Economic concepts in market-oriented farming

Martin Hilmi
Foreword

Nowadays various changes occur in the farming sector worldwide. With the liberalisation and globalisation of agriculture it is important that the people involved understand how free markets operate and the underlying economic concepts. This is a relevant factor for farmers all over the world. Farmers in developing countries are faced by less government intervention in the support of their productions. Farmers in economies in transition are faced with new challenges that until a few years ago were inexistent. Farmers in the European Union are faced with the trade liberalisation of commodities under the Common Agricultural and Rural Policy for Europe (CARPE) and have to face the realities of world supply and demand for their commodities.

These changes make it necessary for farmers to have an appreciation of farm economic concepts and that they use these concepts for better management of their farms in a market-oriented manner. Ultimately, today it is the final customer/user of farm products who guides what is to be produced by the farmer. It is important that farmers produce the right quantity and quality to satisfy the consumer. This calls for improved farm management skills so that farmers can select new opportunities and have a better understanding of how to deal with the market. The principles of economics are fundamental in understanding some of the dilemmas facing farmers and how problems can be addressed.

The purpose of this book is to explain basic concepts of economics and how they can lead to better market-oriented farm management. Farmers need to develop their management skills to compete better in the free market economy.

The underlying lecture notes introduce the reader to some of the concepts and principles of economics and their use in commercial farming.

Lecture notes: it is hoped that this basic text can be used in the training of first year (agricultural) students as reference material, and that this information may later prove to be a valuable and helpful resource for them.

*Agromisa has other educational materials on the farm as a commercial enterprise and on farm accounting, which can be useful in vocational training of present and future commercial farmers.*

The editor
July 2006
ACKNOWLEDGEMENTS
A "thank you" has to go to all the farmers that had the time and patience to sit down and talk about their farm business over the years and how it has been changed by liberalisation and globalisation.

A special thank you also goes to the same farmers for their great hospitality, food, parties, good times, kind heart and sincerity.

A special thank you goes to Dr A.Treager at the University of Newcastle, UK, for her constant support in my continuing doctoral PhD studies.

A special thank you goes to Gianmario, Shazi and Sabirah for their information support and willingness to help, plus the parties and great fun.

About the author
The book has been conceived and written between September 2001 and December 2003 by Martin Hilmi. Martin Hilmi is a Lecturer in Marketing at John Cabot University, Rome, Italy and a Lecturer in Economics and Marketing at the University of Malta, Rome, Italy.
Martin Hilmi is also an agro-food marketing consultant and has consulted and worked in the industry for many years.
He has published books and articles in the field of agricultural economics and food marketing. He holds a BA and MSc in Marketing from the University of Leicester, UK, and is working on his PhD in Agricultural Economics and Food Marketing at the University of Newcastle Upon Tyne, UK.
# Contents

1 Introduction to economics and market-oriented farming  
1.1 What is market-oriented farming?  
1.2 What is economics and what is its place in market-oriented farming?  
1.3 Glossary of important terms in Chapter 1  

2 **THE BASIC ECONOMIC CONCEPTS FOR MARKET-ORIENTED FARM MANAGEMENT**  
2.1 Scarcity  
2.2 Efficiency  
2.3 Farm enterprises  
2.4 Factors of production (resources)  
2.5 Costs of production  
2.6 Opportunity cost  
2.7 Value of production (value of output)  
2.8 Gross margin and profit  
2.9 Cash flow  
2.10 Efficient use of scarce resources  
2.11 Marginal analysis  
2.12 Substitution  
2.13 Risk  
2.14 Glossary of important terms in Chapter 2  

3 Understanding the market  
3.1 What is marketing?  
3.2 How does the free market work?  
3.3 What are the factors that affect demand?  
3.4 What are the factors that affect supply?  
3.5 How are market prices determined?  
3.6 With changes in supply and demand, what happens to price?  
3.7 Why do prices vary from time to time?  
3.8 Why do some prices change sharply while others do not?  
3.9 How do changes in price affect the quantities supplied and demanded?  
3.10 Can farmers set the prices for their produce?  
3.11 Can farmers improve the price of their products?  
3.12 Glossary of important terms in Chapter 3  

4 Application examples of economic concepts related to typical farmer decisions  
4.1 What are the farmer’s goals?  
4.2 What decisions do farmers make?  
4.3 How do farmers select enterprises?  
4.4 How do farmers allocate resources?  
4.5 Single resource decision  
4.6 Two or more resources  
4.7 Allocation of capital among different enterprises  
4.8 How do farmers decide if they can finance a new initiative?  
4.9 How do farmers combine enterprises for maximum profits? (limiting resource constraints)  
4.10 How do farmers assess whether to buy a capital asset?  
4.11 Why do some farmers keep their capital assets?
1 Introduction to economics and market-oriented farming

1.1 What is market-oriented farming?

Farming is part of a system; this system is referred to as the supply system or more typically, the supply chain. This can be seen in the following figure:

![Supply Chain Diagram](image)

**Figure 1: Farming and the supply chain**

As can be seen from the above supply chain, farming is only part of a much larger system. The supply chain works in the following way:

- Farmers get their input supplies, such as seeds, fertilisers, tools and machinery from farm input suppliers.
- Farmers then plant crops, raise livestock or attend to fruit trees, etc.
- Later, collector merchants collect the farmer’s harvest at the farm gate. In turn collector merchants supply this harvest to processors.
- Processors may just simply sort and clean various harvests and sell them in their original form or may transform or combine the harvest into other products; for instance, fruit is processed into jams.
- The processor then sells the products to a wholesaler, who supplies the products to a retailer.
- It is at retail level where consumers buy the products to consume.

Farmers can also decide to sell their produce directly to a processor, wholesaler, retailer or to final customers. For example, a farmer can take his produce directly to the processor by truck, or the farmer can take his produce and sell it in the local farmers' market.

It is important that one has to recognise that the farmer is dependent ultimately upon other organisations in the supply chain to be able to sell the harvest produced.

Clearly a farmer must ensure that wholesalers and final consumers in the supply chain are satisfied with what he has produced. If organisations and consumers in the supply chain are not satisfied with what the farmer produces, they will not buy from the farmer and will choose to be supplied from another farmer. This is the same principle that farmers use when buying from farm input suppliers. If a farmer is not satisfied with an input supplier s/he will change from that supplier and look for better terms elsewhere. This principle holds all the way up the supply chain to consumer markets.

Each movement along the supply chain represents a market. We can define a market as being composed of buyers who are willing and able to pay for produce, and sellers who are able and willing to supply the produce. For example, when the farmer sells produce to collector merchants, s/he is selling in a market to a buyer, who is willing and able to buy. This simply demonstrates that farming always has to contend with a market that is able and willing to buy its produce. Hence it clearly follows that for a farmer to be successful, s/he will need to produce what the market wants and what satisfies the market. This is what is meant by market-oriented farming, i.e. farming to suit and satisfy the needs of markets.
The supply system is nothing new for farmers, but what is new is that many new markets have appeared at each stage of the supply system. In the past, in many countries farmers would be helped by government institutions that provided and set:

- **harvest subsidies**, paying farmers for producing a certain amount of produce
- **input subsidies**, paying some of the price farmers would pay for inputs such as fertilisers; quotas, enabling harvest prices to rise by restricting quantities of a particular harvest, creating marketing organisations such as marketing boards for produce
- **tariffs**, raising prices on produce brought in from foreign countries.

In many countries government support to farmers has diminished due to what is referred to as liberalisation. Simply this means that there is less government intervention in agriculture and more is left to the markets. The buying and selling of products is left to consumers and producers. Trade between countries has also increased dramatically; this is commonly referred to as globalisation. This simply means that there are more farm products from various countries available.

Liberalisation and globalisation are commonly misunderstood. What the terms simply mean is that farmers face greater opportunities to sell their products in the market. Farmers, who can manage their farms in a market-oriented manner, will be able to take advantage of opportunities that could enable them to earn more money. However, in doing so farmers also face competition from other farmers in the market and also risks. For example, the risk of not being able to sell produce in the market at a favourable price. The changes that have taken place do bring opportunities but can also bring disadvantages. The way to avert disadvantages is that farmers need to develop their skills in understanding the market better, by being market-oriented and making better decisions.

**Case Study: Globalisation and liberalisation in Sudan **

Agriculture in Sudan is the main sector of the economy. It provides a living for a large part of the population, such as the many small farmers to be found in the country. Typically agricultural products are sorghum, millet, sesame, cotton, wheat, rice and meat. With the liberalisation and globalisation of agriculture, small farmers in Sudan were faced with a host of opportunities and some perils. The main peril was that of rising costs of production; this was due to the fact that the government would no longer subsidise inputs such as fertilizers, farm machinery etc. The opportunities were that prices for farm products rose, and trade increased, hence production rose. Farmers could sell in more extended markets, both in Sudan itself and also via export to other countries. The opportunity of exporting also gave farmers the possibility of obtaining higher prices for produce sold.


Farmers are always taking decisions that affect their farm business. For example market-oriented farmers may ask such questions as:

- What is the best way of producing for the market?
- What is the range of choices that are open to me?
- When to purchase seeds, fertilisers, insecticides, new implements and equipment?
- What enterprises or combinations should I choose?
- How much should I aim to produce from my crop and/or livestock enterprises?
- What types of farming practices and technologies can I use?
- How best to allocate farm labour amongst different enterprises?
- How much of the crop should be kept for home consumption and how much should be sold in the market?
- What markets should I choose?
- When should I sell my produce?
- How can I cut back on the risks that I face in farming?
These decisions become vitally important when trying to make the most of new market opportunities. Farmers these days must know more about different products and the different ways of producing them. The farmer must know more about farm management: how to organise, manage and plan the farm in the best possible way. The emphasis on the market and the need of farmers to be competitive calls for a stronger understanding of economics and for better farm management skills.

