix are set out below:

1. *Enterprise:* Write the farm enterprise that you are engaged in.

2. *Key constraints:* Using the constraints tree analysis as a guide, identify the key constraints in each particular enterprise. List all the constraints except the last one. (The last one is the lowest level constraint.)

3. *Lowest level constraints:* These are the constraints listed at the end of a particular listing of constraints. They are usually the boxes at the bottom of the constraints tree.

4. *Opportunities:* Decide and write down a specific opportunity to address each of the identified lowest level constraints, write specific opportunities.

Constraints will present new objectives or opportunities to pursue. In some cases, something will need to be fixed. In other cases, the constraints may point to an opportunity not considered before.

Constraints and opportunities analysis (continued)

5. *Changes to be made to current practice:* Specify the changes to be made to current practices. Consider the following when deciding what changes to make:

- *Practices:* In what way does my current management practice need to be changed to address the constraint identified?
- *Technology:* What are the current technologies available? What new technologies can be adapted for improving the enterprise?

Changes should reduce or remove existing constraints; they should focus on the lowest level constraint. Changes can relate to enterprises, the farm and the non-farm area. For example, at the enterprise level, changes may mean changing an agricultural practice. At the whole-farm level, the changes may include the introduction of alternative enterprises.

6. *Resources:* What resources are needed (technical, financial and human)? Is there room for expanding the existing resources for the enterprise selected?

7. *Who is responsible:* Identify the person(s) responsible for implementing the identified changes.

8. Once changes and resources have been identified, the overall effects on the farm system should be appraised. In practice, many enterprises are technically and economically interrelated. For example, higher grain yields may increase the availability of straw as feed for livestock. A small change may affect the whole farm-household system, posing many questions to be answered by farmers and extension workers.

Constraints and opportunities analysis (continued)

The following is an example of a completed constraints analysis matrix using the information from the constraints tree shown earlier.

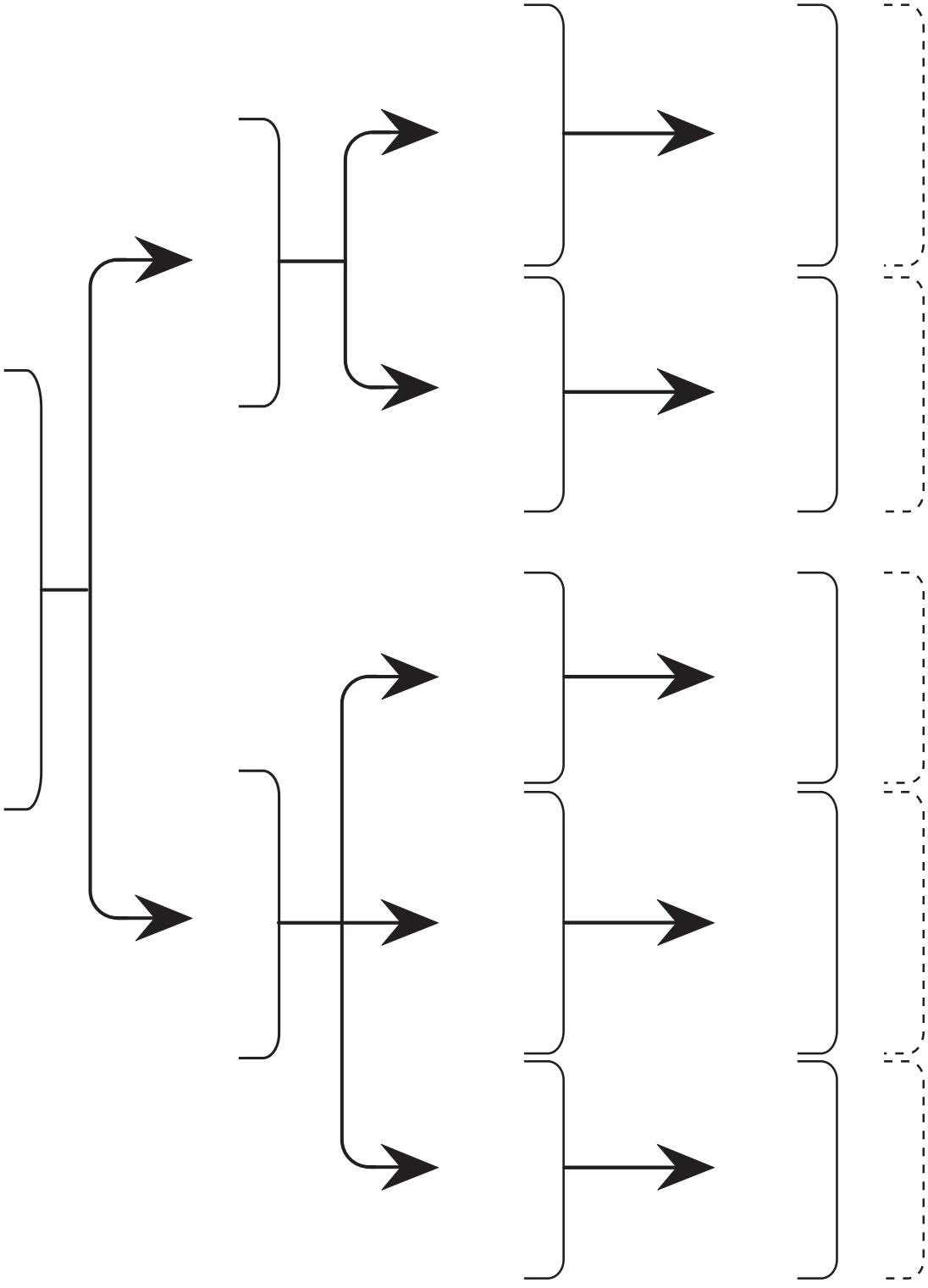
Constraints and opportunities analysis matrix

Enterprise:

Key constraints	*Lowest level constraints*	*Opportunities*	*Changes to be made to current practice*	*Resources needed*	*Who is responsible*
Low profitability Low price	Oversupply on market	Introduce a higher value crop; soyabeans	Plant half the maize lands under soyabeans	Extension information on how to grow soya-beans.	Farmer with support from extension service
Low profitability Low price Sell too early Lack of product storage	High cost of investment relative to ability to finance	Investigate alternative options; seek loan	Train labour to pack and store for the market	Training support from extension service	Farmer with support from extension service
Low profitability Low yield Untimely planting	Lack of farm power	Negotiate with brother-in-law to use tractor	Use tractor on at least 50% of the farm		
Low profitability Low yield Pest infestation	Poor extension information	Learn about integrated pest management at FFS	Apply ISP on fields	Training	Farmer with support from extension service
Low profitability Low yield Poor soil	Lack of fertilizer	Buy fertilizer	Apply fertilizer on 50% of crops	Guidelines on using fertilizers	Farmer with support from extension service

There is no single right or wrong set of answers. Each analysis will differ depending on the resource base of the farm, the farmer's attitude toward risk or the reliability of information. What is most important is that farmers begin to apply a systematic process of identifying constraints and opportunities. This will help to improve farm management skills. This will contribute to the sustainability and profitability of farm livelihood.

Worksheet — Constraints tree format



Worksheet — Constraints and opportunities analysis matrix

Enterprise:

Key constraints	*Lowest level constraints*	*Opportunities*	*Changes to be made to current practice*	*Resources needed*	*Who is responsible*

Worksheet — Constraints and opportunities analysis matrix (continued)

Enterprise:

Key constraints	*Lowest level constraints*	*Opportunities*	*Changes to be made to current practice*	*Resources needed*	*Who is responsible*

Constraints and opportunities checklist questions

The following are some questions that can be used to help a farmer in identifying effects of proposed changes to address the identified constraints and objectives. In this case the changes being investigated are intensification, diversification and alternatives regarding finances.

Intensification

___ Which enterprises can be made more productive through improved production techniques?
___ Which production techniques are available but unknown to most farmers?
___ What will be the changes in costs of production per unit?
___ What will be the changes in gross production per unit?
___ What is the effect of this change on the cash flow of the farmer?
___ Is there adequate labour available to make the change?
___ Are the necessary inputs and materials available?
___ Are the suppliers of key inputs able to provide more inputs of the same quality on time?
___ Will the extra production be sold at the same price?
___ Will the extra production be available for sale or will the farm household use the extra production for home consumption?
___ If the extra production is used for consumption, is the extra production substituting any other consumption and releasing cash?
___ Will the farm household reduce the production of this other crop (releasing land for alternative production or fallow)?
___ If extra inputs are available on credit, will the farm household use the inputs on the crop it was intended for?
___ What will be the input requirements and outputs under conditions of low rainfall and other risks?

Constraints and opportunities checklist questions (continued)

Diversification

___ What are the market opportunities that exist?
___ Are there opportunities for increasing sales to the current market?
___ Are there opportunities for selling produce in other markets in the vicinity?
___ Are there opportunities to market produce in more distant markets?
___ Are there opportunities to diversify production and introduce new enterprises?
___ What are the expected costs and revenues from doing so?
___ What is the effect of this change on the cash flow of the farmer?
___ Is there adequate labour available to make the change?
___ Are the necessary inputs and materials available?

Alternatives

___ What to propose if the farmers do not have sufficient cash in the proposed period?
___ Whether the supplier delivers fertilizer on credit?
___ If not, are there other institutions that could provide credit?
___ If yes, what would be the extra cost?
___ When must the farmer repay the credit?

Learning points

These questions will show that each proposed change in the farm system has to be evaluated in terms of all its possible short- and long-term effects on the farm-household system. They also show the interrelationship between the farm and supporting systems.

Preparing for Session 4.2
Gross margin budgets

Learning outcomes
Understanding (i) the purpose of this instrument in diagnosis and planning,
(ii) the application of the budget tool for forward planning,
(iii) the use of the tool in choosing between alternatives,
(iv) when to apply the budgeting tool,
(v) how to apply the tool.
Ability to (i) know when to use the method,
(ii) carry out the method
(what are the steps in enterprise budgeting?)
How to budget for (i) annual crops/enterprises,
(ii) livestock and perennials

Training aids
Exercise 4.2A (Constructing a gross margin)
Handout 4.2A (Gross margin budgets)
Handout 4.2B (Steps for calculating gross margins)
Handout 4.2C (Worksheet — Gross margin template: actual hectares)
Handout 4.2D (Worksheet — Gross margin template: one hectare)
Handout 4.2E (Worksheet — Gross margin template: livestock enterprise)

Notes

Gross margin budgets

This session explains the concept of a gross margin and its relation to production costs, gross income and profit. A gross margin is a simple and powerful tool for analysis and planning. Participants will look at the components of a gross margin and learn the procedure for calculating a gross margin and knowing when to apply it.

Opening statement

Gross margin is a useful and practical tool for assessing the profitability of farm enterprises. We shall begin by reviewing the main points in Handout 4.2A (Gross margin budgets). Participants should feel free to answer questions.

The outline on the following pages is provided to help the facilitator conduct the review.

Outline of Handout 4.2A (Gross margin budgets)

Main points covered in the handout

- Gross margin measures the relative profitability of the enterprise (not the actual profit.) It will guide farmers on which enterprise to engage in given the resources available.
- The basic formula for calculating a gross margin is:

Gross margin = Gross income - Cost of production

- To calculate the gross margin, the costs must be categorized into variable and fixed costs.
- For crops, gross margin analysis is usually done on a per hectare basis, if land is the most limiting resource and for livestock enterprises on a per head basis.
- In many cases, another resource such as family labour might be of greater concern. For example, some farmers might have extra land but few family members to do all the required work. In this case, gross margins can be calculated on a person-day basis.
- Farm profit is determined by:

Whole farm income (profit) = Gross margins of all farm enterprises - Fixed costs

How can a gross margin be used?

- to make comparisons between farmers within the same area;
- to make comparisons for a single farmer over time;
- as a planning tool in evaluating the potential value of alternative technologies and/or enterprises.

Advantages of gross margins

- The information required is simple.
- The information required can be easily collected.
- The analysis is easy to complete.
- The results are easy for both farmers and extension workers to understand.

The results can help extension workers to decide whether to encourage farmers to adopt a technology or introduce a new farm enterprise.

Exercise introduction

Let us continue our review of this handout by following up with Exercise 4.2A (Constructing a gross margin). Here we will follow a series of steps in the calculation of representative gross margins.

Exercise 4.2A
Constructing a gross margin

Purpose: To construct a per hectare gross margin for selected enterprises using a group consensus approach. The intention of this exercise is to elicit the opinions of the course participants in constructing a gross margin. (Participants should have read Handout 4.2A prior to this exercise.)

Methods: Group participation.

Materials: (i) Handouts 4.2B (Steps for calculating gross margins), C (Worksheet — Gross margin template: actual hectares), D (Worksheet — Gross margin template: one hectare) and E (Worksheet — Gross margin template: livestock enterprise) (ii) flip chart paper or newsprint, (iii) thick marking pens.

Allow about 120 minutes for this exercise

This should provide enough time for instruction and development of the major elements of a process budget. About 10 minutes should be devoted to introductions and a short explanation of the usefulness and need for enterprise budgets.

Procedure

1. Get the participants into their farm teams.

2. Distribute two copies each of Handouts 4.2C and D (Gross margin templates). Distribute one copy of Handouts 4.2B (Steps for calculating gross margins) and 4.2E (Gross margin template for livestock enterprise).

3. Briefly describe the content and the information needed for each template.

4. Each team must choose one crop and one livestock enterprise. The groups should already have agreed on the farm size. They need to decide on the level of technology that they will use.

Exercise 4.2A (continued)

5. Each team should follow the steps outlined in Handout 4.2B. They will need to reach consensus on the enterprise budget. The gross margin that they calculate should be representative of the production practices, input combinations, costs, production level and farmgate prices the team has identified.

Encourage the participants to define every step taken in growing the crop from land preparation to the point when the harvested crop leaves the farmgate. The equipment used should also be identified along with a description of the cultural practices.

Encourage the groups to reach consensus even though there will be differences in the husbandry techniques that each participant knows. If no consensus can be reached, the group should agree to develop two different budgets: one for a production system using higher technology and another using a lower technology.

6. After completing the 'brainstorming' ask the groups to organize their information on their crops into the gross margin format. Encourage them to verify the data they have collected. (Remember, they must calculate a gross margin for a crop and a livestock enterprise.)

Each team must decide how they want to start the calculations. Do they want to work from the actual hectares and convert to a per hectare gross margin? Or do they want to work from per hectare basis and convert to the actual gross margin for their enterprise?

7. The final version of the gross margin budgets should reflect the consensus of the group. Ensure that the specific process/enterprise budget is a fair description of the inputs, costs and returns associated with growing the crop.

8. Discuss results: Open a discussion with the participants on how they could use this enterprise budget template. If the participants run short of ideas you could prompt them into thinking that the budget could be used to compare individual farm situations.

Be sure the participants are clear on the whole enterprise gross margin and the unit based hectare gross margin.

Exercise 4.2A (continued)

The whole enterprise gross margin calculates the gross margin based on the actual number of hectares. This indicates profitability of a particular sized farm, but cannot generally be used for comparing relative profitability unless it is converted to a unit based gross margin.

The unit based gross margin is based on one hectare or livestock unit, etc. This indicates profitability per unit. It can be used for comparing farms and enterprises. It can be used to calculate profitability of a whole enterprise if it is converted to a whole enterprise gross margin.

Space for notes and questions for the facilitator

Gross margin budgets

What is a gross margin budget?

The term *gross margin* generally refers to the remaining income from an enterprise after the variable costs are deducted (Gross income less variable costs). *A gross margin budget* is a fairly detailed estimate of the output, cost, and profitability of individual crop and livestock enterprises. The gross margin budget includes all costs involved in producing the enterprise. It is not profit because it does not include all costs (it excludes fixed costs that the enterprise shares with other enterprises). But it is an indication of the profitability of an enterprise. If an enterprise does not have a positive gross margin, then that enterprise is not profitable.

The gross margin budget can be used to compare the performance of a single enterprise using different farming practices and technologies. Similarly, it can be used to calculate the potential profitability of growing an entirely new crop if farmers wish to diversify their products.

A gross margin is usually calculated on a unit basis. It can be calculated on a per hectare basis, or as a return to labour, based on the number of days worked by the farmer and the farm family. These would be expressed as $ per ha, $ per worker, $ per person day, respectively.

Farmers who market some farm products should know the costs of production and should be able to calculate the gross margin. This will allow them to analyse the current performance of an enterprise using current prices and input—output information. Using the gross margin they can project information into the future. This will help them plan and make decisions. This is called budgeting.

Gross margin budget (continued)

Components of the gross margin

The gross margin is made up of two major parts:

- gross income
- variable costs

The basic calculation for a gross margin is as follows:

Gross margin = Gross income - Variable costs

Further on in this handout, we will discuss the concepts of gross income and variable costs.

How can gross margin be used?

Gross margin is a simple, useful and practical tool for assessing the comparative profitability of different farm enterprises or different technologies. Gross margin analysis can be done by extension workers and by literate farmers who can do simple arithmetic.

Note

Refer to participatory methods to learn non-number based methods of calculating gross margins. This will make it possible for less literate and numerate farmers to make the comparisons. This, in turn, will assist these farmers to make better decisions about their farms as they move into market-oriented farming.

Gross margin budget (continued)

Gross margin analysis is particularly suitable for farmers who are selling increasing amounts of their farm production in the marketplace. Comparisons can be made:

- between farmers;
- within the same farm over time;
- between different technologies on the same enterprise.

Gross margin can be used as a planning tool in evaluating the potential value of alternative technologies and/or enterprises. This will help farmers make informed decisions about their future farming activities and about opportunities as they present themselves.

The advantages of gross margin analysis include:

- information required is simple and easily collected;
- analysis is easy to complete;
- results are easy for both farmers and extension workers to understand.

As will be discussed in more detail later, gross margins ensure that values for non-purchased inputs such as family labour, draft power and manure are included among the variable costs. When this is done, farmers begin to value these inputs more accurately. This in turn will help them make better decisions about non-purchased inputs.