Farmers must understand that there are basic and fundamental questions that have to be considered and that these questions are a central part of farm management. They can be divided into four types:
- What to produce?
- How to produce?
- What methods to use?
- How much to produce?
- For whom to produce?

In considering these questions the farmer is influenced by economics. But one must understand that while economics is important in addressing farmer concerns, not all farmer concerns can be explained only in economic terms. For example, farmers may well take decisions based simply on farm family reasons or other, irrational but valid, considerations. However, in these lecture notes we only use (rational) economic language!

1.2 What is economics and what is its place in market-oriented farming?

Farmers like other business people have unlimited wants. For example, which farmer would not like to grow thousands of tons of a certain crop or rear hundreds of cows every year? These desires are not rational. This is because the resources which farmers use for producing crops and livestock are not available in unlimited quantities. Farmers understand that resources are scarce; for example, there is not an unlimited supply of seeds, fertiliser and water. Resources are limited and have to be used carefully; farmers will have to economise in their use. The study of using limited resources is called economics.

Economics means scarcity, resources are limited and have a value due to their scarcity. Typically, economic value is expressed in price terms. Can you think of any resource that has been transformed into farm products that does not have a price label attached to it? In farming, for example, straw may be seen to have a free value, particularly when it is left after harvest and used as bedding for livestock. But straw does have a price, clearly a low price, but nonetheless it does have a value as a resource.

Further, resources chosen to produce one thing cannot at the same time be used to produce something else. For example, a farmer uses resources (such as seeds, water, etc.) to plant maize; with the same resources s/he will not be able to plant wheat. So, maize can be obtained only by doing without something else, in this case wheat. Choices have to be made to get the most from scarce resources. This is in fact the basis of economics.

A farmer will have certain limited resources that s/he will have to use for producing. Thus (as we saw in the previous section) the farmer's basic economic decisions/choices will be:
- what to produce?
- how to produce?
- what methods to use?
- how much to produce?
- for whom to produce?
The answers to these questions will be determined by a farmer's choices and decisions. A farmer, for example, will decide what crops to produce (let us say, maize); s/he will decide how to produce it, in other words what methods s/he will use to grow the maize; the farmer will decide how much to produce, in other words what quantities of maize to produce.

Now the last economic question "for whom to produce?" is the basis of this economic decision process. The question does not mean who will ultimately buy the farmer's maize, but which market will be best suited for this crop. In other words, the farmer will have to produce for the market. Farmers, whatever choices and decisions are made, always have to keep in mind that it is the market that buys, and hence all production should be market-oriented.

Undoubtedly, the resources needed to produce crops or livestock are under the control of the farmer. The farmer is what we call the decision maker and manager. A decision maker is a person who has the authority and ability to take decisions. A manager is a person who is in charge of and responsible for something, for example, crop production. The farmer is generally both a manager and the decision maker on his farm.

Farmers’ decisions will be about economising the use of scarce resources on the farm and getting the most out of them. That is what in economics is referred to as efficiency. Efficiency is the art of getting the most out of the least. For example, a farmer who gets a big crop output from little input is said to be efficient.

Shown in a simple way: **Less Input & More Output = Efficiency**

---

**Case Study: Efficiency and farm size in Brazil *)**

Brazil is renown for its large diversity of farm products and production methods. This great variability does have aspects on how efficiently farm products are produced. In a study conducted in Brazil on farmers in the Centre West of Brazil, it was found that large farms of between 2,000 - 20,000 hectares were efficient. This was due to the fact that all farm operations were carefully thought out and inputs, such as fertiliser, water, etc. allocated accordingly, so as to get the maximum output of farm products such as maize or beef meat. In small farms, ranging from 20 to 200 hectares some were found efficient. Interestingly as these farmers began to expand their production due to having more money and hence the possibility of buying more input, efficiency would fall. This was due to the fact that the planning of inputs for the expanding farm was difficult to ascertain beforehand. But as the farm continued to grow in size, efficiency would be regained and inputs would be properly allocated to get the maximum benefit in terms of output. In these cases as the farm would grow in size, efficiency would fall, but only for a short period and then efficiency would rise again, a U-formed relationship.

*) Adapted from Helfand, S.: *Farm size and the determinants of productive efficiency in the Brazilian Centre-West*. Durban, South Africa, 2003.

When referring to economics in farming, it is formally called farm economics. A farmer who is knowledgeable in farm economics will be able to manage his or her farm efficiently, gaining the maximum output with minimum input.

At the heart of farm management lie basic principles of economics. Knowledge of these principles is important for good decision-making. Most farmers use economic principles every day of their lives in their farm operations without consciously knowing that they are doing so. These principles have been given names by economists, referred to as concepts, and will be explained in the course of this text.
1.3 Glossary of important terms in Chapter 1

**Basic economic decisions**: What to produce? How to produce? How much to produce? For whom to produce?

**Competition**: Rivalry among different business organisations involved in trade. For example, different farmers who sell their produce in a market.

**Economics**: A science that concerns the use of scarce resources and the best way these scarce resources can be used to produce commodities.

**Globalisation**: Increased trade between countries allowing a greater exchange of products to take place. This leads to a greater availability of different products.

**Liberalisation**: This means that there is less government intervention in agriculture and its trade and more is left to the markets. Decisions on the exchange of products are left to farmers and the buyers of farm products.

**Management**: Administering a business organisation such as that of a farm. For example, taking decisions with regard to activities on the farm, how to best organise labour, how to plant crops etc.

**Market oriented farming**: Farming which is based on the principle that any type of production carried out, either crop or livestock, must be based on what consumers demand. Consumers may be either business organisations, such as processors or the customers who purchase food for themselves and their families.

**Supply system / Supply chain**: All the people and business organisations involved in supplying produce to consumers or users; from seed to plate. The system may include farm input suppliers, farmers, collectors / merchants of farm produce, processors, wholesalers, retailers, restaurants, consumers...
Additional notes:
2 THE BASIC ECONOMIC CONCEPTS FOR MARKET-ORIENTED FARM MANAGEMENT

The key economic concepts that are helpful to farmers for better farm management are as follows:

2.1 Scarcity

As already discussed in the previous chapter, but it is important to repeat it here. Scarcity relates to the simple fact that desires, needs and wants are infinite, but resources to satisfy these needs and wants are limited. For example, a farmer would very much like to have an infinite amount of arable and fertile land to grow crops on, but good arable land is scarce. Economics is the study of scarcity.

2.2 Efficiency

Related to scarcity is efficiency. Efficiency simply means that as resources are scarce, they have to be used in an appropriate manner. Resources have value. Each resource has to be used in the best way possible so as to gain maximum advantage from that resource. This concerns the relationship between inputs and outputs. Using inputs efficiently will mean that costs will be reduced and that output will either remain the same or it will increase. Hence, with lower costs it may be possible to keep either output the same, or even increase output. For example, if a farmer finds new high yielding maize seeds (input) which produce more maize output, the farmer is said to be using the input efficiently.

The main point in efficiency is "getting more from less".

2.3 Farm enterprises

On many farms we may find several different activities taking place. For instance, a farm may grow maize, sunflower, soybeans and keep dairy cows and poultry. These more or less independent activities within one farm business are called farm enterprises.

Inputs are the things that go into production, for example the use of land, farm and family labour, hired workers, seed for crops, feed for animals, fertilisers, pesticides and other supplies, tools and implements, draught labour and tractors. Outputs are the crops and livestock produced from the inputs; they are the products of the farm. The outputs produced depend on the quantities of inputs applied. The relationship between inputs and outputs determines how much a farm produces. Economists call this relationship the production function.

\[
\text{Input} \rightarrow \{ \begin{array}{l} \text{dairy enterprise} \\ \text{maize} \\ \text{soya} \\ \text{chicken unit} \\ \text{......} \end{array} \} \quad \rightarrow \quad \text{Output} \rightarrow \{ \begin{array}{l} \text{dairy enterprise} \\ \text{maize} \\ \text{soya} \\ \text{chicken unit} \end{array} \} 
\]

Sometimes the output of one farm enterprise can be the input of another farm enterprise. For example, a farmer may produce fodder, which is not only an output that can be sold to other farmers but also an input for his or her own livestock enterprise.

Farm enterprises can be divided into three types:

- competitive enterprises
- supplementary enterprises
- complementary enterprises
Each of these categories has different characteristics:

- Competitive enterprises: enterprises "compete" when they share the same resources. For example, if a farmer doesn't have enough labour to harvest two different crops at the same time, one crop can only be increased if the other is reduced.
- Supplementary enterprises: enterprises "supplement" one another when they use resources that might otherwise go to waste. For example, crops grown during early rains may not compete for resources with crops grown during the late rains. The two crops require resources at different times of the year. These crop enterprises are defined as supplementary.
- Complementary enterprises: enterprises "complement" one another when they interact. For example, increased livestock production results in increased production of farmyard manure. This is produced as a by-product, which can be applied to increase crop yields.

### 2.4 Factors of production (resources)

So far we have used the term resources, which in reality has the same meaning as factors of production. But what are factors of production? We distinguish the following:

- Natural resources
- Labour
- Capital
- Information
- Sustainability

In order to grow a maize crop, for example, the farmer needs natural resources such as soil and water, which should be used in a sustainable manner; labour is needed to plant the seeds and capital, such as a tractor, to plough the field and harvest the crop.

**Natural resources**

Natural resources are what can be termed "nature's products". They include such things as land, river water, soil and rainfall, amongst others. All of these factors of production are natural and do not require human effort for them to be produced.

For example, a typical farm family may own or rent some land for cultivation. It may also be land around the homestead that can be used for growing fruit or some forage, and has access to different water sources, for example springs, wells or a river.

**Labour**

Labour is simply human effort whether physical or mental. Labour is the work of farmers, members of their families and hired labourers. Labour is necessary on all farms and for every kind of work.

**Capital**

Capital is a factor of production that is produced as a result of "human effort".

For example, land is cleared, cultivated and even irrigated and drained. Supplies of water are often increased by the construction of dams, storage tanks and canals. The improvements on the land and the skills and knowledge obtained by the farmer are known as capital. Capital includes such things as buildings, dams, roads, money, machinery, inputs, materials and knowledge of how to use these materials and machinery.

Capital is used by all farmers, large or small, and can be divided into three types of capital:

1. **Durable capital**
2. **Stock capital**
3. **Human capital**
1 Durable capital is made up of items that last for a long time. For example farm machinery, farm equipment and farm buildings.

2 Stocks are inputs and materials, for example seed and fertiliser which are usually used within a season, and which are bought on a more regular basis. Another important example of stock capital is that of money; money is used to buy physical inputs, such as seeds and fertilisers etc.

3 Human capital is the knowledge and skills obtained by the farmer and farm labourers in cultivating crops and / or raising livestock. It is the process of years of experience with working on a farm. This knowledge and the accompanying skills are very important in farm management.

Information
Information is closely related to the third type of capital, that of human capital. Information is scarce. For instance, information on how to produce a crop in a certain manner, or how to obtain money to finance current or future production. Also marketing information such as consumers' tastes, prices, transport costs, etc.

Sustainability
This is the art of using information, knowledge and skills to ensure the correct use of natural resources respecting the natural environment. For instance, better irrigation with less water, less pesticide use and fertilizers and pesticides correctly applied.

2.5 Costs of production
Costs of production are all the costs involved in the production of crops and livestock. For purposes of farm management it is useful to divide costs into two kinds: variable costs and fixed costs.

Variable costs apply to a specific type of crop or livestock production. The costs vary as output changes. They occur only if something is produced and 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. Typical variable costs are seeds, fertilizers, sprays, fuel for machines, hired labour, livestock feed and veterinary costs.

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. Fixed costs include, for example, the costs of a tractor, a piece of equipment, and draft cattle. Most of the costs of keeping a tractor, equipment and draft cattle remain the same whether or not the item is used.

2.6 Opportunity cost
There is another cost that is often overlooked but is important in economics. This is what economists call “opportunity cost”. In simple terms opportunity cost can be defined as having "this" means going without "that". For example, if the farmer spends money on buying tools, s/he is likely to have to go without something else as a result. As the farmer's money is limited s/he may be forced to reduce spending on other items. Another example can be that in deciding to work late into the evening during the harvest period, the farmer may be giving up his or her time spent resting.

But how can opportunity cost be taken into account? A simple example can clarify this question. Suppose that a farmer decides to grow wheat. From this crop the farmer can earn $500. If the farmer had grown maize instead, s/he might have earned $700. The opportunity cost to the farmer in growing wheat is the $700 that was lost from not growing maize. In both situations the farmer makes
money, but the point is that the farmer would have made more money from maize. The maize value was the farmer's opportunity cost.

The concept of opportunity cost can also be applied to labour. 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 a day's wages of what would have been earned in the part time town job. This cost is just as real as paying a hired labourer to do the work for the farmer on the farm.

### 2.7 Value of production (value of output)

How much crops or livestock produce is defined as the value of production. The value can be given by what the crops and livestock are worth, in money terms, at harvest time or when they are still in production. The value of production at harvest time is the money received from the sales of produce. The value of sales is very easily measured by the amount of money the farmer gets. This is calculated as the quantity of production sold multiplied by the price that the farmer receives.

\[
\text{Quantity sold} \times \text{Market price} = \text{Value of production}
\]

But typically not all of what is produced is sold. The value of production also has to include the value of unsold produce. This unsold produce could be consumed by the farmer family and / or put into storage. One method of valuing the produce is by using the market price for which the produce could have been sold. Hence the total value of production has to include produce sold, produce consumed by the farmer's family and the produce put into storage.

\[
\text{Quantity sold} + \text{Quantity consumed} + \text{Quantity stored} \times \text{Market price} = \text{Value of production}
\]

The value of production can also be assessed before sales actually take place. This is particularly relevant where crops and livestock require a considerable time span before they can be harvested for sale at the market. For example, tree crops and livestock have life spans of a number of years. Trees and animals increase their value as they grow. A mature tree is worth more than a seedling and an adult animal is worth more than young stock. This change in value also needs to be taken into account.

### 2.8 Gross margin and profit

The gross margin is a measure of profitability: it is not simply profit. The gross margin for a crop or livestock produce is obtained by subtracting the variable costs from its value of production. For example, a farmer who uses his resources to grow crops worth $60 at a variable cost of $10 generates a gross margin of $50 ($60 - $50). As we saw previously, variable costs rise and fall as the crop or livestock production increases or decreases.

\[
\text{Gross margin} = \text{Value of production} - \text{Variable cost}
\]

Profit shows the farmer's gain after taking into account the full production costs of the crop or livestock. It is obtained by subtracting the total cost of production from the value of production. This is simply the difference between the value of production and both the variable and fixed costs together. If the numerical figure obtained is higher in value than fixed and variable costs, there is a profit. If the numerical figure obtained is below the variable and fixed costs, there is a loss.

\[
\text{Profit} = \text{Value of production} - \text{Fixed costs} - \text{Variable costs}
\]
The crop or livestock profit can only take into account those fixed costs that can be allocated to a specific crop or livestock. However, in many cases, determining specific fixed costs for each crop or livestock may be difficult. This means that calculating exact profit per crop or livestock is not easy. In these situations fixed costs can only be calculated for the entire farm, for the entire crops and livestock produced. This will lead to calculating profit for the entire farm.

The fixed costs that can be divided between crops and livestock grown on the entire farm must include the cost of depreciation of equipment, maintenance and repairs, rent and payment for regular labour.

Depreciation is an important term in economics. But what is depreciation? An example will help to clarify this point. If a farmer buys a new tractor and then tries to sell it again the farmer will not get the same price s/he paid for it. This loss in value is called depreciation. This is an important factor to consider when looking at fixed farming costs.

Farm buildings, tools, machinery, and equipment are expensive to buy, and they are expected to last a certain period of time before they need to be replaced. The period of time for which farmers use these items is called its useful life. Farmers need to estimate how long they will be in use for.

A method is used to spread the costs of durable capital items over their useful life. It gives a fairly accurate idea of what it costs to use the item for a year. For example, 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 fixed costs of the farm.

\[
\text{Depreciation} = \frac{\text{Purchase price}}{\text{Useful life}} = \frac{$35,000}{7} = $5,000 \text{ per year}
\]

During a period of seven years, each year $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.

If the tractor was costed to a crop or livestock all at one time, then you would not get a true picture of how profitable that crop or livestock is. The cost of durable capital items has to be assessed over several years.

If a farmer decides to grow a new crop, the fixed costs of the farm are not affected. It is only the variable costs and value of production of the crop that are affected. In the case of a new crop, if the extra variable cost sustained is less than the extra value of production, the farmer will increase profits by growing the new crop.
2.9 Cash flow

The *cash flow* is the flow of money into the farm from sales and the flow of money out of the farm through purchases. Farmers use the concept to check whether or not there is enough money available to cover expenses. The difference between the inflow of cash and the outflow is known as the cash flow. Money is received from the sale of farm produce at different times of the year. Costs are also incurred as payments for inputs and materials that have been used. The cash flow provides the farmer with a picture of the liquidity (financial situation) of the farm at a particular time of the year. This is important to farmers because money is productive and without money farmers cannot buy inputs, and therefore cannot produce and generate profit. Simply put, farmers may be unable to continue their farm operations.

An example will help describe the concept of cash flow. A farmer sells part of the maize crop and earns $500. The farmer has to pay suppliers for inputs purchased. The farmer may also have to pay for hired labour. These expenses amount to $300. The farmer's cash flow is the difference between the two figures, which is $200. With this knowledge, the farmer can ask the following questions:

- Is the farm making enough money to purchase supplies for next year's crop?
- Is there enough cash available to increase maize production?
- Should I grow a different crop instead?
- Will the production of maize generate more money next year? And how much?
- Is there enough money available to buy new tools?
- Should I take a loan or sell some of my belongings if I don't have enough cash to cover next years' production?

2.10 Efficient use of scarce resources

As we previously noted, farm efficiency is concerned with the wise use of resources available to the farmer; in other words "getting more from less". It may be the case that some resources or factors of production are used in an incorrect manner, which causes inefficiency, or are not available in sufficient quantity, thereby causing a limitation on farm production and profitability.

Efficiency needs first and foremost an understanding of the factors of production within the farming system. This means listing all the factors of production which are used on the farm. The knowledge of which factor is limiting an increase in farm profits is required. This means checking which factors of production, land, labour or capital, are in short supply and if so which specific resource is the most limiting. This is called the effective resource constraint.

An example of land

Let us consider that land is a limiting factor of production. Where land is the limiting resource, the aim of the farmer is often to earn as much gross margin or profit as possible per unit of land: gross margin per hectare. Returns per hectare might increase through either raising yields or by selling produce at high prices.