The results from the gross margin analysis can be useful in helping:

- farmers decide whether or not to adapt a technology or change a farm enterprise;
- farmers decide whether or not to introduce new market-oriented enterprises;
- extension workers decide whether or not to encourage farmers to adopt a particular technology or enterprise.

Gross margin budget (continued)

Calculating a gross margin

The basic formula for calculating a gross margin is as follows:

Gross margin = Gross income - Variable costs

Gross income (value of production) for crop enterprises

Calculating gross income is different for annual crop enterprises and livestock and perennial crop enterprises. We shall start with crop enterprises. The gross income or value of production is the money received from the sales of produce plus the value of unsold produce.

The gross income is obtained by multiplying the physical output by the farmgate price of the product and valuing home consumption. The farmgate represents the point of first sale.

Gross income = Yield × Farmgate price

It is generally incorrect to calculate gross income for the enterprise by using the price at which the farmer sold the produce in the marketplace or elsewhere off the farm. If the farmgate price is not known, then it can be calculated by deducting the costs of transportation and other marketing expenses from the market price.

For example, let us say that a farmer had harvested 3 tonnes of cassava. Most of it was sold at the market for $200 per tonne. It cost $10 per tonne to take the cassava to the market. There were no other marketing expenses. The outcome of this is as follows:

Farmgate price: $200/tonne - $10/tonne = $190/tonne
Gross income was: $190/tonne x 3 tonnes = $570

Gross margin budget (continued)

When farmers are planning, they will not yet have sales, consumption and storage data for the crop that has not yet been planted. In this case they will want to estimate the gross income. To do this, they need data about yield and price. If they know that their farm produced 3 tonnes per ha last year and know the average farmgate price was $200 per tonne, then by using the following formula they can estimate the gross income per ha.

No matter how much farmers sell, consume or store the value of the crop (gross income) can be determined by multiplying yield by price.

In most cases, this simple calculation is adequate for basic comparisons and decision-making. However, a more detailed understanding of gross income highlights that the gross income from an enterprise comprises a number of sources of income:

- produce sold;
- produce consumed by the farmer's family/workers;
- the produce put into storage;
- by-products.

Produce sold

The money received from the amount of the product of the farm sold on the market is part of the gross income of the enterprise. Gross income from sales is calculated as follows:

Income from sales = **Quantity of produce sold** × **Farmgate price**

Gross margin budget (continued)

Produce consumed by the farmer's family/workers

Not all of the product produced on a farm will be sold. Some will be consumed (eaten) by the farm family or the workers. Even though this does not bring in cash to the farm, the product has a value and therefore is included in the gross income. The contribution to gross income from produce consumed is equal to the value of the produce consumed. This value is calculated as follows:

Value of produce consumed	=	Quantity of produce consumed	×	Farmgate price

The produce put into storage

Again, in some cases, some of the harvest will be stored. This may later be sold or consumed. But either way, it has a value and therefore contributes to the gross income for the enterprise. The contribution to gross income from produce stored is equal to the value of the produce stored. This value is calculated as follows:

Value of produce stored	=	Quantity of produce stored	×	Farmgate price

By-products

In addition to the main produce, the enterprise may also produce by-products. An example is stover from maize or the manure from a livestock enterprise. These by-products can be sold or used on the same or another enterprise.

Gross margin budget (continued)

In either case, they have value. If some or all of the by-product is sold, the contribution to gross income is equal to the income received from the sale of the by-product. This is calculated as follows:

Income from by-product = **Quantity of by-product sold** × **Price of by-product**

If some or all of the by-product is used on the farm, the contribution to gross income from by-products is equal to the value of the by-products. This value is calculated as follows:

Value of by-product used on the farm = **Quantity of by-product used** × **Price of by-product**

Thus the total value of the by-product is calculated as follows:

Total value of by-product used on the farm = **Income from by-product sold** + **Value of by-product used on the farm**

Therefore, the gross income of an enterprise is calculated as follows:

Income from sales
\+ ***Value of produce consumed***
\+ ***Value of stored produce***
\+ ***Value of by-products on the farm***

= ***Total gross income***

Gross margin budget (continued)

The next example calculates a gross income using some of the income sources discussed above.

Example
Gross income of one ha of maize

Maize grain sold	11 bags of 90 kg at $13/bag	=	$143.00
Grain consumed at home	2 bags of 90 kg at $13/bag	=	$26.00
Stover sold as by-products	5 tonnes at $9/tonne	=	$45.00
	Gross income	=	$214.00

Gross income for livestock enterprises and permanent crops

Farming activities for perennial crops (e.g. fruit trees) and livestock enterprises extend over more than a single year. In these cases, gross income is defined as the difference between the closing valuation of produce stored, plus sales (including marketable produce and by-products consumed on the farm) and the opening valuation of produce stored plus purchases.

Example of a gross income calculation for a livestock enterprise format

	Item	$	
	Closing valuation (at the end of year)		
-	Opening valuation (at the beginning of year)		
=	**Increase/decrease in value of stock (inventory change)**		**(A)**
	Income from sales (livestock)		
+	Income from sales (by-products)		
	Value of products used for home consumption		
=	Value of sales and consumption		
-	Purchases of animals (during the year)		
=	**Net sales**		**(B)**
	Gross income		**(A+B)**

Gross margin budget (continued)

The gross income calculated for perennial crops would use the same calculation method. Changes in value of tree crops and the value of produce stored on the farm would be part of the gross income calculation.

Because it is possible to produce more than a single short-term crop from the same land area within a year, a distinction needs to be made between gross income for a particular season and gross income for a particular year. The gross income of a crop for the year may be the sum of the gross income for two or more crops grown during the year.

Variable costs

Remember, gross margin is gross income less the variable costs.

Gross margin = **Gross income** - **Variable costs**

Costs associated with a farm can be divided into two kinds of costs: variable costs and fixed costs.

Total costs = **Variable costs** + **Fixed costs**

Variable costs. Variable costs are the costs of actual production. They apply to specific enterprises on the farm. These costs vary as output changes. These costs occur only if something is produced. They do not occur if nothing is produced. For example, labour is required in crop production. If a farmer has to hire labour, then as production is increased the need for hired labour also increases. If no yield is produced there is no need for hired labour.

Gross margin budget (continued)

Typical variable costs include the cost of seeds, fertilizers, sprays, fuel for machines, hired labour, livestock feed, and veterinary costs. Variable costs can be allocated to specific enterprises. An example of variable costs for maize is shown below.

Example

Variable costs for maize

Item	Unit	Quantity	Unit price ($)	Amount ($)
Seed	kg	10	0.90	9.00
Fertilizer	50 kg per bag	1	13.00	13.00
Manure	Tonnes	4	13.00	52.00
Pesticide	kg	4	2.00	8.00
			Total inputs and materials	82.00
Labour				
Land preparation	person-days	20	0.70	14.00
Planting/manuring	person-days	10	0.60	6.00
Weeding	person-days	15	0.60	9.00
Harvesting/ threshing	person-days	10	0.60	6.00
			Total labour	35.00
			Total variable costs	**117.00**

Fixed costs. The fixed costs apply to the farm as a whole. Fixed costs are costs that do not vary with changes in production output of a specific type of crop or livestock production. Fixed costs remain the same regardless of the output. Even if there is no output, there will still be fixed costs.

Gross margin budget (continued)

Fixed costs include, for example, the cost of purchasing a tractor or a piece of equipment that is used on the whole farm and the cost of a head of livestock. Most of the costs of keeping a tractor, equipment and draft cattle remain the same if the item is or is not fully used. Fixed costs are also known as overheads.

Fixed costs also include permanent labour, management and depreciation. (Depreciation is the cost of the declining value of capital items such as tractors, machinery and buildings. Depreciation is usually calculated as an annual payment. An example of the way depreciation is calculated is given at the end of the handout.)

Calculating gross margins

Basic calculation

As stated earlier, the gross margin for a crop or livestock enterprise is obtained by subtracting the variable costs from its gross income.

Gross margin = **Gross income** - **Variable costs**

Costs and income analysis are usually done after the harvesting of the crop at the end of the cropping season or year. In the case of perennial harvest, yields and prices vary during the year. Therefore, the time of analysing costs and income should be done for a given crop year. In such cases, it is important that inputs and output refer to the same year being considered for analysis.

Gross margin budget (continued)

A calculation of a gross margin (using the figures from the previous examples) for 1 ha of maize is shown below.

Gross income		$214.00
Variable costs	-	$117.00
Gross margin	=	$ 97.00

Scaling to units for comparison

To be able to make comparisons, the gross margin calculations must be made on the same unit basis, such as hectare, labour or water. If the information available to farmers is for more or less than one unit, then they need to convert it to one unit. See the two examples below.

Example

Farmer 1 with 0.75 ha of millet

At the end of a season, a check of the records finds the following:

Source of income	Quantity (Tonne)	Farmgate price ($)	Value ($)
Sales at market	1.0	200	200
Consumed	0.5	200	100
Stored	0.5	200	100
By-product	0.2	50	10

Total yield

Millet	2.0
By-product	0.2

Gross income **410**

Gross margin budget (continued)

The gross income for the millet enterprise is $410. Let us say that variable costs are $300. Using our formula, we find:

Gross income		$410
Variable costs	-	$300
Gross margin	=	$110

The gross margin from 0.75 ha is $110. But to make a comparison it is necessary to convert this to a unit basis, in this case ha. To do this, simply divide the actual gross margin by the actual hectares.

$110/0.75 ha = $147/1 ha

This farmer has a gross margin of $147 per hectare.

Example
Farmer 2 with 1.5 ha of millet

At the end of a season, a check of the records finds the following:

Source of income	Quantity (Tonne)	Farmgate price ($)	Value ($)
Sales at market	2.0	200	400
Consumed	0.5	200	100
Stored	1.5	200	300
By-product	0.5	50	25

Total yield

Millet	5.0
By-product	0.5

Gross income **825**

Gross margin budget (continued)

Let us say that this farmer has a total variable cost of $700. This would give us the following:

Gross income	$825
Variable costs	- $700
Gross margin	= $125

This gross margin of $125 is for 1.5 hectares. Therefore, if we want to compare Farmer 1 with Farmer 2, we need to convert it to a gross margin for 1 hectare:

$125/1.5 ha = $83.3/1 ha

This farmer has a gross margin of $83.3/ha.

The *total* gross margin for Farmer 1 is less than the *total* gross margin for Farmer 2. However, when converted to a unit basis, we find that although the enterprise is smaller, Farmer 1 has a higher gross margin per hectare than Farmer 2. Farmer 1 has a gross margin of $147/ha and Farmer 2 has a gross margin of $83.3/ha. Although Farmer 2 has a larger final income, Farmer 1 has a more profitable farm. It is likely that with more land, Farmer 1 would earn more income than Farmer 2.

The unit of measure for a gross margin is usually the unit of the most limiting factor. This may include land, labour, water or money invested. In the case of crops (and most trees), the unit of measure is normally per hectare (or acre) — that is, based on land. In the case of livestock, the unit of measure is production per head for livestock. And sometimes in the case of trees, the unit of measure is production per tree.

Gross margin budget (continued)

Converting from units to determine actual income

In many cases, the farmer will obtain gross margin information about a crop where the information is presented on a unit basis. A farmer who wants to know what the actual gross margin would really be needs to convert from a unit to the actual size. To do this, multiply the per hectare gross income by the actual number of hectares. Two different cases are shown in the next example.

Example
The gross margin for maize in the area is $200 per hectare

Case 1 — Farmer 1 has 0.8 ha, which yield...

0.8 ha × $200/1 ha = $160/0.8 ha

Case 2 — Farmer 2 has 1.6 ha, which yield...

1.6 ha × $200/1 ha = $320/1.6 ha

Farmer 1 can expect to have a total gross margin of $160, while Farmer 2 will have a total gross margin of $320.

Farm profit

The farm profit (or whole farm income) is an estimate of the overall profitability of the farm as a whole. Farm profit is calculated by combining the gross margins of each of the farm enterprises and deducting fixed costs. The final figure represents the profit or income of the farm. The income from the farm is necessary to cover the family living expenses. The basic formula is as follows:

Whole farm income (profit) = **Gross margins of all enterprises** - **Fixed costs**

Gross margin budget (continued)

The following example shows how to arrive at the whole farm profit.

Example
Calculation of whole farm profit

A farmer with 3.5 ha of land has the following gross margins from three enterprises:

Enterprise	Ha	Gross margin per hectare ($)	Gross margin ($)
Millet	1.5	150	225
Maize	0.5	120	60
Groundnuts	1.5	200	300
		Total	**585**

The whole farm gross margin is $585. To calculate the whole farm profit, deduct the fixed costs.

Whole farm gross margin	$585
Fixed costs	- $200
Farm profit	= $385

Because the fixed costs do not change very much with changes in production, if the farmer can increase the gross margins on the farm, profits will automatically increase. For this reason it is possible to plan in terms of gross margins and leave the farm profit to look after itself.

Because most small-scale farmers in Africa have very few fixed costs, the gross margin is a very useful indicator of overall farm profit. Farmers need only to plan in terms of gross margins.

Gross margin budget (continued)

Below is a calculation of the whole farm gross margin for a farm with livestock and crops.

Enterprise	Unit	Gross margin per unit ($)	Gross margin ($)
Millet	1.5 ha	150	225
Maize	0.5 ha	120	60
Groundnuts	1.5 ha	200	300
Goats	2 TLSU*	25	50
Total	3.5 Ha 2 TLSU		635
		Fixed costs	*200*
		Farm profit	**435**

*TLSU: Livestock units (in this case 2 goats)

Note

The unit for crops is hectares and the unit for the livestock is LSU (livestock units). The actual gross margin is calculated by multiplying the GM per unit by the number of units.

Summary points

- Gross margin measures the relative profitability of the enterprise. It does not measure the actual profit. It will guide farmers on which enterprise to engage in given the resources available. In order to calculate gross margin, it is necessary to sort costs into variable and fixed costs. The gross margin allocates the variable costs to their respective enterprises.

- If land is the most limiting resource, gross margin analysis is usually done on a per hectare basis for crops and on a per head basis for livestock.

Gross margin budget (continued)

- In many cases, another resource, such as family labour, might be the limiting resource. For example, some farmers might have extra land, but not enough family members to do all the required work. In this case, gross margins can be calculated leaving labour out of the calculation until the end. (This is calculated in Handout 4.2B)

- To calculate the profit for the whole farm, the gross margins for each of the enterprises are combined. From this total, the fixed costs are deducted. This shows the profit for the farm.

Additional reading

Summary of gross income

The factors that influence the gross income of an enterprise can be summarized as:

- The value of produce sold both directly or via intermediaries;
- The value of by-products and produce re-used on the farm — produce that is used again as input on the same farm (e.g. maize produced as grain and used as feed for the livestock enterprise);
- The value of produce consumed by farmers and their families (e.g. rice, beans, cassava) and valued at the farmgate price;
- The gain/loss in value of tree crops and livestock — increase or decrease in value of tree crops and livestock. It is the difference in value at the beginning of the year (opening valuation) and the value at the end of the year (closing valuation).

Gross margin budget (continued)

- The gain/loss in value of stored farm produce — in the case of products from a previous agricultural season and stored ready to be sold (e.g. cassava, yam). This is the difference in value from the time that the produce is stored to the time that it is sold.

More about variable costs — assigning (imputing) the value of key variable inputs

Cash and non-cash costs. Costs can be classified as cash or non-cash. Cash costs are those costs where the farmer actually pays out of pocket. Non-cash costs are those costs incurred but no actual cash payment is made. Examples of cash costs are fertilizers, farm chemicals purchased, hired labour or fuel and oil. Examples of non-cash costs are unpaid family labour, own seeds that are stored, use of draught animals owned by the farmer. The following notes refer to the valuation of non-cash items.

The estimation of variable costs is a little complicated by the need to assign value to inputs to the farm that are not 'bought' or 'hired' from the input supply market.

Family labour. Family labour is an example of an input that is not bought or hired. Family labour is an important input for most farmers, particularly when they are running farming systems that are only partially mechanized.

Different enterprises require very different levels of labour input. For example, vegetables require a much higher level of labour input than maize. Therefore, it would be somewhat unreasonable to compare the gross margin of vegetables to the gross margin of maize without taking into account the labour required.

Gross margin budget (continued)

In the calculation of the gross margin, the payment for hired labour is already taken into account as a part of the variable costs. However, in many cases, the labour on small farms comes largely from family sources. In order to make meaningful comparisons of different enterprises or of technologies relating to the same enterprise, it is necessary to estimate a cost for this family labour.

Estimating the cost of family labour is done by valuing family labour at what it would cost to hire such labour instead of using the family labour.

If little hired labour is used in the area then the *opportunity cost* of labour would not be very high. We say that the cost of family labour is *imputed* (assigned a value). The time required for different farm operations would need to be accounted for and the result multiplied by the opportunity cost. The less mechanized the farming is the more relevant it is to impute a value for family labour.

Labour opportunity cost

The real cost of family labour is the opportunity cost of family labour. Opportunity cost can be defined as the most valuable alternative you give up when you make a decision. For example, if a farmer works part time in town and decides to take a day off in order to work on the farm, in reality the farmer will be giving up the wages that would have been earned in town. This cost is just as real as paying a hired labourer to do the work for the farmer on the farm and often it is more than the cost of hiring labour.

Gross margin budget (continued)

Land

Sometimes an opportunity cost for land is included in the gross margin especially when comparing results from a number of different farmers — some of whom rent their land. To make a valid comparison the opportunity cost of land is imputed by what it would cost to rent it.

More about fixed costs — depreciation

If you buy something new, use it, and then try to sell it again you will not get the same price you paid for it. This loss in value is called *depreciation*. Depreciation is an important factor to consider when looking at the fixed costs of a farm.

Farm buildings, tools, machinery and equipment are expensive to buy. Such items are called *durable capital items*. We expect them to last a certain period of time before they need to be replaced. This period of time (during which we use the item) is called its *useful life*.

If the cost of these items were applied to a crop or livestock enterprise all at one time, then you would not get a true picture of how profitable that crop or livestock is. For example, if the total cost of a tractor were added to the other costs of a particular crop in one year, then the enterprise is likely to appear to be unprofitable. To give a truer picture of profitability, the cost of durable capital items has to be applied over several years.