An example of labour

Labour may be a limiting factor of production. When there is a lot of land available, the performance of the farm may be limited by the amount of labour that the farmer has. The return to labour is the benefit produced from using the labour resource. This is done by calculating the gross margin and relating it to the amount of labour used in production. The farmer needs to compare the profitability of different crops and livestock when labour is the limiting factor of production. How does the farmer calculate this? First of all the farmer needs to work out how much it costs to grow a crop or keep livestock over the growing period. If we take the example of a maize crop we have two types of costs: labour costs and such costs as seeds, water, fertiliser etc., which, together, make up the variable costs (remember: the gross margin per unit of land is calculated as the value of production minus the
variable costs). The farmer also needs to keep a record of the labour used to produce the crop. This is also done on a per hectare basis. All the labour needed to produce the whole crop should be calculated, for example, the labour used in sowing, cultivating, weeding and harvesting. The amount of labour used is expressed in person working days. Each person working day consists of 8 hours of work. The gross margin per hectare is then divided by the total number of person working days of labour used to produce the crop. This gives the gross margin per person working day. This allows the farmer to compare the profitability of this enterprise with others. Producing more with the present labour supply can increase the gross margin per person working day.

An example of capital
Capital is nearly always in short supply and needs to be used efficiently. The return to capital, like the return to labour, is used as a way of measuring its efficiency. The return to capital is the benefit produced from using the capital resource. It is measured as an indicator by taking the gross margin or profit per unit of capital used. For example, investing money in high yield seeds, instead of ordinary seeds, can yield a higher profit per unit of capital money spent.

N.B.: The return to capital is normally expressed as gross margin or profit per unit value of capital, e.g. per $1000 or per $100, whatever value is most appropriate.

2.11 Marginal analysis
Farmers often ask themselves what will happen to their enterprises if they increase inputs. For example, what will happen to a maize crop if the farmer applies more fertiliser? Will the output increase? What will happen to costs as the farmer applies more fertiliser? What will happen to the farmer's revenue? Will the farmer be making more profit? To answer these questions, economists use the concept "marginal analysis". Marginal analysis simply means change. It looks at what happens to total quantity, with a small change of some variable, to produce that quantity. It analyses the change that occurs. For example, if the farmer applies more and more fertiliser to his maize crop, what will happen to the total quantity of maize produced. This is referred to as marginal product or marginal return.

Table 1: The marginal product of maize output applying different levels of fertiliser

<table>
<thead>
<tr>
<th>1. Quantity of fertilizer (bags)</th>
<th>2. Total product of maize (bags)</th>
<th>3. Marginal return of maize (bags)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>13</td>
</tr>
</tbody>
</table>

As we can see from the above table, when the farmer adds one bag of fertiliser to the maize enterprise, 7 bags of maize are produced. In column 3 we can see the marginal product or return is 7; this is the difference between 0 level of fertiliser application and the application of one bag of fertiliser. The marginal product is changed by 7. If the farmer applies two bags of fertiliser, total output reaches 20 bags, and the marginal product is 13. Note that even though two bags were applied, the marginal product did not double. Marginal analysis shows what the change is in total output, by changing the levels of input.

The marginal concept can also be applied to a farmer's costs and revenues; referred to as marginal costs and marginal revenue. For example, when producing maize and applying increasing amounts of fertiliser, what happens to the farmer's costs? What changes occur?

Table 2: The marginal cost of maize

<table>
<thead>
<tr>
<th>Amount of fertiliser (kg)</th>
<th>Cost ($)</th>
<th>Marginal cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>
As we can see from the table above, as the farmer increases the amount of fertiliser used, the costs rise. When applying 10 kg the cost is $5, when applying 20 kg the cost is $9. But the marginal cost, applying 10 kg, is equal to $5; when applying 20 kg, it is reduced to $4, and then when applying 30 kg, it rises to $5.

It can be seen that the change in costs at 20 kg of fertiliser is reduced to $4 and then increases to $5 at 30 kg.

The same principle can be applied to revenue that farmers obtain from selling their maize.

Table 3: The marginal revenue of maize

<table>
<thead>
<tr>
<th>Maize produced (bags)</th>
<th>Price ($)</th>
<th>Revenue ($)</th>
<th>Marginal revenue ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>1.50</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>20</td>
<td>1.25</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>30</td>
<td>1.10</td>
<td>33</td>
<td>8</td>
</tr>
<tr>
<td>40</td>
<td>1.00</td>
<td>40</td>
<td>7</td>
</tr>
</tbody>
</table>

As we can see from the above table, as the farmer sells more of maize her/his revenue (the money s/he earns) increases. The selling price per bag is $1.50, but as the farmer tries to sell more, the price per bag is reduced. This is an elementary economic concept: as the price rises, consumers will ask for less maize; as the price decreases consumers will ask for more maize. So to sell more bags the farmer needs to reduce the price. The farmer's revenue goes from $15 to $25, and the farmer's marginal revenue goes from $15 to $10; when the farmer sells 30 bags, the marginal revenue is $8. As the farmer sells more bags of maize the farmer's marginal revenue decreases.

Farming is a business and for any business to survive it must make a profit. Clearly profit comes from subtracting costs from revenues, as we saw in section 2.8. But what is the best level of output that a farmer can produce to maximise profits? Marginal analysis shows this.

Table 4: Marginal revenue and marginal cost for maize

<table>
<thead>
<tr>
<th>Maize produced (bags)</th>
<th>Marginal revenue ($)</th>
<th>Marginal costs ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>19</td>
</tr>
<tr>
<td>30</td>
<td>24</td>
<td>27</td>
</tr>
<tr>
<td>40</td>
<td>22</td>
<td>28</td>
</tr>
</tbody>
</table>

If, for example, we compare marginal revenue and marginal cost of a farmer, we can select the best level of output a farmer can obtain. For example, if marginal revenue is $16 and marginal cost is $12, for selling 10 bags of maize, clearly the farmer, by selling more bags of maize can increase profits, possibly by $4. If the farmer produces some more bags of maize, his/her costs will go up, but also his revenues. If the farmer decides to make 20 bags of maize and sell them, the farmer's marginal revenue may be $20 and the farmer's marginal cost $19. Here the farmer can be satisfied with what s/he is producing and selling. If the farmer adds or produces more bags of maize, the costs will be higher than the revenues and hence, the farmer will not be making a profit.

If farmers want to maximise profit, they have to choose a level of output where marginal revenue is approximately equal or close to marginal cost. In Chapter 4 we will study further this important concept.
2.12 Substitution

Farmers are constantly faced with choices to be made; choices between enterprises, resources and technologies. The question is, of the choices the farmer has, which is considered to be the best? This is the principle of substitution. It can be usefully applied when farmers consider whether or not to use a new technology or farm practice. As there are many technical ways of producing a crop or running a livestock enterprise, the farmer must choose the method of production that is most efficient, i.e. the method that uses scarce resource wisely.

For farmers to become more efficient they will most likely have to take up new and better technologies and give up old methods. For example, a farmer can prepare a seedbed with hand tools, can hire additional labour, or can use a draft animal, or a small tractor. Which of the alternative methods should the farmer use and how can the farmer assess the options available?

The answer depends on many factors: the farm size, whether the farmer has access to capital, and the cropping pattern, amongst others. In order to come to a decision the farmer needs to know about the factors of production and their cost. A simple principle of economics is then applied. The principle states that when substituting one practice for another the farmer must be certain that the savings in the method replaced are greater than the extra cost of the new technique or practices applied.

2.13 Risk

One of the facts of life is that future events cannot be known with one hundred percent certainty. Risk occurs when the outcome of a decision is not known in advance. For example, there are risks of weather and diseases that affect farm output; farmers don't know whether the rainfall will be good or poor over the season or whether the crop will be infected by disease. Another example of risk concerns price and cost fluctuations, which occur over time as a result of market changes.

Farmers need to make decisions that take risks into account. Risk influences the amount of inputs that the farmer uses as well as its costs. Similarly it affects the crop yield and product prices. As a result farm profits are always uncertain. But not all of the above mentioned risk factors have the same effect on farm profits. Input prices, for example, tend to vary less than output produce prices, hence output produce prices are more risky for the farmer.

Farmers often have to "trade off" between maximising profits and minimising risks. For example, a farmer may decide to plant a new crop variety that has never been planted in the area before, thus the farmer is trading on high risk. The farmer is playing a high risk in the hope of obtaining high profits from the harvest and sale of a new crop variety. It could well be that the crop does not yield high profits, due to non-growth of that particular crop, so the farmer has traded off profit for risk. The same farmer may decide not to take such a risk and to plant a common crop such as maize, thus reducing risk for more certain profit.

The economic principles described above are basic concepts needed to study market-oriented farming. Farming and in particular market-oriented production, call for an understanding of these concepts and they are explained in Chapters 3 and 4 of these lecture notes. In particular Chapter 3 sets out to explain the free market and how it works. Chapter 4 considers application of economic concepts to some of the decisions which farmers make in farming.

2.14 Glossary of important terms in Chapter 2

Farm enterprise: The different production activities that normally take place on a farm. A farmer may decide to grow maize; this is then what is called a farm enterprise. He may also start keeping poultry; this is then another farm enterprise on the same farm.
Competitive / supplementary / complementary farm enterprises: Enterprises that compete for the same resources are called "competitive"; for example, there is not enough labour to harvest two enterprises at the same time, labour dealing with one harvest competes with another harvest. Enterprises are said to be "complementary" when the production of one enterprise complements that of another. For example, a livestock enterprise creates farmyard manure that can be applied to crops. Enterprises are said to be "supplementary" in that they need different resources at different times of their production cycle. For example, crops grown during the early rain season cannot compete with crops grown during the late rains; they supplement each other.

Cash flow: A measure of the cash position of the farm. It is used to see how farm operations affect the cash position. Whether the farmer has enough cash available to cover the costs of introducing an enterprise change.

Costs of production: All the costs that concern production of enterprises on a farm. Costs are divided into two types, fixed and variable. Variable costs change as output changes; if the farmer has to hire extra labour for increased harvesting, then the extra hired labour is a variable cost. Fixed costs are costs that do not change with output. An example of a fixed cost is a tractor.

Opportunity Costs: Producing "this" means going without "that". For example, if a farmer uses all his resources to plant maize, he will not be able to plant soybean, for s/he has used all his resources to plant maize.

Production function: The relationship between the quantity of produce that has been produced and the quantities of inputs required to make the produce.

Factors of production: The inputs that are required to produce something: Natural Resources, Labour and Capital. For example, natural resources can be land and water. Labour can be the farmer (and his family) and hired labour. Capital can be durable capital such as a farm building or a tractor, and stock capital such as seed, fertiliser, and money and "human capital" which is the knowledge gained by the farmer with years of experience.

Depreciation: Durable capital depreciates over time from the initial value it had. For example, if a tractor is bought and a farmer uses it for some time and then tries to sell it again, s/he will get less money than what was paid for the tractor. This means that over time, or the useful life of a tractor, it will decrease in value.

Value of production: The value of what has been produced in money terms. For example, the monetary value of maize after it has been harvested. The value of produce can also be assessed before sales take place. For example, as a calf grows into an adult cow, its meat value will be increasing and this can be expressed in monetary terms.

Efficiency: The use of scarce resources has to be carried out in an appropriate manner. Each resource has to be used in the best way possible to gain maximum advantage from that resource. Efficiency = "getting more from less".

Efficient use of scarce resources: Scarce resources have to be used sensibly and the return of each resource must be maximal. It may be that one resource; land for example, is the resource that limits the increase of the farm's profits. Here efficient use of the land by the farmer is very important, so that s/he gets the biggest profit from each hectare of land under cultivation.

Gross Margin: A measure of how much money a farmer can earn from selling produce, deducting variable costs only.

Gross margin = Value of production less Variable costs
Profit: A measure of exactly how much money a farmer has earned from selling produce, deducting both fixed and variable costs.
Profit = Value of production less Fixed costs less Variable costs

Marginal analysis: Marginal analysis simply means change. It looks at what happens to total quantity with a small change of some variable to produce that quantity. It analyses the change that occurs to total quantity.

Risk: This occurs when the outcome of a decision is unknown. Farmers have to make a trade-off between risk and profit. For example, a farmer may lower risk by planting a common crop that s/he knows will obtain a good price in the market, hence ensuring profit. A farmer may take a big risk by planting a new crop, which has never been planted before in the locality. There will be uncertainty of the outcome of production and of profit at harvest and selling time.

Substitution: Farmers have a choice of what to produce, and how to produce it. The farmer can decide to substitute one crop for another and what method to use to produce this crop. Importantly, when a farmer substitutes one thing for another, the farmer must be certain that what is new costs less than that he previously produced.

Scarcity: Resources are limited. For example, there is a limited amount of water; supplies of water are not infinite.
3 Understanding the market

3.1 What is marketing?

Farm management involves making decisions about the marketing of farm products. In a narrow sense marketing can be defined as the physical function of taking farm products to market, so that they can be exchanged. Farm products are exchanged for money between suppliers (farmers) and buyers (processors and consumers).

The movement of farm products is referred to as physical distribution encompassing all the functions carried out which enable consumers and users to purchase all farm commodities. The typical functions carried out in marketing are:

- Harvesting
- Assembling
- Grading
- Packaging
- Storing
- Loading and unloading farm produce
- Transporting
- Distributing to various buyers such as processors, wholesalers, retailers and consumers
- Selling

Farmers, by growing crops and rearing animals produce a utility. The utility of a good is its usefulness to the buyer. Marketing enables form, time, place and possession utility to occur:

- Form utility: The product is in the form that the buyer requires. For example, maize will be of use to buyers only when it is ready to harvest (matured).
- Time utility: For example, at maize harvest time, maize supplies will be abundant; storing maize to sell later will add time utility. It means that consumers will be able to consume maize even when it is not harvest time.
- Place utility: For example, transporting the maize to a market will create place utility. Maize will be transported to where it is most needed, the market, where customers can purchase the produce.
- Possession utility: For example, maize ownership is transferred from the farmer to customer in a market place. Without possession utility, a product cannot be of use to customers.

A market is where sellers are able to supply and need to sell farm produce, meet consumers and users who are willing and able to buy farm produce. Markets are places where exchanges take place. The consumer has cash that the farmer values, and the farmer has produce that the consumer values. An exchange takes place when two parties, in this case the farmer and the customer, agree to a transaction; the transaction actually occurs when the two parties agree on exchange rates (prices) at which the farm products can be exchanged for cash. The exchange function of buying and selling depends on determination of price. It calls for an understanding of how the market works: the factors that affect supply of farm produce; the demand of users or consumers and what factors cause prices to change.

If farmers are to treat farming as a business, they need to understand how marketing in a broad sense works and how markets operate. The farmer cannot achieve his or her business goals unless farm products are exchanged for money. This implies that farmers plan their production of crops or livestock for the market. Farmers need to be market-oriented. Marketing does not start when crops and livestock are ready to be harvested, but before actual production of crops and livestock takes place.
It is important to understand the relationship between supply and demand in markets, as this will help the farmer to verify possible prices for his or her products. When the farmer plans farm enterprises, s/he needs to know what prices to expect; for example, if the farmer has some indication that maize will generate a higher market price than wheat, the farmer will plant maize. When the farmer harvests, s/he needs to know what prices can be charged. For example, if the market prices are high for his or her crop the farmer will sell the crop immediately, or, if at harvest time the prices are low, the farmer may decide to store the crop (if the crop is storable), and sell it at a later date, hopefully when prices are higher.

To make a profit the farmer has to obtain a price that is high enough to cover the costs of production and marketing. If the costs of production and marketing are not covered by the market price the farmer will have made a loss.

3.2 How does the free market work?

In Chapter 1 a word called "liberalisation" was introduced. Liberalisation means that there is less government intervention in market operations of buyers and sellers. For example, government intervention to fix prices, via marketing boards, on farm produce. In other words, liberalisation means free markets: farmers and buyers of farm produce are free to exchange produce at market prices.

Market prices are determined by two important concepts: demand and supply. Supply is the amount that people are prepared to sell and demand is the amount people wish to buy. The market price is the balance between these two factors, the point where supply and demand meet. Price is the exchange value of a product measured in money. If prices are too high then consumers will not buy the product. If the price is too low the producers will sell all their produce quickly and may only make a little profit. Similarly, if supply increases without demand changing, the price will fall. This is the reason why crop prices fall at harvest time; products available for sale are in great quantity. Alternatively, if demand increases without an increase in supply the price is likely to rise.

Where a product is relatively scarce, consumers "bid up" its price; when the price of a product rises, profits increase and so more of the product is produced. On the other hand, if consumers do not want the product, its price falls and farmers make a loss. This is called the price mechanism. It indicates the wishes of consumers and allocates productive resources accordingly. Both the consumer, who decides what is to be produced, as well as the efficiency of farm operations, determines the profit that farmers make from the business.

3.3 What are the factors that affect demand?

Demand refers to how much of a product consumers and users would actually be willing and able to buy at a given price. In practice the quantity demanded depends on the price of the product and the conditions of demand.

The price of the product

A consumer normally demands more of a product the lower its price is. If the market price is high, consumers reduce their purchases. If we take a single product, let us say, maize, we can draw up a table showing how much maize consumers will be willing to buy at different prices. By adding up the demand of all buyers of maize in the market at different prices it is possible to obtain a table for the whole market at a specific period of time. This is given below:
Table 5: Quantities demanded of maize at various prices in a market

<table>
<thead>
<tr>
<th>Price ($ per bag)</th>
<th>Maize demanded (* 1,000 kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>35</td>
</tr>
</tbody>
</table>

By taking the numbers from table 3.1, quantities demanded of maize can be seen graphically. This is called a demand curve as shown in the next figure.

Figure 3: The demand curve for maize

Figure 4: A change in price causes a movement along the demand curve

The demand curve is constructed by placing the price on the vertical axis, and quantity on the horizontal axis. Prices are set along the vertical line, going from $0 to $12 and quantities along the horizontal line, going from quantities 0 to 35 (000s of kilos). For each price and quantity found in table 3.1 a point is placed on the graph. The points are then joined together to make a line, referred to as the demand curve. If prices rise or fall there will be a movement along the demand curve. Consumers will demand less or more of maize according to whether the price has risen or fallen. As we can see, a rise in price causes a movement along the demand curve, from the original price of P1 to P2. It
causes the quantity demanded to fall. This is important to remember, when we will be looking at market equilibrium and changes in demand and supply (see the following sections 3.4 & 3.5).

Conditions of demand
It can happen that something occurs which makes consumers demand more or less maize in the market. In other words, the level of demand can change. For example, if the consumers' tastes change and consumers see maize as being very good for them; this will increase demand. On the contrary, if consumers fear that the maize on offer may be bad for them, perhaps through contamination with toxins, demand for this maize will fall.

Conditions that could affect demand could arise for the following reasons.

- **Change in taste.** The taste of consumers can change. The reasons for changing tastes can be varied; for example, fear that a product may be contaminated will reduce demand. Alternatively, if consumers perceive a produce as being good for them, demand will rise.
- **An increase in income.** If there is an all round increase in income among people in a country, this will increase demand.
- **Greater equality of income.** If income is distributed more equally among the people in a country, this will also increase demand. For example, the poorer people in a country could not afford to buy dairy products, whilst the wealthier could. If greater equality of income occurs between rich and poor, i.e. the poor have more money; this will increase the demand for dairy products.
- **A change in population numbers.** If the population of a country is growing, this will mean additional people coming into the market and demand will increase, especially if it concerns a staple product.
- **Expectations of future price changes or shortages.** The fear that the price of a product may rise considerably in the future will encourage consumers to demand more and keep it in stock.
- **A change in the prices of products that are close substitutes.** Suppose that cassava meal is a substitute for maize. If the price of maize rises, consumers may prefer to purchase cassava meal as an alternative.
- **Seasonal demand.** Seasonal demand refers to demand that varies with the seasonal harvest. For example, some consumers may prefer maize only when it has just been harvested, i.e. fresh. This will increase demand for maize at harvest time and decrease demand in the non-harvest period.
- **Government policy.** The government could pass a law, reducing tax on maize; this reduction of price could cause demand to increase. On the contrary, if the government increases tax on maize, the increase in price could reduce demand.