A method is used to spread the costs of durable capital items over their useful life. It gives us a fairly accurate idea of what it costs to use the item for a year. Let's look at an example.

Gross margin budget (continued)

Say the cost of a tractor is $35 000. It has a useful life of 7 years. Therefore, each year, one-seventh of the cost of the tractor is taken off its value and added to the enterprise costs. The formula is as follows:

$$\textbf{Depreciation/year} = \frac{\textbf{Purchase price (\$)}}{\textbf{Useful life (years)}}$$

In the example given we get the following:

$$\frac{\$35\,000}{7 \text{ years}} = \$5\,000 \text{ per year}$$

Each year, for 7 years, $5 000 will be a fixed cost to the farm. This fixed cost remains on a yearly basis until the tractor comes to the end of its life.

Space for notes and questions for the facilitator

Steps for calculating gross margins

A gross margin is calculated separately for each enterprise.

1. Determine an average yield per hectare for the enterprise.

2. Determine the average farmgate price for the enterprise. (The farmer or extension worker will need to take the information on prices available in the market and deduct all of the marketing costs from the farmgate to the market.)

3. Calculate the gross income from sales per hectare (i.e. the average yield per hectare multiplied by the price at the farmgate).

4. Calculate the value of consumed and stored produce.

5. Calculate the non-labour variable cash costs of inputs and materials per hectare for the enterprise. These should include items such as the costs of seeds, fertilizer, pesticides, machinery services.

6. Estimate the labour costs per hectare per operation for each enterprise (e.g. land preparation, sowing, weeding or harvesting).

   First: Determine the number of hired person-days required per operation per hectare.

   Second: Determine the rate of pay for hired labour.

   Note: In some countries there is different rate of pay per hectare per operation. If this is the case, then the costs will be calculated per hectare per operation.

   In some countries labour is hired at a fixed rate per day. If this is the case, then the costs will be calculated on the total person-days.

Steps for calculating gross margin (continued)

Third: Calculate the cost of hired labour by multiplying the number of hired person-days per activity by the current wage rate for each activity.

7. Calculate the cost of family labour by multiplying the number of family labour person-days per activity by the opportunity cost of family labour (i.e. the current wage rate, as in step 6).

8. Calculate the total variable costs by summing the cost of inputs and materials, hired labour and family labour.

9. Calculate the gross margin per hectare by subtracting variable costs from the gross income.

10. Repeat this calculation for each enterprise on the farm.

Note

The procedure for calculating the gross margin in terms of returns to labour or per labour-day is similar to the above procedures except that the total family labour is not included. Returns to labour are calculated by taking total income less variable costs and dividing by the total labour days used.

$$\text{Returns to family labour} = \frac{\text{Total income - Variable costs}}{\text{Total family labour-days}}$$

11. Compare the gross margin with the daily rate of labour.

Worksheet — Gross margin template: actual hectares

Gross margin for: _____ Enterprise Actual ha: ___ **(A)**

Income

Item	Quantity (B)	Price (C)	Value (D) [B × C]
Total income from sales (E)			

Variable costs

Item	Quantity (F)	Unit cost (G)	Cost (H) [F × C]
Total variable costs (I) [sum of H]			
Enterprise gross margin (J) [H - I]			
Gross margin per hectare (J/A)			

Worksheet — Gross margin template: one hectare

Gross margin for: _____ Enterprise

Income

Item	Quantity	Price	Value
		Total income from sales	

Variable costs

Item	Quantity	Unit cost	Cost
		Total variable costs	
		Enterprise gross margin per hectare	

Worksheet — Gross margin template: livestock enterprise

Income

	Item	$	
	Closing valuation (at the end of year)		
-	Opening valuation (at the beginning of year)		
=	**Increase/decrease in value of stock (inventory change)**		**(A)**
	Income from sales (livestock)		
+	Income from sales (by-products)		
	Value of products used for home consumption		
=	Value of sales and consumption		
-	Purchases of animals (during the year)		
=	**Net sales**		**(B)**
	Gross income		**(A+B)**

Worksheet — Gross margin template: livestock enterprise (continued)

Variable costs

Item	Quantity	Unit cost	Cost

Total variable costs	
Enterprise gross margin per herd	
No. of livestock head	
Gross margin per head	

Preparing for Session 4.3
Marketing margins

Learning outcomes
Understanding (i) the purpose and instrument in diagnosis, (ii) when to use the method, (iii) how to carry out the methods

Training aids
Exercise 4.3A (Using marketing margins to choose a market)
Handout 4.3A (Marketing margins)

Notes

Marketing margins

In this session particpiants will learn the basics of calculating marketing margins. Through this they will be able to help farmers primarily to understand the reason for the often large difference between the prices they receive and the market prices.

Opening statement

The varying costs incurred along the marketing chain are often misunderstood. To better understand these let us explore the use of measured marketing margins. We will now review the main parts in Handout 4.3A (Marketing margins). Feel free to ask questions.

The outline on the following pages is provided to help the facilitator conduct the review.

Outline of Handout 4.3A (Marketing margins)

What are marketing margins?

- These are the differences between the value of a product at one stage in the marketing process and the value of the same product at another stage.
- Measuring this margin shows how much has been paid for the marketing services of the product.

When are marketing margins used?

- Calculating marketing costs and margins can help the farmer and/or extension worker decide which marketing procedure will provide the greatest benefit.
- Added or marginal costs must result in at least an equal marginal return; otherwise, the market is not profitable.

What are marketing costs and how are they calculated?

Marketing costs are the costs incurred when moving produce from the farm to the market. There are several stages involved. In each stage there are costs incurred. The stages are:

- produce preparation (cleaning, sorting and grading);
- packaging;
- handling (loading and unloading);
- transport;
- storage;
- losses (quality-related; quantity-related).

Other marketing costs

There are many other relatively small costs incurred when marketing agricultural produce. These costs include *fees*, *commissions* and *unofficial payments*. While they may be low in one country, they may make up a sizeable proportion of costs in another. Some examples follow:

- People using markets may have to pay market fees.
- People using markets may have to pay to have the produce weighed.
- Traders normally have to be licensed and pay licence fees.
- In some markets, wholesalers charge commissions.
- Taxes may have to be paid.
- Sometimes, *bribes* are needed to get produce through roadblocks or to get permission to operate a business.

All of these costs need to be included in the calculations.

How is the marketing margin used?

To choose between marketing channels, farmers can compare the marketing margins of the options. To do the calculations they need to know two things:

- the price that their produce is likely to sell for in the market;
- the marketing costs incurred to sell it in the market.

Profitability

- The farmer must calculate the impact of the marketing costs on farm profitability.
- If the additional costs of marketing do not bring at least an equal return in income (from a better price at a better market), then another marketing strategy should be considered or perhaps another product.

Note

The exercise in this session requires a list of commodities, market prices and marketing costs. The commodity prices should be realistic prices for each commodity as offered by a trader at the farm or at a wholesale market. The marketing costs should be related to marketing the product and should inculde handling, fees, transport among others.

Exercise introduction

In Exercise 4.3A (Using marketing margins to choose a market), we will choose marketing options by calculating marketing margins.

Exercise 4.3A
Using marketing margins to choose a market

Purpose: To decide on a marketing strategy for a given commodity based on the calculation of a marketing margin. (Participants should have read Handout 4.3A prior to this exercise.)

Methods: Calculations.

Materials: (i) Pen and paper, (ii) calculator, (iii) flip chart paper or newsprint, (iv) prices and marketing costs list of pre-selected commodities.

Allow about 120 minutes for this exercise

Procedure

1. Divide the group into their farm teams.

2. Assign each team a commodity and give each team the relevant price/ marketing costs list.

3. Each team must decide between selling the assigned commodity to a trader at the farm or at a wholesale market, or auction. To make the decision, teams will need to calculate the marketing margin for its allocated commodity. To do the calculations, they should follow the example presented in Handout 4.3A. They will need to calculate the following:

- quantity of each commodity to be sold;
- weighted average price per commodity;
- total marketing costs;
- marketing margin.

Exercise 4.3A (continued)

4. After completing the calculations, each team should discuss the results and decide whether they will sell to the trader or to the market themselves. They should record the decision and the reason(s) for the decision.

5. Ask each team to report their decisions and their reasons to the whole group. Discuss the results, paying special attention to those who decide not to market directly even when the marketing margin is higher than the price being offered by the trader.

Space for notes and questions for the facilitator

Marketing margins

Why is the price of a product in a shop or retail market often so much higher than the price paid to the farmer?

Getting a product from the farm to the consumer is part of the marketing process. Each of the different steps involved in moving produce from the farm to the consumer, along the *marketing chain* involves costs.

The costs of marketing are not always fully understood by farmers or consumers. We can understand that traders spend money on transport or packaging but there are many other less obvious costs. Because these costs are not always visible, those doing the marketing are often accused of making unreasonable profits. Farmers look at the prices paid to them by traders and compare them with the prices consumers pay for the same product. They often assume that farmers and consumers are being exploited. Likewise, consumers often feel prices are too high. To understand the difference between farmgate price and the final price of a product, we will look at marketing margins.

What are marketing margins?

A marketing margin is the difference between the value of a product at one stage in the marketing process and the value of the same product at another stage. Measuring this margin shows how much has been paid for the marketing services for the product at that stage of the marketing process. It is the added cost of marketing.

Marketing margins (continued)

When are marketing margins used?

Farmers producing for the market should be aware of the choices that are open to them with respect to marketing. For example, it may be possible for a farmer to sell horticultural produce in the local fresh market, or, alternatively, to sell to agroprocessing plants for canning or producing juices. Some farmers may consider selling to exporters. Farmers may also choose to work together as a group to market their produce jointly. In some cases they may decide to market through traders and wholesalers. In other cases they may decide to market directly to the retailer.

Calculating marketing costs and margins can help the farmer and/or extension worker decide which marketing procedure will give the best benefit. Added or marginal costs must result in at least an equal marginal return; otherwise, the market is not profitable.

What are marketing costs and how are they calculated?

Marketing costs are the costs incurred when moving produce from the farm to the market. There are several stages involved, in each there are costs incurred. The stages are:

- produce preparation
- packaging
- handling
- transport
- storage
- losses

Produce preparation

The first marketing cost incurred is *produce preparation*. This involves cleaning, sorting and grading. This may be done on or off the farm. Either way, the cost associated with preparation is a marketing cost.

Marketing margins (continued)

Packaging

The next cost that is normally faced is *packaging*. Types of packaging used may range from simple jute bags to plastic packaging for the direct transport of fruits to consumers in supermarkets. This too may be done on or off the farm.

Handling

Handling costs are incurred at all stages of the marketing chain. They include loading and unloading. Each time a product is handled the cost per kilogram is small. But a product may be handled many times before it reaches the market. The total of all of these small handling costs can end up being quite substantial.

Examples of handling processes

- farmer or labourer loads produce onto oxcart or other transport;
- labourer unloads produce at assembly market and it is weighed;
- a wholesaler or employee repackages the produce in the wholesaler's containers;
- produce is carried to and loaded on the wholesaler's truck;
- produce is unloaded at wholesale market and taken to premises occupied by the wholesaler's agent and weighed;
- produce is unpacked and sorted or graded;
- produce is repacked in the retailer's containers;
- produce is carried to the retailer's transport;
- produce is unloaded at the retailer's store;
- produce is repackaged into packaging used at the retailer's store.

Marketing margins (continued)

Transport

Once packed, produce is *transported*. Transport costs are incurred by farmers when they take their produce to the market. Sometimes transport costs are very clear because they involve the direct payment by a farmer to the transport owner each time a delivery is made. In other cases these costs are less direct, for example when the farmers own and operate their own vehicles. In the latter case, the farmer needs to determine the running costs of transport per kilometre. When the running costs and the quantity of products carried per trip are known, the cost of transport per kilogram or per tonne of product can be calculated. To calculate transport costs using their own vehicles, farmers need to know:

- vehicle running cost/km ($/km);
- quantity that can be carried per trip (kg or tonne/trip);
- distance to the market (km).

Example

Calculation of transport costs

Let us say that the farmer has a vehicle that can carry 200 kg of produce per trip. The running cost of the vehicle is $0.50/km. It is 10 km to the market.

	Detail	Amount	Unit
(A)	Running cost for transport	$0.50	per km
(B)	Distance to market	10	km
(C)	Cost per trip **(A × B)**	$5.00	per trip
(D)	Mass/weight per trip	200	kg
(E)	Cost per kg **(C/D)**	$0.025	per kg
(F)	Cost per tonne **(E × 1 000)**	$25.00	per tonne

* These are the costs per kg or tonne to transport 200 kg. If less than 200 kg is transported, then the costs will be higher. Thus, one way to reduce marketing costs is to use transport optimally.

Marketing margins (continued)

Storage

Storage is an important cost for many products. The main purpose of storage is to extend the availability of produce over a longer period than if it were sold immediately after harvest. The assumption behind storing produce for the market is that the price will rise sufficiently while the product is in store to cover the costs of storage. The costs of storage will vary, but they are usually very clear because they are paid for directly.

Losses

Losses are common when marketing agricultural produce. Even if nothing is actually thrown away products may lose weight in storage and transit. Post-harvest losses of produce, particularly fresh produce, can be substantial, both in terms of quantity and quality. This will affect both the amount of product for sale and the selling prices. The following are common causes of post-harvest (marketing) losses divided in terms of quantity and quality.

1. Quantity-related losses

    - Large quantities of the product on the market or 'gluts' (as often happens during the main season) often means that much will be thrown away unsold.
    - Moisture loss (reduces weight of the product, e.g. grains, fruit and vegetables).

2. Quality-related losses

    - Produce damaged while being handled or transported.
    - Produce deteriorates (including over-ripening) over the period it is waiting to be sold.
    - Moisture loss (particularly with fruit and vegetables).

Marketing margins (continued)

Example

The cost of loss

A trader purchases 2 kg of green peppers from a farmer at $5.00/kg. When the trader gets to market only 1.8 kg are still available for sale (e.g. a loss of 10 percent). The selling price of green peppers is $9.00/kg. Marketing costs are an additional $2.00/kg for the 2 kg of green peppers purchased.

Quantity lost	Market price of product	Value of loss
0.2 kg	$9.00/kg	$1.80

The impact of this loss on the margin to the trader can be calculated as follows:

Activity	Quantity	Price		Total	20 kg purchase	
Income from sales	1.8 kg	$9.00/kg		$16.20	$162.00	**(A)**
Purchases	2 kg	$5.00/kg	$10.00		$100.00	
Packing and transport	2 kg	$2.00/kg	$4.00		$40.00	
			Costs	**$14.00**	$140.00	**(B)**
			Margin to the trader	**$2.20**	**$22.00**	**(A-B)**

If the trader had prevented the loss, the margin would have been $4.00 ($2.20 + $1.80). This may seem insignificant, but if (as shown in the right-hand column) the trader had purchased 20 kg instead of 2 kg, their value of the loss would have been $18.00 and their margin $22.00 instead of $40.00. This is a substantial cost.

Marketing margins (continued)

Other marketing costs

There are many other relatively small costs incurred when marketing agricultural produce. These costs include *fees*, *commissions* and *unofficial payments*. While they may be low in one country they may make up a sizeable proportion of costs in another. Some examples follow:

- People using markets may have to pay market fees.
- People using markets may have to pay to have the produce weighed.
- Traders normally have to be licensed and pay licence fees.
- In some markets, wholesalers charge commissions.
- Taxes may have to be paid.
- Sometimes *bribes* are needed to get produce through roadblocks or to get permission to operate a business.

All of these costs need to be included in the calculations.

More on marketing costs

There are two types of marketing costs: *variable marketing costs* and *fixed marketing costs*. Variable costs are costs that are incurred if marketing activities are carried out (e.g. transport costs from the farm to the market, handling costs, packaging materials, parking fees, commissions based on weight). Fixed costs are costs that will be paid by the farmer whether or not marketing activities are carried out. Fixed marketing costs include taxes, insurance, fixed rent for the stalls, fixed salary of the workers involved in marketing, depreciation of the trucks, weighing scale and other equipment.

Marketing margins (continued)

Calculations

Once all the marketing costs have been calculated it is then necessary to put them together to work out the total marketing costs for the farmer.

Marketing margins are related to the prices received for produce. Costs have to be related to these prices. Farmers selling their produce directly to the market are likely to get different prices at different times of the year, and even at different times of the day. Farmers need to understand how the markets they use operate, because this will affect the marketing margins.

The marketing margin is the difference between the prices farmers receive for their produce and the costs incurred in marketing.

Example

Farmer selling tomatoes in the nearest rural market

A farmer harvests 100 kg of tomatoes. Of this volume there is a 10 percent because of damage and other causes. The remaining tomatoes (90 kg) are sold at the market at the prices shown in the table.

Quantity	Price	Income from sales
50 kg	$1.10/kg	$55.00
20 kg	$1.00/kg	$20.00
15 kg	$0.80/kg	$12.00
5 kg	$0.60/kg	$3.00
10 kg	not sold	$0.00
	Total income	**$90.00**

Then the average selling price per kilogram is ... **$90 ÷ 100 = $0.9**

Marketing margins (continued)

The farmer incurs other marketing costs charged over the season. These are:

Marketing cost	Amount
Market fees	$1.00
Handling labour	$2.00
Cost on route	$1.00
Transport	$0.50/10 kg box ($0.05/kg)
Packaging	$0.50/10 kg box ($0.05/kg)

Given all this information, it is now possible to calculate the marketing margin.

	Value ($/kg)	
Quantity sold		
0.9 kg × weighted average selling price of $0.90 per kg	0.81	**(A)**
Marketing costs		
Market fees	0.01	
Labour employed by farmer to pack, load and unload	0.02	
Cost on route	0.01	
Transport to wholesale market	0.05	
Packaging	0.05	
Total marketing costs	0.14	**(B)**
Marketing margin	**0.67**	**(A-B)**

Note

The market margin calculation should be conducted on a unit weight basis. You should be careful to convert all of the items to the same base. In this example the calculation is carried on a per kilogram basis.