<table>
<thead>
<tr>
<th>Case Study: Egg demand fell in Europe &amp; USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>The demand for eggs in Europe and the USA had been constant for many years. Eggs were seen as a nutritious food that consumers could prepare easily and buy at convenient prices. In many parts of Europe, especially the colder parts of Europe, eggs were in great demand and seen to be fit especially for consumption by young children and old people. For young people it was a very good source of energy and for old people it was seen as a food that was highly digestible. Poultry farmers were faced with a constant and rising demand for eggs. This of course made poultry farmers expand their laying flocks so as to expand production to satisfy the growing demand. Egg producer associations, supported by governments, would frequently advertise to the general public about how good eggs were. However, scientists researching into the effect of eggs on the human body maintained that eggs contained too much cholesterol, which in the human body was bad for blood circulation and the heart. Over a short time and with lots of media coverage of their findings, the demand for eggs started to decrease as consumers saw they could be a risk for their health. This fear caused many consumers to change tastes and switch to other food products. The demand for eggs shifted inwards and poultry farmers were left with a lot of unsold eggs. However, over time consumers regained trust in eggs and scientists researching eggs found that eggs could be harmful if eaten with other fatty foods. This caused consumer tastes to switch back to egg consumption and demand for eggs shifted outswards; in other words consumer demand for eggs in-creased.</td>
</tr>
</tbody>
</table>
It is important to understand that changes in conditions of demand, such as consumer tastes, will cause the expansion or contraction of demand in a market. This can be seen in the following figure.

**Figure 5: Changes in the conditions of demand**

Changes in the conditions of demand will cause the demand curve to shift either outwards or inwards. This will either expand or contract the market for maize. This is important to remember when we will be looking at what is called equilibrium and changes in demand and supply (see below, sections 3.5 and 3.6).

An important distinction to make here is that if a change in price occurs, the demand curve will not move outwards or inwards, but there will be a movement along the demand curve. This will cause either an increase or decrease in quantities purchased. Likewise, if the demand curve shifts outwards or inwards, for example due to a population change, this will either expand demand in the market (more consumers), or contract the market (less consumers). This distinction is important to remember.

### 3.4 What are the factors that affect supply?

Supply refers to how much of a product a farmer makes available for sale at a given price. As with demand the quantity supplied depends on (i) the price of the product (ii) the conditions of supply.

**The price of the product**

If the price of a product is high, normally more of a product will be supplied. For example, if the price of tomatoes is high, the farmer and his family will probably consume fewer tomatoes in order
to make sure that more can be sent to market. The higher price would also encourage the farmer to extend the area under cultivation and provide the crop with more or better quality inputs so that a higher yield can be obtained. A higher price for tomatoes would encourage other farmers, and possibly the less efficient too, to go into tomato production.

Just as with demand, if we take a single product "maize" we can draw up a table showing how many maize suppliers will be willing to sell at different prices. This consists of the total amounts supplied at different prices by all producers in the market at a specific period of time.

Table 6: Quantities of maize supplied at various prices in a market

<table>
<thead>
<tr>
<th>Price ($ per bag)</th>
<th>Maize supplied (000s kilos)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>32</td>
</tr>
<tr>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

By taking the numbers from table 3.2, quantities of maize supplied can be seen graphically. This is called a supply curve as shown in the next figure.

Figure 6: The supply curve for maize

The supply curve is constructed by placing price on the vertical axis, and quantity on the horizontal axis. Prices are set along the vertical line, going from price $0 to $12 and quantities along the horizontal line, going from quantity 0 to 35 (000s kilos). For each price and quantity found in table 3.1 a point is placed on the graph. The points are then joined together to make a line, referred to as the supply curve.

If prices rise or fall there will be a movement along the supply curve. Farmers will supply less or more maize according to whether the price rises or falls.

As we can see, the rise in price causes a movement along the supply curve, from the original price of P1 to P2. This causes quantity supplied to rise. This is important to remember, when we will be looking at market equilibrium and changes in demand and supply (see below, sections 3.5 and 3.6).
Conditions of supply

Something may occur so that farmers send more or less maize to the market. In other words the level of supply can change. For example, the yield of a maize crop at harvest may be lower than expected due to a water shortage during the growing period. This will create a shortage of maize in the market and prices will rise.

Conditions of supply may change through:

- A change in the cost of the factors of production. A fall in the cost of inputs reduces the cost of production. For example, if the price of renting land falls, a farmer will rent more land and plant more maize, increasing the supply. If the price of renting land increases, the farmer may well cut back on production and hence supply will fall.
- A change of interest of farmers. Farmers should be looking at profitability. This means that if they estimate a crop will not earn them high enough profits they will not plant it. For example, if farmers estimate that wheat prices will not earn them a profit, they will switch to another crop, let us say maize, that will be more profitable. This will result in a shortage of wheat.
- Improved techniques. Improvements in technologies and practices may reduce the cost of production, and increase the level of production; hence more will be supplied. For example, new seeds (new varieties) may require less labour, less water, less fertiliser and insecticides to produce an abundant harvest. This will cause supply to rise.
- Changes resulting from nature. Changes in production can also occur as a result of poor weather, floods, drought, the incidence of pests and diseases and abnormal situations such as local armed conflicts and general insecurity. For example, if floods devastate maize fields, supply will decrease.
- Seasonal supply. Some produce ripens at a particular time or season of the year. This will create, in that season, an increase of supply. In the non-harvest season, there will be less supply of that product. Maize at harvest time will be abundant in supply and prices will usually fall. At the time of the year when maize is not harvested, supply will be less and prices will rise.
- Government policy. For example, if a government puts a tax on the output of maize, this will result in less maize being supplied to the market. Conversely, if a government grants a subsidy on maize production, thus decreasing costs, this will result in an increase of supply.
It is important to understand that changes in the conditions of supply, such as a change in the cost of production, will cause the expansion or contraction of supply in a market. This can be seen in the following figure.

**Figure 8: Change in the conditions of supply: supply increase**

Changes in the conditions of supply will cause the supply curve to shift either downwards or upwards. This will either expand the market supply of maize or contract the market supply of maize. This is important to remember, when we will be looking at what is called market equilibrium and changes in demand and supply (see below, sections 3.5 and 3.6).

An important distinction to make here is that if a change in price occurs for maize, the supply curve will not move downwards or upwards, but there will be a movement along the supply curve. This will cause either an increase or decrease in quantities supplied. If the supply curve shifts downwards or upwards, due to a change in the costs of factors of production, this will either expand supply in the market, if the cost of factors of production go down, or will restrict supply to the market if the costs of factors of production rise.

Having seen both demand and supply, it is now possible to see how a market price is determined in a free market.
Case study: Italian farmers change interest in production methods

In Southern Italy, a region typically seen as developing farmers’ interest in high yielding, agriculture diminished. They wisely understood that the use of abundant chemical fertilisers and pesticides, together with hybrid seeds, was generating environmental damage and diminished the quality of their crops. In particular, many farmers from the Island of Sicily found that it would be better for them to cultivate olive trees in a more natural manner. Many of the small scale olive farmers, much like those found in Tunisia and Morocco, decided to turn to production methods that were sustainable for nature and organic at the same time. This meant that farmers were reverting to traditional methods of farming and were able to supply markets with organic olive oil that commanded a higher price than traditional olive oil. This caused a great increase of organic olive oil to market, the supply curve shifting outwards. Many farmers found that the increased supply of organic olive oil could be successfully exported to foreign markets in Germany and the USA where they could get higher prices than found in their local markets.

3.5 How are market prices determined?

Market prices are determined by the interaction of demand and supply. But what does this actually mean? At a particular price, both suppliers and consumers are willing to make an exchange; suppliers are willing and able to sell and consumers are willing and able to buy. Economists call this the equilibrium price. That is the point where the amount demanded matches the amount supplied. If we look at the tables of demand (see table 3.1 chg ref) and supply (see table 3.2 chg ref) for maize, the equilibrium price is $6 (marked in bold). This price is the only one where there is balance between buyers and sellers. At this price, 20,000 kilograms of maize are both demanded and offered for sale. This can be seen in the figure below.

![Market price formation: price equilibrium for maize](image)

In the above figure we can see that demand and supply cross each other, at point \( P_e \). This is where supply and demand are said to be in balance, or in equilibrium. This results in a market price of $6 and at a quantity supplied of 20,000 kilograms of maize.

But how do supply and demand come into equilibrium? Suppose that initially the price of maize is set at $8 per kilogram. Here 15,000 kilograms of maize will be demanded but 25,000 kilograms supplied. This is called a dis-equilibrium: there would be an excess of supply over demand of 10,000 kilograms of maize. This means that farmers would be left with a surplus, which can only be sold once the price is reduced. The price fall will cause movement along the demand curve, downwards, and at the same time a movement along the supply curve, downwards. As the price falls, demand expands and supply contracts until a price of $6 per kilogram are reached. This is where both supply
and demand are in balance. Here consumers as well as farmers are satisfied, hence there is then no need for the price to fall further. There is neither excess in supply nor excess in demand.