Marketing margins (continued)

Exercise
How to use the marketing margin

Joan has a choice about marketing. She can sell directly to wholesale or local markets. She can also sell to traders who come to her farm. To decide which is the better option, she should be able to compare the marketing margins of the options.

However Joan will need to do some calculations in order to decide what is more worthwhile. She needs to know two things:

- the price that their produce is likely to sell for in the market;
- the marketing costs incurred to sell it in the market.

Joan will need to calculate the impact of the marketing costs on the profitability of her farm. If the additional costs of marketing do not bring her at least an equal return in income (from a better price at a better market), then she should consider another marketing strategy or perhaps another product.

Preparing for Session 4.4
Break-even budgets

Learning outcomes
Understanding (i) the purpose of the instrument,
(ii) when to use the method,
(iii) how to carry out the methods

Training aids
Exercise 4.4A (Break-even analysis case)
Handout 4.4A (Break-even budgets)
Handout 4.4B (Case exercise and worksheet — A break-even analysis)
Handout 4.4C (Solutions — A break-even analysis)

Notes

Break-even budgets

This session introduces a tool that extension workers can use to help farmers determine the break-even points of their enterprises. One use of this is to assist farmers become price-makers, not price-takers. The session will define the concept of breaking even and define a break-even budget. It will examine when a break-even budget should be used and demonstrate how it is calculated. Examples will be given of a break-even yield and a break-even price.

Opening statement

Today we will begin by reviewing the main points in Handout 4.4A (Break-even budgets). By understanding this technique we can analyse the relationship between costs and income at different prices. Feel free to ask questions at any time.

The outline on the following page is provided to help the facilitator conduct the review.

Review of Handout 4.4A (Break-even budgets)

What is a break-even budget?

- It is a technique for studying the relationship between costs and income at different levels of production.
- It estimates the maximum acceptable level of a cost item or the minimum acceptable level of a benefit, given an estimated level of cost.
- It looks at the level of the activity where income equals total cost, so that no profit (margin) is made. Break-even occurs where total cost and gross revenue are equal.

What is break-even yield?

The yield required to recover all the costs incurred in production at given prices of the product and input costs.

$$\text{Break-even yield (BY)} = \frac{\text{Total variable cost/ha}}{\text{Product price}}$$

What is break-even price?

The product price needed to recover all variable costs incurred in production at a given output level and cost of input.

$$\text{Break-even price (BP)} = \frac{\text{Total variable cost/ha}}{\text{Expected yield/ha}}$$

Exercise introduction

In Exercise 4.4A (Break-even analysis case) we will go over Handout 4.4B (Case exercise — a break-even analysis) to practice calculating gross margin, and the break-even yield and break-even price.

Exercise 4.4A
Break-even analysis case

Purpose: To practise break-even calculations. (Participants should have read Handout 4.4A prior to this exercise.)

Method: Case study analysis.

Materials: (i) Handouts 4.4B (Case exercise — A break-even analysis), C (Solutions — A break-even analysis), (ii) pencil and paper, (iii) calculators.

Allow about 30 minutes for this exercise
(depending on their skill with mathematics and tables)

Procedure

1. Distribute Handout 4.4B to each participant.

2. Set up teams of two members each. Give each team a number.

3. Ask each team to do the three tasks given in the handout. They are to write their answers clearly on the paper provided. They should put their team number on their papers.

4. Ask each team to hand in their answers to another team.

5. Distribute Handout 4.4C.

6. Go over the answers for each of the tasks. Ask each team to mark the papers they have been given and return them to the relevant team.

7. Go over the answers again. Encourage the participants to ask questions.

Space for notes and questions for the facilitator

Break-even budgets

We have previously estimated gross margins. The use of average costs and prices are the only sensible choices, but averages can be deceiving. Averages represent the common mid-point between two extremes and therefore give a picture that intentionally does not reflect either case.

In this discussion, we shall investigate what happens when we move away from the average or expected case and towards either of two extremes — the best case or the worst case. The break-even budget is an instrument used to determine the effect of these extreme possibilities.

Break-even analysis is a technique for studying the relationship between costs and income at different levels of production and different prices. A break-even budget estimates the point at which a farm's gross income is equal to its total variable costs.

On the one hand, the break-even gives an indication of maximum acceptable level of cost. That is, the point at which, if costs increase, the farm will not be profitable. On the other hand, the break-even gives the minimum acceptable level of a benefit given an estimated level of cost. That is, the point at which, if the income decreases, the farm will not be profitable.

In other words, a break-even budget looks at the level of the activity where income equals total cost, so that no profit (gross margin) is made. Again, break-even occurs where total variable cost and gross income are equal.

Break-even budgets (continued)

One can determine break-even points for yield and market price. The break-even essentially answers the following questions:

Yield: Given a known price and cost, at what level of production (yield) would the farm "break even" (costs equal income)?

Price: Given a known yield and cost, at what market price would the farm "break even" (costs equal income)?

Calculating break-even budgets in each of these areas can help farmers plan their farms, particularly when they are considering making a change in production/commodities (yield), inputs/mechanization (cost) or markets (price).

For example, a farmer might be interested in substituting one variety of tomato for another. If the production potential of the new variety is unknown, a break-even budget is constructed to estimate the minimum yield that would have to be achieved to make the change worthwhile. Alternatively, if the expected yield is known but the price is not, the budget could indicate the minimum price that must be obtained to make the change economically feasible. Cost variations could also be explored for the new variety using the break-even budget.

Break-even budgets (continued)

Example

Gross margin for 1 ha of maiza, Kenya

Item	Unit	Quantity	Unit price (Ksh)	Amount (Ksh)
Income				
Maize yield	Bag (90 kg)	20	1 000	20 000
Stover	Load	1	400	400
			Total income	20 400 **(A)**
Variable costs				
Seed	kg	10	70	700
Fertilizer	50 kg bag	1	1 000	1 000
Manure	Tonnes	4	1 000	4 000
Pesticide	kg	5	100	500
Land	Person-days	18	50	900
Planting/ manuring	Person-days	10	50	500
Weeding	Person-days	16	50	500
Harvesting/ threshing	Person-days	8	50	400
			Total variable costs	8 500 **(B)**
			Gross margin	**11 900** **(A-B)**

This example can be used
to calculate the break-even information.

Determining the break-even yield

Break-even yield (BY) is the yield required to recover all the costs incurred in production at given prices of the product and given input costs. The formula for calculating the break-even yield of a given enterprise is:

$$\textbf{Break-even yield/ha (BY)} = \frac{\textbf{Total variable cost/ha}}{\textbf{Product price}}$$

Break-even budgets (continued)

So the BY for the previous example is...

$$\text{Break-even yield/ha (BY)} = \frac{\text{Ksh 8 500/ha}}{\text{Ksh 1 000/bag}}$$

which gives...

Break-even yield/ha (BY) = 8.5 bags/ha

From the data presented, the break-even yield for Kenyan maize farms is 8.5 bags per ha. If the actual maize yield is higher than 8.5 bags per ha (the break-even yield), it will be profitable for the farmers to grow maize. Conversely, if maize yield is lower than its break-even yield (8.5 bags per ha), the farmer will incur a loss if they grow this crop.

Determining the break-even price

Break-even price of the product is the product price needed to recover all variable costs incurred in production at a given output level and cost of input.

$$\text{Break-even price/bag (BP)} = \frac{\text{Total variable cost/ha}}{\text{Expected yield/ha}}$$

$$\text{Break-even price/bag (BP)} = \frac{\text{Ksh 8 500/ha}}{\text{20 bags/ha}}$$

Break-even price/bag (BP) = Ksh 425/bag

The break-even price of maize is Ksh 425 per bag. This means, if the price of maize is above the break-even price, it will be profitable to grow maize. However, if the price of maize falls below Ksh 425 per bag, maize farmers will sustain a loss if they grow maize.

Space for notes and questions for the facilitator

Case exercise — A break-even analysis

A farmer in the Kisumu, Kenya, area has been growing rice on 1 ha of their land, for the last 5 years. After harvesting last year's yield, the farmer started to consider whether it is profitable to continue to maintain the rice enterprise. The income and costs of 1 ha of the rice enterprise are detailed below.

Item	Unit	Quantity	Unit price (Ksh)	Amount (Ksh)
Income				
Rice	Bag	15	900	13 500
			Total income	13 500
Variable costs				
Ploughing	ha	1	600	600
Planting	ha	1	300	350
Seed	kg	60	10	600
Fertilizer	kg	50	15	750
Pesticide	kg	4	100	400
Threshing	Bag	15	20	300
Labour	Person-days	200	40	8 000
			Total variable costs	11 000

Perform the following three tasks, based on the case described (worksheet provided on the next page).

Task 1. Calculate the gross margin.
Task 2. Calculate the break-even yield.
Task 3. Calculate the break-even price.

Worksheet — A break-even analysis

Task 1. Calculate the gross margin

Task 2. Calculate the break-even yield

Task 3. Calculate the break-even price

Solutions — A break-even analysis

Task 1. Calculate the gross margin

Gross margin = Gross income - Variable costs

Gross margin = Ksh 13 000 - Ksh 11 000

Gross margin = Ksh 2 000

Task 2. Calculate the break-even yield

$$\text{Break-even yield/ha (BY)} = \frac{\text{Total variable cost/ha}}{\text{Product price}}$$

$$\text{Break-even yield/ha (BY)} = \frac{\text{Ksh 11 000/ha}}{\text{Ksh 1 000/bag}}$$

Break-even yield/ha (BY) = 11 bags/ha

Task 3. Calculate the break-even price

$$\text{Break-even price/bag (BP)} = \frac{\text{Total variable cost/ha}}{\text{Expected yield/ha}}$$

$$\text{Break-even price/bag (BP)} = \frac{\text{Ksh 11 000/ha}}{\text{13 bags/ha}}$$

Break-even price/bag (BP) = Ksh 846.15/bag

Preparing for Session 4.5
Sensitivity analysis

Learning outcomes
Understanding (i) the purpose
of the instrument, (ii) when to use the method,
(iii) how to carry out the methods

Training aids
Exercise 4.5A (Sensitivity analysis calculations)
Handout 4.5A (Sensitivity analysis)
Handout 4.5B (Case scenarios —
A sensitivity analysis)
Handout 4.5C (Solutions — A sensitivity analysis)

Notes

Sensitivity analysis

This session introduces a tool that extension workers can use to help farmers take more informed decisions to cope with risk. The tool analyses the sensitivity of an enterprise to changes of factors such as yield, input price and market price.

Opening statement

Sensitivity analysis can be used to determine the outcome of change(s) that effect(s) enterprise profitability. This tool can be used with any of the planning and management techniques that we have discussed so far in this course. Let us now review Handout 4.5A, which explains in detail this procedure.

The outline on the following pages is provided to help the facilitator conduct the review.

Outline of Handout 4.5A (Sensitivity analysis)

What is a sensitivity analysis?

Sensitivity analysis is a farm management tool that can be used to identify the critical variables and their affect on projected profitability. This is a tool to help answer the question: "What if…?" or "What would happen if?"

What influences enterprise profitability?

- yield;
- the amount of the harvest that is marketed, rather than consumed on the farm;
- the price received for produce sold;
- the prices of inputs.

Exercise introduction

In Exercise 4.5A (Sensitivity analysis calculations), we shall practise some calculations in order to familiarize with the concepts of this analysis.

Exercise 4.5A
Sensitivity analysis calculations

Purpose: To practice sensitivity analysis. (Participants should have read Handout 4.5 prior to this exercise.)

Method: Number-based calculations.

Materials: (i) Handouts 4.5B (*Case scenarios — A sensitivity analysis*) and *C* (Solutions — *A sensitivity analysis*), (ii) pen and paper, (iii) calculator.

Allow 30 minutes for this exercise

Procedure

1. Divide the participants into teams of 2.
2. Distribute Handout 4.5B to each participant.
3. Assign one of the first four questions to each team.
4. Ask them to do the sensitivity analysis. They should write the complete calculations down and put their team number on the paper.
5. Ask each team to hand their paper to another team for marking.
6. Distribute Handout 4.5C for the solutions. Go over the answers to each scenario and have the papers marked.
7. Return the papers to each team. Discuss any questions.
8. Jointly work on Question 5. Ask participants to think through the consequences of increasing or decreasing the area planted to these crops and the effect on total variable costs. Discuss and answer any questions.

Space for notes and questions for the facilitator

Sensitivity analysis

What is a sensitivity analysis?

Sensitivity analysis is a farm management tool that can be used to identify the critical variables and their effect on projected profitability. This is a tool to help answer the question: "What if…?" or "What would happen if?"

- What if our production decreases? Or increases?
- What if the price of our product goes up? Or down?
- What if the cost of an input changes?
- What if the family increases the amount of crop it consumes?

This technique quantifies the outcome of a change in a single or combination of selected variables that effect enterprise profitability. Sensitivity analysis can be used with any of the farm business planning and management techniques that we have discussed to date to help make decisions on the farm.

What influences enterprise profitability?

Yields may be only one of the factors that influence enterprise profitability. Others include:

- the amount of the harvest that is marketed, rather than consumed on the farm;
- the price received for produce sold;
- the prices of inputs.

Where maize and other food crops are concerned, the amount of produce marketed by the farmer may be even more variable than yields. This is because the farmer markets only that portion of the food crop that is not required for on-farm consumption. If yields decrease, on-farm consumption may remain almost the same because the farmer will first reduce the amount of produce marketed before reducing on-farm consumption.

Sensitivity analysis (continued)

Yields and prices tend to move in opposite directions for food crops. When yields fall, there is a scarcity of the crop and prices tend to rise. When yields rise there is an abundance of the crop and prices tend to decline. The movement of prices and yields in opposite directions means that the enterprise budgets vary less than they would if prices were held constant or moved in the same direction as yields.

Thus yields, on-farm consumption and prices together influence the farmer's gross margin. This makes sensitivity analysis a very useful instrument to apply. This is illustrated by way of a simple farm budget that compares the situation in a normal rainfall year with the situation in a bad year. The normal year enterprise income is assumed to be $320, as given in the calculation below.

In a low rainfall, "bad year", production falls by 50 percent, but on-farm consumption requirements remain the same. Consequently, the quantity of produce marketed also decreases. Prices subsequently rise but the farmer's cash receipts are still greatly reduced.

	Normal year ($)	Bad year ($)
Produce yield (tonnes)	10	5
Produce consumed on-farms (tonnes)	2	2
Marketed produce (tonnes)	8	3
Farmgate price per tonne	40	55
Total enterprise cash income	320	165

The information on yields, consumption and prices under the "bad year" scenario provides one element of the total farm cash income. Cash expenditures may also change in a "bad year" depending on when the low rainfall occurs. At different times in the season, low rainfall will affect different activities.

Sensitivity analysis (continued)

When low rainfall is noted before the crop is planted and continues throughout the crop season, a farmer may anticipate the effects listed below.

Area of effect	Effect
Yield	Decrease
On-farm consumption of crop	No change
Product price	Increase
Land preparation cost	Decrease
Application of materials used in planting	Decrease
Application of materials used after planting	Decrease
Cost of purchased materials used in planting	Decrease
Cost of purchased materials used after planting	Decrease
Harvest costs	Decrease

If, however, the poor rains come only later in the season after the crop is in the ground, the following effects can be expected.

Area of effect	Effect
Yield	Decrease
On-farm consumption of crop	No change
Product price	Increase
Land preparation cost	Decrease
Application of materials used in planting	No change
Application of materials used after planting	Decrease
Cost of purchased materials used in planting	No change
Cost of purchased materials used after planting	Decrease
Harvest costs	Decrease

Sensitivity analysis (continued)

Applying a sensitivity analysis

The following example will help in understanding the concept of sensitivity analysis.

A maize farmer expects to generate a profit of Ksh 11 000 over the next year. The farmer is concerned because a neighbouring farm has suffered from a disease that has decreased crop yields by 25 percent. The question the farmer needs to answer is: *"How will my profits change if my crop gets the same disease?"*

The following data is given about the farm:

Current yield of maize	20 bags
Price of maize	Ksh 1 000
Total variable costs	Ksh 8 700
Gross margin	Ksh 11 300
Harvesting cost per bag	Ksh 20

Remember

The sensitivity analysis is used to calculate the change in gross margin that could occur following changes in selected key variables that affect profitability. In this case, yield could change and the farmer wants to determine how this will affect income and profits.

First, we calculate the change in the margin for maize in the event of the farmer's crop getting the same disease as the neighbour's crop.

Reduction in yield = **Current yield** × **% Reduction**

Sensitivity analysis (continued)

The implications are a 25 percent reduction in yield and the costs saved as a result of the drop in production.

Reduction in yield = 20 bags × 25% reduction

Reduction in yield = 5 bags

Second, we calculate the decrease in gross income as a result of the reduced yield.

Lost gross income = Reduction in yield × Prooduct price

Lost gross income = 5 bags × Ksh 1 000/bag

Lost gross income = Ksh 5 000

Third, we calculate the variable costs saved by the reduced yields. In this case the only variable cost affected by yield is the harvesting cost.

Reduced variable costs = Reduction in yield × Cost of harvesting

Reduced variable costs = 5 bags × Ksh 20/bag

Reduced variable costs = Ksh 100

Fourth, we calculate the overall reduction in Gross margin

Reduction in gross margin = Lost gross income - Reduced variable costs

Reduction in gross margin = Ksh 5 000 - Ksh 100

Reduction in gross margin = Ksh 4 900

Sensitivity analysis (continued)

Fifth, we calculate the new gross margin based on the projected loss in yield.

New gross margin	=	Original gross margin	-	Reduction in gross margin

New gross margin = Ksh 11 300 - Ksh 4 900

New gross margin = Ksh 6 400

A 25 percent reduction in the yield of maize results in a 56.6 percent decrease in gross margin. The conclusion is that the margin generated appears to be extremely sensitive to the problem and that appropriate management time should be devoted for its prevention.

Similar calculations can be done for changes in other aspects of the farm.

Link to assessing risk and vulnerability

Sensitivity analyses can help farmers determine how vulnerable they are to risks. Further, using results from sensitivity analyses and comparing them with break-even figures will provide even more information about vulnerability to risk. In a sense, they will have an idea of the risk boundaries of their farms. This is very useful farm management information to have when making decisions.

Space for notes and questions for the facilitator

Case scenarios — A sensitivity analysis

Mary has 2 ha of land on which she normally grows millet (1.5 ha) and tomatoes (0.5 ha). She has enough water to irrigate 0.6 ha of tomatoes. She recently attended a farmers association meeting where she learned three things:

- She learned that there was a shortage of tomatoes in the city. As a result, the price of tomatoes was going to increase from an average of $500 per tonne to possibly $550 per tonne.
- She also learned that they expected very late rains this year and that there could be a 20 percent decrease in her millet yield.
- She also learned that the price of manure was going to increase by as much as 20 percent in the next season.

After the meeting Mary went home. She needed to decide what to do about next year's crop; and she needed to know what was going to happen to this year's millet crop. What affect would these changes have on her profitability?

Using this information answer the following questions.

Millet gross margin information

Yield	1 t/ha
Price	$250/t
Total variable costs	$150/ha
Manure cost	$50/ha
Harvest cost	$10/ha

Tomato gross margin information

Yield	10 t/ha
Price	$500/t
Total variable costs	$3 000/ha
Manure cost	$500/ha
Harvest cost	$10/ha

For the participants

Question 1. What will be the effect of the increased tomato price on Mary's tomato profitability?

_____
_____
_____
_____
_____
_____
_____

Case scenarios — A sensitivity analysis (continued)

Question 2. What will be the effect of the decreased millet yield on Mary's millet profitability?

Question 3. What will be the effect of the increased manure price on Mary's millet profitability?

Question 4. What will be the effect of the increased manure price on Mary's tomato profitability?

Question 5. How much of each crop should Mary plant next year?

Space for notes and questions for the facilitator

Solutions — A sensitivity analysis

Before answering Handout 4.5B it is always advisable to determine the gross margin for each commodity.

GM for millet = $100/ha at 1.5 ha = $150
GM for tomatoes = $2 000/ha at 0.5 ha = $1 000

Question 1. What will be the effect of the increased tomato price on Mary's tomato profitability?

The change in profitability will be shown by a change in Mary's gross margin. A change in the price of tomatoes does not affect yield, it only affects income. There is no change to variable costs. Therefore, the change in gross margin will be equal to the change in gross income. We calculate the change in gross income as follows.

Change in gross income = Current yield/ha × Change in price/t × Actual ha

Change in gross income = 10t/ha × $(550 - 500)/t × 0.5 ha

Change in gross income = 10t/ha × $50/t × 0.5 ha

Change in gross income = $250

The increase in the price of tomatoes ($50/t) will cause Mary's gross income to increase by $250. And in this case, because there is no increase in variable costs, Mary's profit should increase by $250.

Solutions — A sensitivity analysis (continued)

Question 2. What will be the effect of the decreased millet yield on Mary's millet profitability?

First we must calculate the reduction in yield.

Reduction in yield = Current yield × % Reduction × Actual ha

Reduction in yield = 1t/ha × 20% × 1.5 ha

Reduction in yield = 0.3t

Second, we calculate the change in gross income. Because we are planning for reduction in yield, we know Mary will lose gross income.

Loss of gross income = Reduction in yield × Product price

Loss of gross income = 0.3t × $250/t

Loss of gross income = $75

Next we must calculate the change in variable costs. We shall suppose that the reduced yields assume the same land preparation, etc. for planting and that the only change in costs will be related to harvest. But we notice that the harvest costs are per hectare, not per tonne. So we shall assume this will not change. Therefore the effect on gross margin will be equal to the loss of gross income. Thus, Mary's profitability would decrease by $75 for her millet crop.

Solutions — A sensitivity analysis (continued)

Question 3. What will be the effect of the increased manure price on Mary's millet profitability?

The manure price is part of Mary's variable costs. An increase in the price of manure would increase variable costs and therefore decrease the gross margin. Assuming all other factors do not change, the change in manure price will inversely equal the change in gross margin.

The current manure price for millet is $50/ha. A 20 percent increase in the price of manure would mean an increase in the manure price for millet of $10/ha — resulting in a $15 increase on 1.5 ha.Thus, Mary's gross margin (profitability) for millet would decrease by $15.

Question 4. What will be the effect of the increased manure price on Mary's tomato profitability?

As with millet, the manure price is part of Mary's variable costs. An increase in the price of manure would increase variable costs and therefore decrease the gross margin. Assuming all other factors do not change, the change in manure price will inversely equal the change in gross margin.

The current manure price for tomatoes is $500/ha. A 20 percent increase in the price of manure would mean an increase in the manure price for tomatoes of $100/ha — resulting in a $50 increase on 0.5 ha. Thus, Mary's gross margin (profitability) for tomatoes would decrease by $50.

Her gross margin is_____

Solutions — A sensitivity analysis (continued)

Question 5. How much of each crop should Mary plant next year?

To answer this question, we need to determine the gross margin for each crop.

Millet

Yield	1t/ha
Price	$250/t
Total variable costs	$150/ha
Manure cost	$50/ha
Harvest cost	$10/ha

1 hectare		1.5 hectares	
Gross income	$250	Gross income	$375
Total variable costs	$150	Total variable costs	$225
Gross margin	$100	Gross margin	$150

Tomatoes

Yield	10t/ha
Price	$500/t
Total variable costs	$3 000/ha
Manure cost	$500/ha
Harvest cost	$10/ha

1 hectare		0.5 hectares	
Gross income	$5 000	Gross income	$2 500
Total variable costs	$3 000	Total variable costs	$1 500
Gross margin	$2 000	Gross margin	$1 000

Solutions — A sensitivity analysis (continued)

Anticipated changes

20%	increase in price of manure
$50	increase in the price of tomatoes
20%	decrease in the millet yield

Impact on gross margins

Millet, 1 hectare	
Gross income	$200
Total variable costs	$160
Gross margin	$40

Tomatoes, 1 hectare	
Gross income	$5 500
Total variable costs	$3 100
Gross margin	$2 400

The impact on the gross margins
is a decrease of 60% for millet
and an increase of 20% for tomatoes.

Mary can plant a maximum of 0.6 ha of tomatoes (because of a limit of water). So it is suggested that she plant 0.6 ha of tomatoes and 1.4 ha of millet. This will result in a combined gross margin of $1 496. Under the previous conditions, the combined gross margin was $1 150. This is an increase of 30 percent.

Preparing for Session 4.6
Food requirements

Learning outcomes
Understanding (i) the food requirements,
(ii) how to carry out the calculations

Training aids
Exercise 4.6A (How much land for food?)
Exercise 4.6B (Food flow planning)
Handout 4.6A (Planning for food needs)

Notes

Food requirements

Deciding how much land to dedicate to food production for the household is an important decision made by many farmers in Africa. This session introduces a tool that extension workers can use to help farmers and their households determine the amount of food required by a household and the possible amount of farm produce available for market. It is an important tool to help optimize land use and increase profitability while not compromising the basic food security of the family.

Opening statement

Providing food for a family is an important part of farming. Smaller-scale farmers must often make a choice between growing food for the family or growing crops for the market. Both have their benefits. Both have their risks.

Learning points

Farmers will often decide to grow crops both for food and for market. Those with enough land to do this are fortunate. In many cases the land may not be enough to provide for all the family requirements and also yield crops for the market. It may be necessary for the farmer to grow some of the family's needs and some crops for the market. The increase in income in sales may be used to purchase food for the farm household.

Exercise introduction

Exercise 4.6A (How much land for food?) will help us to understand how to use the land available to best advantage for family food needs.

Exercise 4.6A
How much land for food?

Purpose: To determine the food requirements for a family and the amount of land needed to produce it. (Participants should have read Handout 4.6A prior to this exercise.)

Method: Food requirement calculations and group discussion.

Materials: (i) Handout 4.6A (Planning for food needs), (ii) pen and paper, (iii) calculators.

Allow about 30 minutes for this exercise
(depending on skill with mathematics)

Procedure

1. Divide the group into their farm teams.

2. Randomly allocate to each farm a family size.

3. Each team farm is taken to be 2 ha in size.

4. Ask each team to calculate the food requirements based on the information in Handout 4.6A.

5. Ask each team to choose two food crops from one of the following:

Maize Wheat Rice Millet
Yams Cassava Sorghum

Note
You may want to change the list to reflect food crops that are common to the area from which the extension workers come.

Exercise 4.6A (continued)

6. Have them divide the total food requirement between the two crops. For example, if they need 1 440 kg, they may grow 1000 kg of one food crop and 440 kg of another food crop. Or they may wish to divide it equally. It is up to the farm family to decide.

7. Allocate yield information for the various crops. Be sure the range of yields given is realistic for the areas from which the extension workers come. Give each team a different yield for each crop so that no two teams have the same yields per crop. See the example given below.

*Crop**	Team 1	Team 2	Team 3	Team 4
Maize	3	4	5	6
Wheat	5	3	6	4
Rice	8	6	4	5
Millet	1	0.75	0.9	0.8
Yams	6	5	4	3
Cassava	4	6	3	5
Sorghum	5	4	3	2

*tonnes per hectare or per acre

8. Ask each team to calculate the amount of land required to ensure they produce enough food to meet their food requirements. Ask them also to calculate the amount of land remaining to plant cash crops.

9. Ask each team to report their decisions and calculations to the rest of the group.

Note

Handout 4.6A provides a guide to the basic mathematics, but some participants may need assistance with the mathematical concepts. Note also that the final area planted to food crops should be rounded to the nearest manageable figure. For example, if the calculations lead to .26 ha this should be rounded to either 0.25 or 0.3. When rounding down, the participants will need to confirm that they are growing enough food.

Exercise introduction

In the previous exercise, we looked at how to plan the farm so that the farm produces an annual quantity of staple food needed by the farm family.
However, equally as important is to assess the annual flow of food through the year.
Now let us look at Exercise 4.6B (Food flow planning), which will help us identify periods in the year when there could be food shortages.

Exercise 4.6B
Food flow planning

Purpose: To identify when food shortages on a smallholder farm might occur and to understand causes and solutions for these potential food shortages. (Have participants refer to Handout 4.6A.)

Methods: Food matrix, causal diagram and opportunities matrix.

Materials: (i) Thick marking pens, (ii) large sheets of paper.

Allow 60 minutes for this exercise

Procedure

1. Participants get into their farm teams.

2. Ask each team to discuss the food eaten by their farm family. This would include the food crops planned in the previous exercise plus any other foods they normally consume during the year (e.g. vegetables, eggs, milk).

3. Ask each team to set up a food matrix with the months across the top and the various foods eaten by the family along the left column.

4. Ask the teams to brainstorm on the demands for and availability of their range of foods over the course of a typical year. They should note the months during which there is a shortage of one or more of the identified foods.

5. Using a causal diagram, each team should identify why there is a shortage.

6. Using an opportunities matrix, each team should identify actions to be taken to resolve the cause of the food shortage.

Exercise 4.6B (continued)

7. Ask each team to share its findings with the rest of the participants.

8. Encourage discussion of these findings. Be sure to encourage the participants to relate their discussions to the real-life situations in which they work.

Learning points

Some of the main causes of food shortages include:

- poor food storage (e.g. including post-harvest technologies such as drying);
- poor food reserve management (i.e. consuming more than required per day);
- crises (e.g. deaths that necessitate special food consumption for funerals).

Household management is a key part of food management, which in turn is a key part of farm management.

Space for notes and questions for the facilitator

Planning for food needs

Self-sufficiency in food is a priority objective

For most farm families in Africa, self-sufficiency in food is the first objective. Consequently food production is a main objective for the farm. Self-sufficiency in food can either be obtained directly from the farm harvests or by use of cash to purchase from the market. A great majority of family farmers in Africa still prefer to produce their own coarse food needs. By coarse food is meant basic carbohydrate foodstuffs such as maize, root and tuber crops, sorghum, millet and rice.

Coarse foods are differentiated from other foodstuffs such as oilseeds, vegetables, fruit, fish, meat and dairy products. These are of higher per unit value, but are needed in smaller quantities. They are either produced or gathered on or around the farm or purchased on the market. Although they are of great importance for the qualitative value of nutrition, only coarse foodstuffs are taken in consideration in this session.

Families who suffer from food insufficiency generally also suffer from malnutrition. It is important to note that having sufficient coarse grains is only one part of food security. Food security also includes access to other important food groups.

Food and market-oriented farming

As farmers become more market-oriented they need to keep in mind the family's food requirements. Can they risk growing only for the market and buying all the family's food? Or should they grow some food for their family and some crops to sell? How much of their land should be planted to food crops for the family? How much land can be planted to crops to be taken to the market?

Planning for food needs (continued)

To decide, the farmer first needs to know how much food the family will need for the year. The amount of food (coarse grains) an average person (child or adult) needs per day is 0.65 kg. This works out to about 240 kg per year. Therefore, the farmer simply needs to multiply 240 kg times the number of family members to know how many kilograms of coarse grains will be needed each year to feed the family. The figures for various sizes of families are given below.

Family size (people)	Food required each day (kg)
1	240
2	480
3	720
4	960
5	1 200
6	1 440
7	1 680
8	1 920
9	2 160
10	2 400

What to grow?

Now that the farmer knows how much food the family is going to need each year, two things are required: (i) what grains they want to eat and (ii) whether to grow these grains or buy them using money from crops sold on the market.

What grains do they want to eat?

This is a matter of personal preference and a matter of what is available.

Planning for food needs (continued)

Grow food or buy food?

This is a serious family and farm management decision. It really is about risk.

Buying food. Can the crop planted for the market make enough profit to feed the family? Risk can be reduced by:

- investigating the market and learning about what crops get what prices;
- investigating access to the market in terms of roads, transport and facilities;
- honestly assessing family farming skills and what can be grown confidently.

Growing food. This is limited by what crops can be grown in the area and the knowledge needed to grow. Again there is a risk. Are the crops planted for food suitable? Can risk be reduced by making a careful calculation of family food needs and then converting this into hectares?

The extension worker should be prepared to advise farmers on food crop options. Eventually a decision will have to be made.

Let us take a case where a farmer has chosen to grow all the food for family needs and to grow other crops to sell.

How much land is needed for planting food?

The amount of land the farmer needs depends on:

- the total amount of food needed;
- the types of crops to be grown;
- the expected yields of the chosen crop(s).

Planning for food needs (continued)

Example

A farmer with a family of six people

Sarah calculates that she will need 1 440 kg of grains to feed the family for the year.

She has 2.5 ha of land for planting. They are in two parcels. One is 1.8 ha and the other is 0.7 ha. Her crop choices are millet and maize. She wants to have them in equal quantities for her family. In other words, she wants 720 kg of millet and 720 kg of maize to give her the 1 440 kg. She knows she can get 3 tonnes per hectare growing maize and 0.75 tonnes per hectare growing millet. How much land does she need to plant to maize? How much to millet?

Maize

Sarah knows that 1 ha of maize will give her 3 tonnes. This is the same as 3 000 kg. She wants only 720 kg. This is now a case of simple mathematics.

If she can get 3 000 kg from 1 hectare ...

$$\frac{\textbf{3 000 kg}}{\textbf{1 ha}}$$

How many hectares does she need to get 720 kg?

$$\frac{\textbf{720 kg}}{\textbf{X ha}}$$

We can set these equations equal to each other ...

$$\frac{\textbf{3 000 kg}}{\textbf{1 ha}} = \frac{\textbf{720 kg}}{\textbf{X ha}}$$

Planning for food needs (continued)

Which gives us ...

$$3\ 000\ X = 720$$

$$X = \frac{720}{3\ 000} = 0.24$$

Therefore, Sarah needs to plant 0.24 ha of maize. This is very close to 0.25 ($\frac{1}{4}$ ha).

Let's check the answer.

If she plants 0.25 ha ($\frac{1}{4}$ ha) of maize, she can expect 0.25 of the yield.

$$0.25\ ha \times 3\ 000\ kg/ha = 750\ kg$$

Therefore, if she plants $\frac{1}{4}$ ha of maize, she will have enough maize to feed her family.

Millet

Sarah knows that 1 ha of millet will give her 0.75 tonnes of millet. This is the same as 750 kg. She needs 720 kg. The calculations are similar to those for maize.

$$\frac{750\ kg}{1\ ha} = \frac{720\ kg}{X\ ha}$$

$$750\ X = 720\ ha$$

$$X = 0.96\ ha$$

This means she should plant 0.96 ha. This is almost 1 ha.

So now Sarah knows that she must plant 0.25 ha of her land to maize and 1 ha of her land to millet.

Planning for food needs (continued)

In order to make sure her family has the food they need for the year she will use 1.25 ha of her land.

Her total land size is 2.5 ha. After planting the maize and the millet, she will have 1.25 ha (2.5 – 1.25 ha) left to plant crops for the market.

To make the decision of what to plant on the remaining 1.25 ha, Sarah can use the enterprise budgets to calculate gross margins. In addition, she will also want to:

- look at opportunity costs and risk;
- plan her market;
- check on the sustainability of the input/output support for different crop choices;
- check on her labour.

Food flow planning

In addition to understanding the quantity of food required in a year, it is also important to know when there is likely to be a shortage of food. This can be done through a simple matrix exercise in which the family consults about when different foods are available and when they are not. The following matrix is an example for a food flow.

Planning for food needs (continued)

Example

Food flow for a family of six

(coarse grain requirement: 1 140 kg)

Months	J	F	M	A	M	J	J	A	S	O	N	D	
Foods													Total
Maize (kg)	80	80	0	0	0	80	80	80	80	80	80	80	720
Sorghum (kg)	90	40	40	35	35	65	65	65	65	65	65	90	720
Total	170	120	40	35	35	145	145	145	145	145	145	170	1 440
Coarse grain requirement (kg)	120	120	120	120	120	120	120	120	120	120	120	120	1 440
Shortfall/ surplus	50	0	-80	-85	-85	25	25	25	25	25	25	50	0

This food flow shows that this family has a shortfall of grains in the months leading up to the harvest. An investigation would highlight that one of the reasons they have this shortfall is because they consume too much each month. A causal diagram would help the family identify why it is consuming more than is needed. (Note: it may be that the quantities shown in a food flow matrix may be expressed in bags rather than kilograms.)