Similarly, if the initial price is $4 per kilogram, 25,000 kilogram of maize will be demanded but only 13,000 kilogram offered for sale. This will result in an excess of demand but a shortage in supply. Consumers might even line up to buy maize and consequently the price will rise. Farmers will make sure that their production increases, so as to satisfy demand. The result is that, as the price increases demand contracts and supply expands. Once the price of maize reaches $6 per kilogram there is no need for prices to rise further, because consumers will settle to buy at that price, hence the price will be in equilibrium.

Free markets have a natural tendency to reach equilibrium because the forces of demand and supply are allowed to interact freely. This is referred to as the market mechanism.

3.6 With changes in supply and demand, what happens to price?

It is important that farmers know how market prices are formed, via supply and demand, but it is also important they understand that supply and demand change very frequently. Changes can be brought about by a rise in price, which means that movement will occur along the demand and supply curves. Changes in conditions of supply and demand will cause supply and demand curves to move, creating market expansions or contractions. These changes are frequent in free markets and obviously will affect the profitability of farms.

Change of price
A change in price will involve a movement along the demand and supply curves. The movement along the demand or supply curves can be seen in figures 3.2 and 3.5. For example, if a wider range of competing products enters into the market, consumers will have a wider choice of what to choose. Although the quantity of a product may remain the same, the price goes down, in order to attract consumers who may be thinking of purchasing an alternative product.

Change in the conditions of supply and demand
As we saw in section 3.3 concerning demand and supply, if conditions of either demand or supply change, this will create a shift of the demand or the supply curve. For example, if consumer tastes change and maize is preferred, the demand curve will shift outwards and to the right. On the supply side, if, for example, one of the factors of production such as labour costs less, this could encourage farmers to produce more and hence supply more. This will cause the supply curve to shift downwards. The question is what happens to the price and quantity as a result of a shift in demand or supply?

The two figures below show what happens when there is a shift in the demand and the supply curve.

As we can see from the above figure, the demand curve moves outwards, due to an increase in customer taste for maize. The original equilibrium price, $E$, in the figure, was $6 and the quantity was 20,000 kilos. Now with the movement of demand, quantity demanded at $6 will be 30,000 kilos, point $R$ in the figure. At point $R$ though only 20,000 kilos are supplied. This will create excess in demand and will cause the price to rise. The new equilibrium, point $NE$ in the figure, will be reached. The new price will be $8 and the quantity demanded will be 25,000 kilos. Thus the change in demand will result in larger quantities supplied by farmers, at a higher price. This is clearly an opportunity for farmers. It is also true that demand could decrease reducing prices and quantities supplied.

It is important that farmers are aware of changes in demand, so that either they can take advantage of gaining a higher price and supplying larger quantities to the market, or be able to reduce supply to the market, thus saving on costs and not loosing money with falling prices and, perhaps, opt to grow another crop, which may earn more money.
As we can see from the above figure, price and quantity are in equilibrium at point E in the figure. The supply curve moves downwards, due to a reduction in the cost of labour. This reduction in the cost of labour encourages farmers to supply more maize to the market. The quantity supplied is now 40,000 kg at $6, point R in the figure. But this price is too high in relation to demand. This will cause the price to fall to $4 and quantity demanded to be 30,000 kg; the new equilibrium, point NE in the figure. Thus the change in supply will bring about a fall in price for maize, but an increase in quantities demanded. Farmers knowing about changes in supply will be able to make better management decisions.

It is important that farmers understand changes in both supply and demand and what affect that has on prices and quantities. This will help them to make better management decisions and be more market oriented.
3.7 Why do prices vary from time to time?

Prices do not change only once; they can change quite often. As we have seen in section 3.5, prices change due to conditions of supply and demand. *Price variations are very common in free markets.* For example, prices vary in consequence of changes in production and demand at different times of the year. The supply of agricultural products often varies from season to season and because of weather, plant diseases and farmers' decisions; they also vary from year to year. Importantly prices also vary depending on the availability of competing products. If a wider range of competing products comes into the market, consumers have a wider choice. Although the availability of a product may remain the same, the price could go down if the consumer decides to switch to a competing product.

Over time, however, there is often a situation of rising prices. This is referred to as *inflation*. Typically inflation manifests itself throughout a country. Inflation is related to how badly the country is doing as a whole and is something that farmers cannot do anything about. Having high inflation means that prices keep rising, making planning more and more difficult. For example, in the case of input costs, a bag of fertiliser, which cost $10 last year, now costs $12. Similarly a kilogram of tomatoes was sold for $4 last year and can now be sold for $5. The fertiliser is bought at prices that keep rising as the crop is produced. Inflation requires good management practices so that the farmer can account for.

### Case Study: Potato farming and price variation in Tunisia and India

In Tunisia potatoes are produced on small, irrigated farms usually less than five hectares. Potatoes can be grown year round except during the hot summer months between June and September. The main production season is in spring, with harvest in May June, and another season in the autumn, with harvest in November. There is also a small winter crop.

In India most of the potato crop is produced during the winter season on small, irrigated farms in the Indo Ganges Plain. Harvest begins in November and is most concentrated during January to March. In lowland areas because of the hot weather during the rest of the year production is not possible, but a small summer crop though is produced in the highland areas.

Typically at harvest time, in both Tunisia and India prices for potatoes fall. This is because there is a large supply of potatoes to markets and demand for potatoes typically stays the same. As time passes from harvest time until the next harvest, prices start to rise because the quantities available for supply diminish.

In India, for example, the average price at the end of the storage season is typically more than double the price at harvest. In Tunisia potato prices increase an average of 80 percent in the period between harvests.


3.8 Why do some prices change sharply while others do not?

As seen before, demand expands as price falls and supply increases as prices rise. It is obvious that people are interested in buying products which have a low price, while farmers are interested in increasing their production to follow higher prices. This simple statement, however, may not always be true. A determining factor is how *necessary* is a product to the buyer. For example, if the price of seed rises considerably, purchases may not always be reduced. The farmer simply needs the seed to be able to produce his or her next crop. The farmer may not be able to do without the seed. And if seed prices fall, the farmer may not demand more of the product, because he or she has already planned how much to plant; excess supplies of seed will not be useful. In some instances it is possible that once the price of one product rises the farmer will substitute it for another product. For example, if the price of one type of pig feed increases, such as maize, the farmer can substitute for another kind of pig feed, cassava meal perhaps. It is important to remember that demand may not change at all or it may change very little, even with a substantial change in price, when "necessity products" are involved.
On the other hand, the demand for non-necessity products, for example highly specialised farm inputs such as super nutrient feed for poultry raising, will vary considerably as the price varies. For some products a small rise or fall in price causes a marked change in the amount demanded. These types of products are termed non-necessity or non-essentials; if the farmer goes without them, it will not be a great loss for him; they are not vital for farm operations.

Similarly, the supply of a product brought to the market also depends on the market price. The supply of some products can be far more quickly adjusted to changes in price than the supply of other products. This depends on the production cycle of a particular product: some products can be increased quickly, or reduced, to meet price changes. For example, this occurs in the production of mushrooms. Though other items such as fruits, meat, coffee and tea take longer to adjust to price changes. For example, the production cycle of beef cattle to market weight takes quite some time. If the price of fruits, meat or other commodities rises, increase in production will not come into effect immediately as it takes some time for farmers to decide to increase their output and even when they have done so, it takes time to adjust production. It requires planting fruit trees, expanding cattle herds etc. Even once production has been adjusted it may take a long time to increase supplies for the market.

3.9 How do changes in price affect the quantities supplied and demanded?

Changes in price which affect the quantities supplied and demanded is referred to in economic terms as elasticity. Elasticity is a measure of seeing how quantity demanded or supplied changes as a result of changes in price. Commodities are usually called elastic or inelastic to price variations. For example, commodities such as milk, potatoes, maize and meat will all have different elasticity. But what does all this really mean?

When the quantity of a commodity demanded or supplied does not change very much after a price change, the commodity is referred to as being inelastic. Take milk, for example. If the price of milk rises, as it is as a 'necessity commodity' (a commodity which consumers cannot go without), quantities purchased will only decrease by a very small amount. Thus we can say that milk has an inelastic demand. In other words, consumers will keep on buying it for two main reasons: it cannot be substituted by another commodity (there is no commodity that is similar or close to milk), and, secondly, milk has utility for consumers as a necessity commodity (consumers need milk and will buy it even if the price rises).

As we can see from the above figure, the inelastic demand curve is typically a steep demand curve, because of customer responsiveness to changes in price are small. At price 1 and quantity 2, consumers demand is at point O. The quantities they purchase are 2. With the rise in price 2, quantities purchased do diminish, but only in a small amount (from quantity 2 to quantity 1.90). This signifies that consumers will buy even if prices rise.

Elasticity is also applied to the supply of commodities. Supply is called inelastic when a change in price will give little or no change in quantities supplied. For example, farmers producing milk will not immediately supply more milk or may supply just a little more milk in response to an increase in price. This is because the factors of production affect supply. It takes some time to increase the size of a herd of dairy cattle, and this factor will not permit an immediate response to a price change. This means that, at least in the immediate future, milk production is inelastic.
Here it is important to consider the time factor on the supply side. Over short periods of time supplies of some commodities, such as milk, beef, etcetera, are inelastic. But over longer periods of time supply of commodities can become more elastic. This is because the farmer has the ability to eventually expand the dairy herd and will therefore be able to supply more milk.

*Elastic* demand or supply is when the quantities of a commodity that are demanded and supplied change a lot as a result of a price change. For example, horticultural commodities such as flowers, beans and tomatoes, are typically elastic commodities; if the price increases quantities demanded will drop considerably. This is referred to as an *elastic demand*.