Preparing for Session 4.7
Labour planning

Learning outcomes
Understanding (i) the purpose of the seasonal labour calendar, (ii) when and how to apply the seasonal labour calendar, (iii) its use in identifying solutions, (iv) the impact of stresses and shocks on labour

Training aids
Exercise 4.7A (Preparing a seasonal labour calendar)
Handout 4.7A (Labour planning)

Notes

Labour planning

All farms require some form of labour to carry out various activities. If it is not well planned, profits will decrease. This session introduces a tool that extension workers can use to help farmers analyse their labour needs against labour availability. The session will define labour analysis and examine when it should be used, and demonstrate how it is conducted. It will also examine the effect of changes on the labour balance over the season and explore suggested solutions.

Opening statement

We shall begin this session by reviewing the main points in Handout 4.7A (Labour planning), in which we shall discuss both the importance of labour planning and the possible use of a seasonal labour calendar. As always, feel free to ask any questions.

The outline on the following page is provided to help the facilitator conduct the review.

Outline of Handout 4.7A (Labour planning)

- Labour refers to the people who do the physical work on the farm.
- Labour can be provided in kind (without pay) by the family.
- It can be hired.
- It can be secured through a social capital arrangement.
- Labour costs are often a high percentage of the total costs of production.
- Farmers need to plan carefully for labour.
- Planning labour for an individual enterprise affects the labour for the whole farm.
- A seasonal labour calendar is often used to analyse and plan farm labour.

Exercise introduction

In Exercise 4.7A we shall assess the labour requirements for a farm seasonally and for the whole year. During the exercise participants may wish to focus on identifying the periods of serious labour bottlenecks and obvious labour idleness (under-employment). We shall also practise creating our own seasonal labour calendars.

Exercise 4.7A
Preparing a seasonal labour calendar

Purpose: To identify and plan labour requirements for a farm. (Participants should have read Handout 4.7A prior to this exercise.)

Method: Matrix.

Materials: (i) Flip chart paper or newsprint, (ii) thick marking pens.

Allow about 90 minutes for this exercise

Procedure

1. Participants get into their farm teams.

2. Ask each team to draw a matrix similar to the one shown in Handout 4.7A (Labour planning). (14 columns, ±15 rows)

3. The teams should identify the activities undertaken for all the enterprises on their virtual farms. These should be listed in the left-hand column.

4. The teams should identify the regular household activities. These should also be recorded in the left-hand column.

5. For each activity the team should discuss and agree on the monthly labour requirements under the appropriate month. This should be converted into person-days by multiplying by 26 days per month.

6. The team should total the labour requirements for each month. There should be three monthly totals: one for the farm activities, one for the household activities and one that totals the labour requirement for farm and household activities.

7. When the labour requirements are finished, the team should look at family labour availability during the year. This should be recorded for each month.

Exercise 4.7A (continued)

8. Beneath the family labour availability row, the team can calculate and record the labour surpluses or shortages.

This indicates the times when labour will need to be hired. They should also discuss stresses and shocks which may impact on the availability of labour. This would include such things as illnesses, attendance at school or migration.

9. Each team should discuss and make a plan to meet the labour requirements in the months where there is shortfall.

10. Ask each team to present their calendars. Encourage discussion.

Learning points

- What are some of the main causes of labour shortfalls?
- How do farmers deal with labour shortfalls?
- What coping strategies can be employed by farmers to save on labour?
- What do farmers do with labour surpluses?
- What is the labour availability by gender?
- How could shared labour be factored in?
- How can surplus labour in the family be utilized?

Space for notes and questions for the facilitator

Labour planning

Importance of labour planning

Labour refers to the people who do the physical work on the farm. All farms need labour to carry out basic activities of farming. Pre-production activities, production activities, and marketing activities all require someone to do the work. Labour can be provided in kind (without pay) by the family. It can be hired. Or it can be secured through a social capital arrangement.

Labour costs are often a high percentage of the total costs of production. Therefore, it is important to plan carefully the use of family, hired and social labour. The use of labour can be planned on two levels. It can be planned for the individual enterprise and for the whole farm.

At the level of the individual enterprise, labour planning is used to improve the performance of the different operations associated with the enterprise and to ensure that the right number of workers are engaged when required.

At the farm level, use of labour throughout the year is assessed. The planning of labour for an individual enterprise affects the labour requirements for the whole farm. The two are closely linked. If a farmer makes any change that affects labour in an individual enterprise, the farmer will need to examine the impact of this change on the labour requirements and resources for the whole farm. Similarly, if there is some change to the overall farm operation, the farmer will need to examine the impact on the individual enterprises.

Labour planning (continued)

A tool often used to analyse labour requirements and resources is to use a seasonal labour calendar. This calendar can give a visual assessment of labour on individual enterprises and on the farm as a whole over a given period of time (e.g. month, season, cropping cycle, year).

Procedure for a seasonal labour calendar

In planning the use of labour on the farm over a season, seasonal labour requirements for each enterprise and other household activities can be drawn up. The procedure for constructing the labour seasonal calendar is as follows:

1. List the different *farm* activities to be undertaken during the year or at a particular season by the family.

2. List the *household* activities to be done also during the year or the season.

Note

In most cases in Africa, women work both on the farm and in the household. Therefore it is essential that planning for farm labour include the household. This will give a clearer picture of the total demand for labour by a farming household. Alternatively the labour planning could also be broken down by gender.

3. Assess the labour requirements for each enterprise and household activity.

4. Asses the person-days required.

Labour planning (continued)

5. Assess the family members who will be available to work both for household and farm activities at different periods of the year.

6. Calculate the person-days available per month.

7. Examine the labour supply based on the availability of family members and labour shortages or where you require additional labour.

8. Formulate a strategy for dealing with labour shortfalls and surpluses (labour peaks and troughs).

It is important to consider the peaks and troughs of seasonal labour availability in relation to the farm labour requirements. By modifying the cropping pattern and making changes to the enterprise operations it is possible to achieve a better allocation of labour and ensure its more efficient use. Periods of trough can be used for general farm maintenance or to generate income through off-farm activities. Labour requirements during the peak periods (e.g. land preparation, planting, weeding or harvesting) could be met through the employment of either part-time or causal work or alternatively the introduction or use of more efficient mechanization or draught power.

An example of a seasonal calendar framework is given on the next page.

Labour planning (continued)

Example

Seasonal labour calendar in person-days for labour required

(1 ha maize, 1 ha sweet potatoes and 10 livestock on communal land)

This assumes that a farm family can work for 26 days per month.

Months	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	
Farm activities													Total
Buying inputs		4					4						8
Ploughing			8							8	8		24
Planting				10							10	10	30
Weeding	10	10		10	10						10	10	60
Fertilizing				14						14	14	14	56
Herding cattle	24	24	24	24	24	24	24	24	24	24	24	24	288
Harvesting					30	46	30				30	30	166
Remove stover							3					5	8
Marketing					8	8	8				8	8	40
Farm maintainance	4	4	4	4	4	4	4	4	4	4	4	4	48
Total farm labour	38	42	36	62	76	82	73	28	28	50	108	105	728

Labour planning (continued)

Months	J	F	M	A	M	J	J	A	S	O	N	D	
Household activities													Total
Fetching water	5	5	5	5	5	5	5	5	5	5	5	5	60
Fetching firewood and fuel	3	3	3	3	3	3	3	3	3	3	3	3	36
Food preparation	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	6
Cleaning	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	6
Tending to children	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	6
House repairs	0	0	0	1	0	0	1	0	0	0	1	0	3
Total household labour	9.5	9.5	9.5	10.5	9.5	9.5	10.5	9.5	9.5	9.5	10.5	9.5	117
Total labour required (person-days)	**47.5**	**51.5**	**45.5**	**72.5**	**85.5**	**91.5**	**83.5**	**37.5**	**37.5**	**59.5**	**118.5**	**114.5**	**845**
Family members available	5	3	3	4	4	3	4	3	4	4	4	5	46
Family members available (person-days)	130	78	78	104	104	78	104	78	104	104	104	130	1 196
Additional labour requirements (person-days)	**0**	**0**	**0**	**0**	**0**	**13.5**	**0**	**0**	**0**	**0**	**0**	**0**	

Preparing for Session 4.8
Cash flow

Learning outcomes
Understanding (i) the purpose of the tool,
(ii) when and how to apply the tool,
(iii) its use in identifying solutions,
(iv) the impact of changes on cash,
(v) the farm and household income and expenses,
(vi) the timing and volume of cash shortfall
and ways of addressing them

Training aids
Exercise 4.8A (Cash flow: problems
and possibilities)
Exercise 4.8B (Cash flow analysis)
Handout 4.8A (Cash flow)
Handout 4.8B (Guidelines for cash flow
analysis exercise)
Handout 4.8C (Information for dairy enterprise)

Notes

Cash flow

It is often the case that a farm that is profitable based on gross margin calculations ends up with a cash shortfall at the end of the season. This session introduces the concept and practice of developing a cash flow to enable a farmer to see where the money goes and where it comes from. This puts farmers in a better position to control their financial situation.

Opening statement

Let's begin the session by reviewing the main points in Handout 4.8A (Cash flow). While gross margin is concerned with the profitability of the farm enterprise, cash flow is concerned with examining if the necessary finance is available for implementation.

The outline on the following pages is provided to help the facilitator conduct the review.

Outline of Handout 4.8A (Cash flow)

What is a cash flow?

The farm cash flow is the flow of money into the farm from sales and the flow of money out of the farm through purchases and other payments.

For smallholder farmers where the farm and household are closely linked, the cash flow also includes other income flows into the household and payments made by the household.

The cash flow helps the farmer determine the financial performance of the household as a whole.

It guides the farmer in assessing whether they will have enough money to carry out their plan or if they will be short of money in any month.

It enables the farmer to find the time of the year where additional financial resources may be required.

Net cash flow: the difference between the inflows and outflows. This is found by simply subtracting the money spent over the year from the money received.

Cash inflow is made up of:

- sales of produce marketed;
- income from wage labour and other employment;
- gifts;
- loans.

Cash outflow is made up of:

- purchases and payments for inputs for the farm (e.g. hired labour, fertilizers, seed, pesticides, animal feeds, salt licks);
- land preparation costs, purchase of new machinery and other operational costs;
- household expenses (e.g. medicine, food, school fees, taxes, gifts);
- debt and interest.

The farm should try to generate a positive cash flow.

Use of cash flow

Cash flow budgets are important in:

- developing the farm plan;
- choosing between alternative farm enterprises;
- comparing actual and budgeted results (to enable corrective action to be taken on time);
- arranging for loans.

Exercise introduction

We shall complete the review of this handout by doing the following two exercises. First, we shall look at farm problems as the might relate to cash flow in Exercise 4.8A (Cash flow: problems and possibilities). Second, we shall work out a cash flow from the gross margin information on your farms using Exercise 4.8B (Cash flow analysis).

Exercise 4.8A
Cash flow: problems and possibilities

Purpose: To explore cash flow problems and solutions. (Participants should have read Handout 4.8A prior to this exercise.)

Method: Brainstorming.

Materials: (i) Pen and paper.

Allow 45 minutes for this exercise

Procedure

1. Divide the participants into teams of four or five. Do not use the farm teams. Give each team a sheet of paper and ask them to draw a line down the middle of the paper, from top to bottom.

2. Discuss and agree on three problems that farmers commonly face related to income (cash inflow) and expenditure (cash outflow) and how they usually solve them.

In the left column they should record the problems.
In the right column they should record the solutions.

3. Ask each team to share their findings. Encourage discussion and how the problems might be addressed using a cash flow.

The list opposite could serve as the basis for a discussion.

For the facilitator

Low profitability. Cash flow problems may be an indication of the problem of low profitability. The first step would be to analyse the profitability of each of the farm enterprises using the gross margin. Increasing profit and profitability is often the best way to remedy cash flow problems.

Unexpected cash problems. One way to prevent cash flow problems is to identify problems before they occur. Cash flow would give the farmers time to alter their plans and remedy the problems by timing cash inflows and cash outflows.

Low profitability together with low cash inflow. This calls for a careful look at the combination of enterprises on the farm. Perhaps another crop rotation or livestock enterprise would increase cash inflow and allow the farmer to increase profitability at the same time.

High production costs. An effective way to improve cash flow is through cost control. Is the farmer using the best seeds and seeding rates? Is fertilization at the right level? Can the use of commercial fertilizer be reduced through the use of manure? Can integrated pest management help?

Need to increase selling flexibility. The best approach to this problem is to improve the farmer's marketing strategy. For non-perishable products, the farmer has some flexibility in timing sales. Improving farm profitability should be the main goal in formulating a marketing strategy.

Increase cash inflow. Family members may seek part-time or full-time employment off the farm. Any additional costs related to off-farm employment, such as transportation and clothing, need to be considered carefully.

Increase cash availability. Selling livestock or other capital assets is a common way of dealing with cash flow problems. The farmer should sell unproductive assets first to ensure that the farm business can still operate and generate income.

Exercise 4.8B
Cash flow analysis

Purpose: To practise analysing the farm household cash flows. (Participants should have read Handout 4.8B prior to this exercise.)

Method: Cash flow analysis case study.

Materials: (i) Handouts 4.8B (Guidelines for cash flow analysis exercise) and C (Information for dairy enterprise), (ii) pen and paper, (iii) calculator.

Allow 30 minutes for this exercise

Procedure

1. Ask the participants to get into their farm teams. Give each participant a copy of Handout 4.8B.

2. Remind the participants of the basic steps to follow to construct a cash flow:

   (i) inflow and outflow: list the income and expenditure items when they occur in the year;
   (ii) prepare a cash flow table;
   (iii) calculate the monthly net cash flow;
   (iv) calculate the cumulative net cash flow;
   (v) analyse the net cash flow.

3. Using the information generated so far in this training programme, each team should develop a cash flow for their farm. They should follow the steps in Handouts 4.8A and B, and complete the worksheet provided in Handout 4.8B.

4. Ask each team to report briefly on their cash flows. Encourage discussion. Help with corrections as needed.

Exercise 4.8B (continued)

5. The next step in the exercise is to add a dairy enterprise to your farms. This will have to be included in the cash flow. The information is presented in Handout 4.8C (Information for dairy enterprise).

6. Distribute Handout 4.8C to the participants. Ask each team to work out the impact of introducing the dairy enterprise to the family farm. They should consider the following questions:

   - Does the enterprise make a profit?
   - How many cows should the family buy?
   - Can the family afford to finance the enterprise?
   - Will they have to take out a loan?

7. Ask each team to present its findings to the rest of the participants. Encourage discussion.

Space for notes and questions for the facilitator

Cash flow

What is a cash flow?

We have previously discussed gross margin as a tool to assess the profitability of an enterprise. Gross margin indicates how worthwhile a change may be if the quantities and prices assumed are realized. When a new enterprise is introduced into the farming system a gross margin is usually prepared to assess whether the enterprise generates enough income to cover expenditures. But this is only a part of the analysis.

It is also useful to assess the overall effect of the enterprise on the household finances. To do this, the farmer needs to prepare a cash flow. The cash flow is simply the flow of money into the farm from sales and the flow of money out of the farm through purchases and other payments.

While it is common to prepare a cash flow for a farm, in the case of smallholder farm families, it is more useful to include the household in the cash flow calculations. For many smallholder farms, just as with labour, the farm finances and the household finances are very closely interlinked.

The farmers can use the cash flow to determine the financial performance of their households as a whole. It will help them to assess whether their families will have enough money to carry out their plan or if they will be short of money in any month. It enables the farmer to find the time of the year when additional financial resources may be required.

Cash flow (continued)

There is an important difference between a gross margin and a cash flow. The gross margin looks at the overall performance of the farm and its enterprises. When accounting for income, a gross margin will include the value of products consumed by the family. In a cash flow, only actual cash income is included; even though crops consumed by the family have value, they are not sold, and they do not generate cash. Therefore they are not included in the cash flow. Similarly, costs such as family labour, which are often not actually paid, are included in the gross margin, but are not included in the cash flow.

This difference is important because although an enterprise may be profitable in terms of gross margin — if the farmer is not selling enough of the crop — then the cash needed to pay inputs, hired labour and other cash costs may not be generated.

Net cash flow

The net cash flow is the difference between the cash inflows and cash outflows. Net cash flow is calculated by subtracting the money (cash) spent over the year from the money received. (Non-cash items, such as crops consumed by the family, unpaid family labour and depreciation, are not included in the flow of cash.)

Net cash flow = **Cash inflow** - **Cash outflow**

Cash inflow is made up of:

- sales of produce marketed;
- income from wage labour and other employment;
- gifts;
- loans.

Cash flow (continued)

Cash outflow is made up of:

- purchases and payments for inputs for the farm (e.g. hired labour, fertilizers, seed, pesticides, animal feeds, salt licks);
- land preparation costs, purchase of new machinery and other operational costs;
- household expenses (e.g. medicine, food, school fees, taxes, gifts);
- debt and interest.

The farm should try to generate a positive cash flow. This comes about by ensuring that more cash flows into the farm than out of the farm. Analysis of a farm cash flow generates a detailed projection of the farmer's ability or inability to finance an enterprise. In the absence of records, details of household expenditure usually have to be estimated.

Use of cash flow

Farmers can use a cash flow to analyse their farms, plan for the future and to monitor farm activities. Controlling the flow of cash in and out of their farm is an important task of the farmer. Cash flow budgets are important in:

- developing the farm plan;
- choosing between alternative farm enterprises;
- comparing actual and budgeted results (to enable corrective action to be taken on time);
- arranging for loans.

Cash flow (continued)

As a planning tool, the cash flow can be used to see the effect of a small change on the farming system or the financial impact of a complete farm plan. It can be used to examine whether the financing is available within the farm household, or alternatively if there is a need to take out a loan. In cases where the farmer has already decided to take a loan, the cash flow will also indicate whether and when the interest and debt can be repaid.

How to construct a cash flow

As noted earlier, the main feature of a cash flow is that it focuses specifically on cash. The non-cash items included in gross margin analysis are not included in a cash flow. Non-cash items such as depreciation, the value of family labour and food consumed at home are excluded.

Also as noted earlier, the cash flow for smallholder farmers includes the on-farm and off-farm (household) inflows and outflows. It should cover all cash income and expenditures for the farm household. It should include loans that the farm household receive from moneylenders, friends and lending institutions as cash inflows. And it should include repayment of these loans (principal and interest) as cash outflows.

A cash flow can be calculated on a monthly, quarterly or annual basis. Annual cash flows are common for longer term investments such as livestock and tree crops. Monthly and quarterly cash flows are well suited to annual crops.

Cash flow (continued)

A farmer can construct a cash flow on what is currently being done or on the basis of what is intended over the next year. In the example that follows, we shall construct a cash flow budget to examine the projected cash situation of a plan to introduce a new enterprise. We shall look at cash flow projections on a monthly basis over one year.

Let us imagine a farm household that earns some income from selling maize and cassava and rearing dairy cows. They also have some chickens. The family has three children attending school. The farmer wishes to introduce beans into the system, knows that the enterprise is profitable but wonders whether there are enough funds to finance the enterprise.

When the farmers plan the farm programme for next year, they want to find answers to the following questions:

- How much money are the farm enterprises likely to generate and how much cash expenditure will be needed to cover costs?
- When will they receive the money (inflow) and when will the money be needed (outflow)?
- If the amount of money they expect to receive over the year does not cover the amount needed, how can they make up the difference? Will it be made up by savings? Do they have reserves? Do they have access to loans?

Cash flow (continued)

Prepare the cash flow as follows:

1. Identify inflow and outflow

List the income and expenditure items and when they occur in the year, as shown in the time plan schedule below.

Cash inflow			**Cash outflow**		
Description	*Month*	*Income ($)*	*Description*	*Month*	*Expenditure ($)*
Sale of maize	January	270	Money spent on farm inputs (maize)	March	300
	March	300		September	300
	September	300	Money spent on farm inputs (cassava)		37
	October	100	Money spent on farm inputs (livestock)	January	30
	November	100		February—September	400
Sale of cassava	April	340		October—December	90
	August	120	Brooding cost and feeding (chickens)	September	60
Sale of milk	March—September	420	Money spent on input (beans)	April	200
Sale of chicken	January	130		May	50
	September	60		July	40
Planned sale of beans	July	450		October	180
	December	400		December	40
			Money to cover living expenses	January—December	120
			Money to cover school expenses	February	200
				May	140
				September	100
			Money to cover health expenses	January—December	120
	Total	**2 990**		**Total**	**2 407**

Cash flow (continued)

2. Prepare a cash flow table

From the inflow outflow table, we can work out the monthly balance. This can be done by entering all of the information in a cash flow chart, which is given at the end of this handout.

Money coming in (sales of products)

	J	F	M	A	M	J	J	A	S	O	N	D
Maize	270		300						300	100	100	
Cassava				340				120				
Milk			60	60	60	60	60	60	60			
Chicken	130								60			
French beans (planned)							450					400
Total cash inflow	**400**	**0**	**360**	**400**	**60**	**60**	**510**	**180**	**420**	**100**	**100**	**400**

Money going out

	J	F	M	A	M	J	J	A	S	O	N	D
Payments and purchase of inputs												
Maize inputs			300						300			
Cassava inputs				37								
Farm inputs livestock	30	50	50	50	50	50	50	50	50	30	30	30
Chicken feeding expenses									60			
Beans inputs				200	50		40			180		40
Household expenses												
Living expenses	10	10	10	10	10	10	10	10	10	10	10	10
School fees		200			140				100			
Hospital expenses	10	10	10	10	10	10	10	10	10	10	10	10
Total cash outflow	**50**	**270**	**370**	**307**	**260**	**70**	**110**	**70**	**530**	**230**	**50**	**90**

Cash flow (continued)

3. Calculate the monthly net cash flow

This is done by subtracting the expenses from the income for each month. It will be positive if income is greater than expenses, and negative if income is less than expenses. The results are added to the bottom of the cash flow table as shown in the example at the end of this handout.

	J	F	M	A	M	J	J	A	S	O	N	D
Total cash inflow	400	0	360	400	60	60	510	180	420	100	100	400
Total cash outflow	50	270	370	307	260	70	110	70	530	230	50	90
Monthly net cash flow	**350**	**-270**	**-10**	**93**	**-200**	**-10**	**400**	**110**	**-110**	**-130**	**50**	**310**

4. Calculate the cumulative net cash flow

In order to assess whether the family has enough cash over the year to cover the introduction of beans we have to construct a cumulative cash flow. The cumulative net cash flow is calculated by adding the monthly net cash flow with the cumulative net cash flow of the previous month.

For example, in January, the monthly net cash flow was $350. This is also the cumulative net cash flow because it is the first month in the season. In February, the monthly net cash flow is -$270. Adding these two together tell us that by the end of February, the cumulative net cash flow was $80.

	J	F	M	A	M	J	J	A	S	O	N	D
Monthly net cash flow	350	-270	-10	93	-200	-10	400	110	-110	-130	50	310
Cumulative balance	350	80	70	163	-37	-47	353	463	353	223	273	583

Cash flow (continued)

5. Analyze the net cash flow

This example shows that the family has a shortfall of cash in May and June. This means that even though beans is a profitable enterprise the family does not have the money available to cover the expenditures expected to occur in those months. What can the family do? There are a number of possibilities the farmer can choose to do:

- decide not to introduce beans;
- try to save some money in order to cover the financial shortfall;
- decide to cut back on some of the inputs used for growing beans;
- decide to reduce some of the area under maize and cassava in order to reduce costs;
- sell some livestock to cover the financial gap;
- decide to take a loan to cover the shortfall.

Example
Using a loan

Let us assume that farmer Bill decides to finance his shortfall with a loan. He would need to determine how much of a loan he needs and whether and when he could make payments to repay the loan.

The shortfall that cannot be covered amounts to $104. A loan of $200 would ensure the cash flow required. If he is to repay the loan over 4 months and is charged a rate of 18 percent interest, he will make 4 payments of $59 each. The total repayment would be $236.

The figures on the next page are an example of how a loan and repayment schedule could be planned to make this proposal feasible.

Cash flow (continued)

Example
Using a loan (continued)

		J	F	M	A	M	J	J	A	S	O	N	D
A	Monthly balance	350	-270	-10	93	-200	-10	400	110	-110	-130	50	310
+ B	Proposed loan				200								
- C	Proposed repayments							-59	-59	-59	-59		
	Cumulative balance	350	80	70	363	163	153	494	545	376	187	237	547

Assumptions:

- loan of $200 paid back over 4 months
- grace period of 2 months
- interest rate at 18%
- payable at four equal instalments

In this example, if Bill took out a loan of $200 he would cover the financial shortfall and would have the funds available to repay the loan. The cumulative balance would then be positive for the entire 12-month period showing that there is no more need for finances.

Where loan options are viable it is necessary to understand that taking out a loan is treated as an inflow, but the cost of repayment (principal and interest) also needs to be taken into account and is treated as an outflow.

In conclusion, Bill should be confident that introducing beans into the farming system is profitable and by taking a loan would also be financially feasible. The final decision rests with him.

Cash flow (continued)

Guidelines for extension workers

As more and more farmers move toward market-oriented farming, extension workers will need to help farmers understand and develop skills in managing their business finances. Farmers will need to understand that, as managers of their own businesses, they need to control cash inflows and cash outflows. Farmers can do this effectively by using the Time Plan Schedule at the end of Handout 4.8B to record income and expenditures.

Example of a complete cash flow budget

		J	F	M	A	M	J	J	A	S	O	N	D
	Sales of farm products												
Money coming in	Maize	270		300						300	100	100	
	Cassava				340				120				
	Milk			60	60	60	60	60	60	60			
	Chicken	130								60			
	Beans (planned)							450					400
	Total cash inflow	**400**	**0**	**360**	**400**	**60**	**60**	**510**	**180**	**420**	**100**	**100**	**400**
	Payments and purchase of inputs												
Money going out	Maize inputs			300						300			
	Cassava inputs				37								
	Farm inputs livestock	30	50	50	50	50	50	50	50	50	30	30	30
	Chicken feeding expenses									60			
	Beans inputs				200	50		40			180		40
	Household expenses												
	Living expenses	10	10	10	10	10	10	10	10	10	10	10	10
	School fees		200			140				100			
	Hospital expenses	10	10	10	10	10	10	10	10	10	10	10	10
	Total cash outflow	**50**	**270**	**370**	**307**	**260**	**70**	**110**	**70**	**530**	**230**	**50**	**90**
	Total cash inflow	**400**	**0**	**360**	**400**	**60**	**60**	**510**	**180**	**420**	**100**	**100**	**400**
	Total cash outflow	**50**	**270**	**370**	**307**	**260**	**70**	**110**	**70**	**530**	**230**	**50**	**90**
	Monthly net cash flow	**350**	**-270**	**-10**	**93**	**-200**	**-10**	**400**	**110**	**-110**	**-130**	**50**	**310**
	Cumulative balance	**350**	**80**	**70**	**163**	**-37**	**-47**	**353**	**463**	**353**	**223**	**273**	**583**

Space for notes and questions for the facilitator

Guidelines for cash flow analysis exercise

Basics steps to construct a cash flow

(i) Inflow and outflow: list the income and expenditure items when they occur in the year.
(ii) Prepare a cash flow table.
(iii) Calculate the monthly net cash flow.
(iv) Calculate the cumulative net cash flow.
(v) Analyse the net cash flow.

Cash inflow

1. On the time plan schedule sheet, start with the money coming in and enter all the sources of income a household has in the left column. They should be the same as those entered in the cash flow budget (business plan).

2. Month by month fill in the cash flow expected from each source. This is strictly cash and when it will be received.

3. Include remittances or gifts if relevant.

4. Do not write any loan or grant yet, even if it is expected.

Cash outflow

5. Write each income generating activity in the left column just below the sources of income rows and identify the inputs that have to be bought under each activity.

6. List any capital items, including machinery, buildings and equipment, that have to be bought during the budget period.

7. Month by month fill in the money to be spent on each item in the month when the transaction will occur.

8. Expenditure for home and personal expenses can be estimated realistically for each month.

Guidelines for cash flow analysis exercise (continued)

9. Ignore the loan repayments and loan fees row.

10. Work out the net cash flow for each time period in the budget as:

Net cash flow = Cash inflow - Cash outflow

In the event of a negative cash flow in any month, the extension worker should give the farmer a chance to explain how the cash shortfall will be solved.

11. Work out the closing balance for the first month as:

Closing balance of the 1st month = Opening balance - Net cash

12. Transfer the closing balance for the 1st month to the opening balance for the 2nd month and subtract the net cash flow from it to get the next closing balance.

In the event that there is a negative closing balance, in any month, the extension workers should give their farmers a chance to explain how the cash shortage will be solved.

Consider the following alternatives and add what the farmers would wish to do:

- one expense can be reduced or delayed;
- negotiate for a later payment to the supplier;
- some items to be paid for by instalments;
- go for a loan or grant;
- change the pattern of inputs;
- go for piecemeal work;
- other.

13. Money obtained as a grant or loan can now be entered in the right month and closing balance be recalculated.

Guidelines for cash flow analysis exercise (continued)

Worksheet — Time plan schedule

Cash inflow			Cash outflow		
Description	*Month*	*Income ($)*	*Description*	*Month*	*Expenditure ($)*
	Total			**Total**	

Space for notes and questions for the facilitator

Information for a dairy enterprise

Unit
2 dairy cows that produce an average of 3 litres per day per cow.

Cost of purchasing the cows
$200 each

Income
The price of milk is $0.50 per litre.
2 calves sell for $100 each, sold in February.

Expenses
Feeds and other requirements for livestock are $400 per cow per year.
Wages for livestock is $60 per month.

A loan is available at an interest rate of 15 percent.

Preparing for Session 4.9
Records

Learning outcomes
Understanding (i) the purpose and importance of keeping records on the farm,
(ii) the application of some basic farm records

Training aids
Exercise 4.9A (Review of farm records)
Exercise 4.9B (Records for gross margin and cash flows)
Handout 4.9A (Keeping farm records)
Handout 4.9B (Examples of forms for record keeping)

Notes

Records

The last session in this module is about records. Most of the farm management tools learned in this module depend on reliable and accurate data and information. Farmers who keep good, if simple, records of farm activities will be in a much better position to make the farm management tools work for them. This will lead ultimately to increased profitability.

Opening statement

In order to use any of the farm management tools discussed in this module, farmers will need information. And yet many smallholder farmers do not keep records. They try to rely on memory, but this is not reliable enough to be able to use these tools effectively. In this session we shall learn how essential record-keeping is to farm management.

Exercise introduction

Here we shall explore some of the ways in which extension workers can assist farmers to understand the importance of keeping records and the contribution they make to increasing farm profitability. The review of this handout will be done in three exercises. These are: Exercises 4.9A (Review of farm records) and B (Records for gross margin and cash flow)

Exercise 4.9A
Review of farm records

Purpose: To improve understanding of the role of records in market-oriented farm management. (Participants should have read Handout 4.9A prior to this exercise.)

Method: Mind mapping.

Material: (i) Heavy paper or light cardboard of three different colours, (ii) thick marking pens.

Allow about 45 minutes for this exercise

Procedure

1. Give each participant three cards of the different colours.

2. Ask each person to write on one card an answer to the following topics:
   - The value of records to farmers and extension workers
   - Why farmers do not keep records
   - Types of records

3. Each participant should then stick the cards on the board and explain it.

4. Discuss one topic at a time.

5. After presentation of each topic, cluster all similar cards and have a general discussion.

Ensure that the main points of the handout are discussed.

Exercise 4.9B
Records for gross margins and cash flows

Purpose: To design records for gross margins and cash flows.

Method: Group discussion and presentation.

Material: (i) Flip chart paper or newsprint, (ii) thick marking pens.

Allow about 45 minutes for this exercise

Procedure

1. Retain the teams from the previous exercise. The assignment is to design the types of records that a farmer and rural entrepreneur could use to record the information needed to manage the business.

2. Assign each team with the task of designing record-keeping formats for gross margin and cash flow information. Each team should have the following tasks:

   Team 1. Farm map
   Team 2. Input record, labour record, poultry/livestock record
   Team 3. Income record, expense record

3. Ask each team to make a brief presentation to explain their assigned record. Encourage discussion

Note the practical use of the records developed.

Space for notes and questions for the facilitator

Keeping farm records

As we learned in Module 3, information is an essential part of farm management. In order for farmers to be able to use any of the farm management tools, they will need information about their farm. Sometimes they will want to examine their farm's performance over a number of years. Without some means of recording data and information, farmers will find it difficult to analyse their farm and to plan for improvements.

What is record-keeping and what are farm records?

Record-keeping is a process by which data is systematically collected, organized and stored. The stored data can be retrieved, put together in different ways and then analysed — turning the data into information. This information is then used to make decisions. Thus farm records are the means of storing data and information so that it can be recalled and used at some later date. As will be discussed in greater detail later, farmers use memory, diaries, physical records and financial records. Each of these types of records helps the farmer remember what has happened on the farm and what the current stock levels are. Farm records may also include off-farm information about things such as market prices, input prices and market demands.

Why keep records? The value of keeping records

Keeping records is an important part of market-oriented farm management. The farmer can use the data and information from farm records to:

- measure the production performance of the farm;
- measure the financial performance of the farm;
- examine the farm business;
- plan the farm business.

Keeping farm records (continued)

More importantly, without good records farmers must rely on their memory for making decisions. Having a workable system for recording and retrieving data and information will make it much easier to improve the profitability of their farms. They will need to record, keep and be able to retrieve data about production, marketing, processing and household consumption, and expenses.

Likewise, farm records also provide useful information for extension workers to help farmers increase farm profits, adjust farm practices, select enterprises, determine the best use of available resources, obtain credit and formulate production plans. Many extension workers keep approximate figures for the area they are working but it is much better if each farmer has accurate farm records of what has happened.

The advantages are many. Many farmers find keeping records worthwhile once they understand how the information collected can be used.

Records are important management tools that enable the extension workers and farmers to:

- Provide the farmer with a history of what has happened on the farm between seasons and years. By comparing one year's records with the next year a farmer can see what progress is made and see whether yields and profits are improving. This also enables the farmer to trace weaknesses.

- Assess the physical and financial performance of an enterprise or the whole farm business. By measuring the outcome of farm management decisions, records should allow farmers to compare data and indicators of profitability for both the enterprise and farm with other neighbouring farms.

Keeping farm records (continued)

- Assess how a farm is progressing over a given period. This enables the farmer to seek advice and the extension worker to provide advice on corrective measures where problems arise and before things get out of control. Farmers will also be better able to check whether things are going according to plan. The farmers can monitor performance and see whether they are using too many purchased inputs or whether crop and livestock yields are increasing or decreasing. They enable the farmers to control the daily routine operations of the farm. They will know what has been done and spent at any given time during the year. It is important to detect where things are going wrong quickly so that they can be put right before big losses occur.

- Establish a basis for budgeting and planning changes in the farm business. Farmers need to make decisions each year when they plan what they are going to farm. The production and financial records from previous years help farmers to make these decisions. Farmers need to know what yields can be expected from crops and livestock and what costs and income they are likely to get. With properly kept records, farm management and advisory decisions can be made with confidence.

- Tell farmers how much they are earning so they can make sure that they are not spending too much on family expenditure. In this way they can avoid getting into money difficulties.

- Facilitate advisory services to farmers wishing to borrow money for investment, sales and marketing of agricultural products. Farmers have advantages in dealing with the banks, moneylenders and input suppliers offering credit if they are able to show earnings. Records will be useful for assessing the financial needs of the farm. It allows the farmer to adhere to legal responsibilities on the farm.

Keeping farm records (continued)

- Apart from its potential use in farm management decision-making, farm records are sometimes used to formulate national policies, programmes and action plans.

Why farmers do not keep records

In many cases in Africa, record keeping is not well developed among farmers. This is in part because of the low levels of education, literacy and numeracy. Very few farmers keep records and know how to use the information collected. Below are some of the reasons for lack of record-keeping among farmers, presented together with some suggested solutions:

Reasons	Suggested solutions
Cannot read and write	Use pictorial illustrations Get help from children/literate neighbours
Forgetting to record	Make frequent contacts to remind them to record
Discouraged by low yields	Encourage farmer to farmer learning
Procrastinating recordings	Encourage them by examples from like farms
Tiredness after the day's work	Advise to carry record book along and make use of children
No safe place to keep record books	Create a simple, secure place Explain importance of record books to children and other family members
Don't have record book to record in	Help develop simple records Ask government, NGO, coop, etc. to assist farmers with record books
Farmer's spouse or children market without recording	Demonstrate to them the importance of recording sales
Lack of reasons why records need to be kept	Take time to explain reasons to farmers
Laziness and lack of encouragement by neighbouring farmers	Encouragement and invitation to group discussions and meetings
Not recording home consumption, gifts, donations and ceremonial usage	Extend the importance of recording home consumption and gifts

Keeping farm records (continued)

Types of records

Record-keeping can be kept simple and need not take up much of the farmer's time. There are many simple methods that have been devised for farmers to keep records even though they may not be literate. It does require self-discipline and commitment to fill them in regularly. So farmers have to be motivated by a desire to improve their level of income.

Various types of farm records could be introduced for literate, semi-literate and illiterate farmers. Some of the most commonly used records are listed below.

Physical records. These serve the daily needs of farmers in managing their operations and are designed to control specific activities. The records cover the main farm enterprises: crop, livestock, fisheries and household based food processing. They are used to produce specific kinds of information. Production records could be divided according to the main input types, for example:

- *Crop inputs:* seed, fertilizer, labour, herbicides, pesticides, fuel, pumps and irrigation infrastructures.
- *Livestock inputs:* day old, feed, drugs, vaccines, housing, labour.
- *Fisheries inputs:* fingerlings, fertilizer, feeds, lime, net, hook & line, and labour.
- *Processing inputs:* raw materials, equipment and labour.

Physical records show the quantities of the inputs used and outputs obtained. In addition, physical records indicate timing and methods of operations. Some of the most common physical records are: (see Handout 4.9B for examples).

Keeping farm records (continued)

The farm map. This is a drawing of the main features of the farm. It shows land parcels or plots; properly identified and located and indicating their correct sizes. The map is useful for understanding the size of the farm and the location and allocation of land, building and infrastructure. A map helps the farmer to plan the farm from basic production decision to improvement investments, such as land levelling, irrigation, drainage systems or roads.

To develop an accurate and truly useful map, it may be necessary to survey the farm and calculate the area. Preferably a plan should be drawn to scale showing all the plots and their areas. Business-minded farmers should know the size of all the plots on the farm, even if they do not have a farm plan. Fallow land should also be measured as this is also a part of the farm and will be used to grow crops some time in the future.

Production records. These provide farmers with valuable information on yields, inputs and cropping practices used in the production process on specific parcels or plots. A crop record should include details of the crops grown on each plot, the dates of planting and harvesting, the amount of seed used and yields. Yields may be measured in the traditional way as so many bags or baskets or in kilograms or tonnes. The actual weight sold can also be recorded, particularly at point of sale. The yield per hectare of a crop is calculated by dividing the total yield of the plot by the number of hectares to that crop.

Keeping farm records (continued)

Labour records. These keep track of labour inputs. The labour inputs are expressed in hours or days of operation for each of the farm enterprises and the corresponding payment in cash or kind. It may also be useful if these records indicate the source of this labour (e.g. family, hired from community, migrant).

Machinery and equipment records. These keep track of the expenses involved in operating machinery. This includes regular running costs, the nature, and the type and cost of repairs. This kind of record is most commonly kept by larger, more commercial farmers. However, it can be applied even to animal draft and hand equipment, where the records will help the farmer know the cost of farming with this kind of technology.

Livestock/poultry records. The farmer should also keep records on livestock. Many farmers keep a few pigs, hens, goats, and sheep or cattle. Records should be kept for each. It is important to keep a record of the number that are on the farm. This not only gives a check on theft, deaths and losses, but knowing the numbers of animals helps the farmer calculate yield per animal or per bird. A separate record should be kept for each class of stock. These include information on items such as breeding, health, production and feed composition.

Marketing Records. These records refer to information on market transactions and procurement of purchased inputs.

Keeping farm records (continued)

Financial records. These are used to evaluate the financial performance of an individual enterprise or of the whole farm. They are also used for cash flow analysis. Financial records help the farmer to know how well individual enterprises perform and contribute to overall farm profit at the end of the season or production cycle. Financial records include the main cash transactions on the farm: sales, purchases and money borrowed as expressed in the cash flow and gross margin calculations.

Financial records are kept in the form of accounts of what the farmer spends and receives. Purchases and expenses can be recorded on one page. Sales and receipts can be recorded on another. An example of a simple account book is shown below:

Purchases and expenses

Date	Detail	$

Sales and receipts

Date	Detail	$

Keeping farm records (continued)

Home consumption, income and expenditure

Records can also be kept of home consumption, of other non-farm sources of income, and of expenditure. If a large part of production is used to feed the family it should also be recorded. This part of production does not appear as sales in the account book, but it has value. The value of the farmer's crop includes not only what is sold, but also what is consumed by the farmer's family. Keeping a record of farm products consumed acknowledges the value of that production. It also ensures the farmer has an accurate record of production from the farm. This will help determine the true profitability of the farm.

This information could be recorded as follows:

Date	Details	$	Comments
January 1	6 eggs	2.50	
January 15	2 kg of spinach	1.00	

At the end of the year the farmer adds up the total value of home consumption. The value is added to the farmer's total receipts to give the value of total production of the farm. The value of sales plus the value of home consumption, less total expenses provides an assessment of farm profit.

Keeping farm records (continued)

Another record could cover household non-farm income sources and expenditures. This will help the farmer to understand the role of the household cash flow on the farm.

An example of this kind of record is shown below

Income sources		
Date	Item of income	Amount ($)

Expenditure		
Date	Item of expenditure	Amount ($)

Records for non-literate farmers

It is possible to help farmers keep records without having to be literate or numerate. For example columns can be allocated to the local denominations of money and amounts taken or spent on certain items can be recorded by making a mark in the relevant column. An example of a cash flow layout structured with these types of records is given below*.

☀	⊕	$
1-9-06	100	800
1-9-06		100
1-9-06		60
1-9-06		40
		1000

☀	⊖	$
1-9-06	2 x 200	400
1-9-06	1 x 250	250
1-9-06	1 x 120	120
1-9-06		60
		830

100 1000 − 830 = 170

* Reference: FAO 1999. *Enhancing Farmer's Financial Management Skills* by Jennifer Heney

Keeping farm records (continued)

Principles of record keeping

There are some general principles that apply to all record keeping. Records should be:

- accurate and complete and filled in as soon as possible after the operation;
- neat and written clearly;
- complete by not leaving out any information;
- be simple in design, easy to keep and retrieve;
- easy to analyse;
- appropriate.

Care should be made that only the really vital information required by the farmer is collected through record-keeping. The whole purpose of record-keeping is to improve the standard of farm management. There is no value in spending time on records and calculations of profit and production in individual enterprise if no use is made of them. All of the results should be compared with some standards as discussed above.

Keeping farm records (continued)

Summary of farm record types

Background and farm information. This information needs to be collected only once per production cycle of the enterprise.

Farm inputs. Indicates the inputs applied to the enterprise. This form needs to be completed every time an input other than just labour is applied to the enterprise.

Labour. Indicates by date and day the operations undertaken on an enterprise and the cost of labour engaged to perform them. This needs to be completed every time labour is carried out on the enterprise.

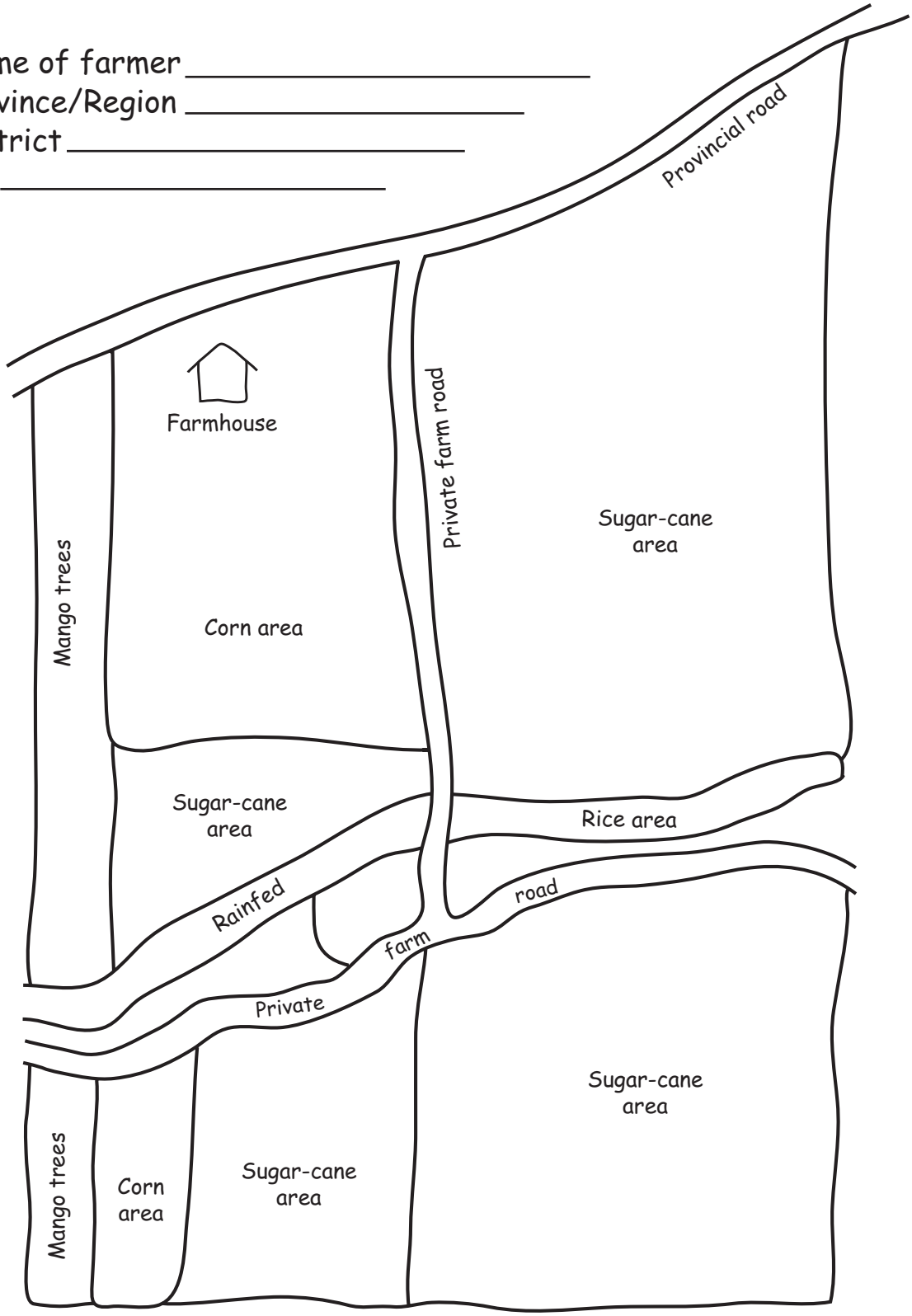
Production/output and sales. Used to estimate and calculate production/output and its value. This needs to be completed at the end of the production cycle of the enterprise.

Produce/inputs not sold or bought. Information on products, inputs and their estimated/imputed value/costs associated with the enterprise but were not sold or bought. This also needs to be completed at the end of the production cycle of the enterprise.

Gross margin estimation. Estimates gross margin (gross income minus variable costs) for the enterprise. This has to be completed at the end of the production cycle of the enterprise and will be based on all the above information.

Examples of forms for record keeping

Name of farmer _____
Province/Region _____
District _____
Lot _____



Note: a simple farm map, such as the one above, can be drawn by hand

Examples of forms of record keeping (continued)

Record form — **Field material input**

Enterprise _____ Area planted _____

Date	Input	Quantity	Price per unit ($)	Value ($)
	Total			

Record form — **Labour**

Enterprise _____ Area planted _____

Date	Operation	Family (person-days)	Hired			Total labour (days)
			per/days	$/day	value	
Total						

Record form — **Livestock/poultry**

Type _____ Number raised_____

Date	Operation	Feeds		Concentrate		Veterinary supplies		Others	
		qty	cost	qty	cost	qty	cost	qty	cost

Examples of forms of record keeping (continued)

Record form — **Income**

Enterprise _____ Area planted _____

Date	Description	Sold			Value of produce ($)		
		quantity (kg)	price per unit ($)	value ($)	consumed	stored	given away
Total							

Record form — **Expenditure**

Enterprise _____ Area planted _____

Date	Description	Number/ quantity	Price per unit ($)	Value ($)
Total				

Notes

Review of Module 4

At the end of this segment participants will have the basic understanding and skills to apply a selection of farm management tools to support market-oriented farming.

The following outline will guide the facilitator in a brief review of the activities of this module.

Session 4.1
Constraints and opportunities analysis

Purpose of this session:
To understand and apply a constraints and opportunities analysis to diagnose the performance of the farm business and its enterprises.

Learning outcomes

(i) Understanding the purpose of the instrument, (ii) knowing when to apply it and (iii) possessing the skills to use it.

Session 4.2
Gross margin budgets

Purpose of this session:
To understand and apply gross margin analysis to diagnose profitability of farm enterprises.

Learning outcomes

(i) Understanding of the purpose in diagnosis and planning, (ii) knowing when to use the method, (iii) developing skills in constructing gross margin budgets, (iv) understanding the use of the tool in choosing between alternatives.

Session 4.3
Marketing margins

Purpose of this session:
To construct a market budget for selected enterprises to enable farmers to take more informed decisions on the choice of market channels open to them.

Learning outcomes

(i) Understanding the purpose of the instrument for market selection, (ii) knowing when to use the method, (iii) developing skills in constructing marketing margins.

Session 4.4
Break-even budgets

Purpose of this session:
To provide extension workers with the means of taking better decisions under situations of risk and uncertainty.

Learning outcomes

(i) Understanding the purpose of the instrument, (ii) knowing when to use the method, (iii) developing skills in calculating break-even points.

Session 4.5
Sensitivity analysis

Purpose of this session:
To provide extension workers with a simple tool to enable them to take better decisions after accounting for changes in selected, key variables.

Learning outcomes

(i) Understanding the purpose of the instrument, (ii) knowing when to use the method, (iii) identifying key variables of change, (iv) developing skills in conducting sensitivity analyses.

Session 4.6
Food requirements

Purpose of this session:
To assess the food requirements for a family and the amount of land that needs to be allocated towards the production of food crops.

Learning outcomes

(i) Understanding the food requirements of the farm household, (ii) recognizing the usefulness of the tool in farm diagnosis and planning, (iii) developing the skills to carry out the calculations.

Session 4.7
Labour planning

Purpose of this session:
To identify and better plan the labour requirements of a farm household in order to make more efficient use of scarce human capital.

Learning outcomes

Understanding (i) the purpose of the Seasonal Labour Calendar, (ii) when and how to apply it, (iii) its use in identifying solutions.

Session 4.8
Cash flow

Purpose of this session:
To assess the availability of cash to the farm household to finance profitable activities.

Learning outcomes

Understanding (i) the purpose of the tool, (ii) when to apply it, (iii) how to apply it, (iv) estimate cash shortfalls, (v) identify strategies to address financial gaps.

Session 4.9
Records

Purpose of this session:
To recognize the need for farm record-keeping
as the basis for collection of data
to make more informed farm management decisions.

Learning outcomes

Understanding (i) the purpose and importance of keeping records on the farm, (ii) the sources of information, (iii) the information requirements of the farmer.

Closing questions

Ask participants if they feel that
the overall purpose of the module has been achieved
and if they have improved their understanding
of the concepts behind the tools and have developed
their skills and competency in selecting
the most appropriate tools for application and use.
Make reference to each of the tools
on the next page individually.

Tool	Understanding of the tool	Skill in applying the tool
Constraints and opportunities		
Gross margin budgeting		
Marketing margins		
Break-even budgets		
Sensitivity analysis		
Food requirements		
Labour analysis		
Cash flow		
Records		

Notes

Notes

Notes

The following is a list of the AGSF series TRAINING MATERIALS FOR AGRICULTURAL MANAGEMENT, MARKETING AND FINANCE

1. Farm planning and management for trainers of extension workers in the Caribbean, 2004 (CD-ROM, English).
2. Horticultural marketing extension techniques, 2004 (CD-ROM, English).
3. Farm planning and management for trainers of extension workers. Asia, 2006 (Hard copy and CD-ROM, English).
4. Integrating environmental and economic accounting at the farm level, 2005 (CD-ROM, English).
5. Curso de gestión de agronegocios en empresas asociativas rurales en América Latina y el Caribe, 2005 (CD-ROM, Español).
6. Market-oriented farm management for trainers of extension workers. Africa, 2007 (Hard copy and CD-ROM, English).

In preparation

- Farm planning and management for trainers of extension workers. Latin America (CD-ROM, in Spanish).
- Training manuals on farmer business schools. Asia and Africa.

Other work

- FAO Pacific Farm Management and Marketing Series 3, Helping small farmers think about better growing and marketing (Hard copy)*.

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Now that we have explored the place of market-oriented farm management in agriculture, we are in a position to learn tools that farmers can use to make decisions on their farms and households. In Module 4 we shall explore some of the tools that will help farmers to make these decisions. Some of the tools are quick and easy to use, while others are specialized and more complex.