![Figure 14: An elastic demand curve for flowers](image)

As we can see from figure 13 and figure 14, the elastic demand curve has a smoother slope than the inelastic demand curve. This is because customer responsiveness to price changes is large in terms of quantities bought. As we can see, when the price is 1, the quantity demanded is 3. When the price rises to 1.25, the quantities demanded drop to 1. This is because many horticultural commodities can be substituted easily; one kind of flower can easily be substituted by another.

On the supply side, supply is *elastic* when it is possible to increase supplies easily. For example, a farmer observes that the price of a commodity has increased and s/he is able to use more land, labour, seed, etc., quickly thus producing more of the commodity in a short time. The commodity produced is called elastic.

Economists usually calculate the degree of elasticity of a commodity to price changes by a mathematical formula. See below:

\[
\text{Elasticity} = \frac{\text{Percentage (\%) change in quantity}}{\text{Percentage (\%) change in price}}
\]

The elasticity is calculated by collecting data on prices and quantities over time and verifying percentage changes in quantity and price over that period. The numbers are then divided to arrive at the result. If the result is higher than 1, the product is elastic, if the result is less than 1, the product is inelastic.

It is important to realise that the notion "elasticity" can help farmers. It will help them understand why prices and quantities of some commodities vary more markedly than others.
Farmers who know ....

... how supply and demand vary ....
... the conditions that affect supply and demand ....
... how and why prices vary ....
... how elastic or inelastic demand and supply of commodities are ....

...... can improve their management skills and plan for better production for the market.

3.10 Can farmers set the prices for their produce?

Farmers most often do not set their own prices. They accept the market price for what they produce. They are, what are called in economics, "price takers". The reason for this is that farmers generally grow products that are very similar to those that other farmers grow. Their types of products are commonly referred to as commodities. Commodities are products such as maize, wheat, soybean, lamb meat, etc. They all have similar characteristics and are undifferentiated. For example, maize grown by farmer A will not be different from maize grown by farmer B. Hence many farmers supplying the same market will all be supplying similar commodities.

Supplying similar commodities, with no differentiating factor will mean that farmers will have to accept the price that the market sets ("price takers"), based on the quantities supplied and the quantities demanded. If a farmer in the market were to charge too high a price then buyers would refuse to buy the commodity, as they could probably buy the same commodity from another farmer. The farmer would have a choice. He could either stick to the decision and hope that somebody will buy the produce; on the other hand, he could choose to lower the selling price to the level of that of other farmers. This is the market price. By maintaining high prices and waiting for consumers, the farmer runs the risk of not being able to sell any produce and eventually being forced to go out of business. By lowering the price the farmer adjusts it to the market conditions.

Having said this there are some situations where farmers may be able to influence the market price. This type of production moves commodities that are undifferentiated to being commodities that are differentiated. For example, "organic fruit" or a type of meat only found in a certain region. This sometimes occurs where specialised products are being produced for a limited "niche market". Niche market means a market composed of particular consumers where demand is focused on special or typical products. This type of market can be a highly specialised market or occur only at a specific time of the year when demand for that product is high and premium prices can be attained. Commodity differentiation is also achieved by packaging under a brand name and in a distinct colour or type of package.

Brand name means that the farmer places a name or symbol on his or her produce, so that it is readily recognisable by consumers. For example, "Farmer Joe" apples could be a brand name that could be put on apples with a little sticker on every apple. A farmer may use a distinct type of package to put his or her produce in, possibly varied by colour, size and design. For example, "Farmer Joe" apples placed in a yellow plastic package. In this particular situation the farmer may not be a price taker but rather a price maker. For example, what farmer Joe sells, is different from that of Farmer B. This places such farmers at a great advantage particularly when it comes to negotiating with the traders who are responsible for the distribution of their produce.

3.11 Can farmers improve the price of their products?

The price obtained for many farm products depends upon quality. Consumers pay more for a product that is fresh, clean and undamaged. This is true for most commodities. Quality improvements for both crops and livestock can come about by using better production and postproduction practices. Untimely and improper methods of production, harvesting, rough handling, non-sorting of damaged...
produce and substandard packaging result in lower prices and puts the farmer at a disadvantage when selling the produce.

By improving production, harvest and post harvest handling practices, minimum losses and premium prices can be obtained. To produce high quality products and seek higher prices, it is sometimes necessary for farmers to make a special effort, which may involve extra cost, for example, new methods of production. However, this extra cost could be covered by an increase in money received for quality produce. The farmer will be increasing profitability.

Better prices can also be obtained by producing larger eggs or leaner meat animals. These will fetch higher prices, compared to small eggs and fat animals. It is important that the farmer considers the extra costs involved in the production process and compares them to the extra money that the produce will receive in the market place. If the profit is higher than previously obtained, the profit will be worth the extra effort.

Further, better prices can also be gained by farmers organising themselves in a way that increases their power in the markets. This often strengthens their bargaining position when dealing with buyers and negotiating contracts. Farmers can organise groups into formal and informal associations such as co-operatives, etc. Marketing groups may also be in a position to offer its members other benefits; they may offer a market information service that keeps a constant watch on market prices. Further, it could offer lower costs of transportation as a result of bulk transport. The costs per unit of produce marketed can be reduced by selling produce on a large scale. The benefits from group marketing are what economists call economies of scale. Combined marketing brings about a reduction in the per-unit-cost of produce marketed.

### 3.12 Glossary of important terms in Chapter 3

**Associations:** These can be either formal or informal. An example of a formal association is when farmers associate into a marketing co-operative. Their pooling of resources gives them a better bargaining power and reduces marketing costs.

**Brand:** A name or logo placed on a product to differentiate the commodity from other farmers’ commodities

**Conditions of Demand and Supply:** If the conditions of demand and supply change, they will create a change in price and in quantities. The conditions of demand may be a change in taste, an increase in income, greater equality in income, a change in population, expectations of future prices and shortages, seasonal demand, government policy. The conditions of supply are a change in the cost of factors of production, a change in interest of farmers, improved techniques, changes resulting from nature, seasonal supply, and government policy.

**Competition:** This is business rivalry between different farmers in a market.

**Commodities:** Commodities are products such as maize, wheat, soybean, lamb meat etc. They all have similar characteristics and are not differentiated. For example, maize grown by farmer A will not be different from maize grown by farmer B.

**Demand:** Demand refers to how much of a product consumers and users would actually be willing and able to buy at a given price. What quantities of a product would be bought at a determined price?
Demand and Supply Curves: Graphical representations of demand and supply. Demand curve: quantities demanded for a product are calculated for every price that the product could have. On the vertical axis are prices, on the horizontal axis quantity. On each axis numerical values are placed. The relationship between prices and quantities are plotted on the graph and a line is drawn to connect the various plotting points. This same method is used for the supply curve.

Economies of scale: Combined or associated activities among farmers, such as marketing, that bring about a cost reduction per unit of produce marketed.

Elasticity: It is a measure of seeing how quantity demanded or supplied changes, in response to a change in price. Elasticity is a measure of responsiveness to changes in price. Products are often called elastic or inelastic to price variations.

Exchange: This is where two parties, in this case the farmer and the consumer of farm produce agree to a transaction; the transaction occurs when the two sides agree on exchange rates (prices) at which farm products can be exchanged for cash.

Free market: This is where demand and supply can interact without any restrictions, such as government regulations.

Inflation: This is a steady general rise in prices that occurs in many countries.

Marketing: It is the physical function of taking farm products to market. The movement of farm products is referred to as physical distribution; all the functions that are carried out to enable consumers and users to have farm products available for sale. The typical functions carried out in marketing are harvesting, loading and unloading of farm produce, grading, packing, storage, transportation and selling.

Market: A market is where sellers, such as farmers, who are willing and able to sell farm products, meet customers who are willing and able to buy farm produce.

Market expansion and contraction: Markets will expand or contract according to the changes in demand or supply. For example, if consumer taste changes, and the consumer wants more tomatoes, the market for tomatoes will increase (expand). On the other hand, if consumers do not like tomatoes any more, the market for tomatoes will decrease (contract).

Nature of products: Products can be defined as necessity or essential products, or non-necessity non-essential products. Necessity products are usually bought whatever the price, hence quantities purchased will not vary considerably with a price rise. Non-necessity products will not be bought if the price rises, hence if the price rises quantities purchased will decrease.

Niche market: Niche market means a market composed of particular consumers where demand is focused on special or typical products; for example, organic fruit and typical regional cheeses.

Packing materials: Materials that are used to wrap farm produce, so that commodities can be differentiated; e.g. by different colours or package design. Good packing protects the product while it is marketed.

Price determination: The price is determined by the interaction of supply and demand in a market. It is the willingness and ability of consumers to exchange money for farm produce, supplied by farmers, who are willing and able to sell that farm produce.
Price equilibrium: At a particular price, both suppliers and consumers are willing to make an exchange. The equilibrium price is where the amount demanded matches the amount supplied; the two are in balance, are in equilibrium.

Price changes: Prices will change depending on supply and demand, season of the year, availability of competing products and nature of products (whether necessity products or non-necessity products).

Price taker: Supplying similar commodities, with no differentiating factor, will mean that farmers will have to accept the price that the market sets (being price takers) based on the quantities supplied and the quantities demanded.

Price maker: Supplying a market with differentiated commodities (different from other competing farmers). For example, a farmer can differentiate by method of production, such as organic farming; by branding = adding a logo or name to the produce, putting the produce in a special package, etc. This will enable a farmer to decide on what price to charge, as s/he is not selling a commodity, but a unique product.

Price of a product: The demand and supply quantities will be determined by the price of the product. If prices rise, demand quantities will decrease and supply quantities will increase. If prices fall, demand quantities will increase, and supply quantities will decrease.

Quality: Improvements carried out in production and postproduction practices aimed at improving the quality of the product, in terms of produce characteristics.

Supply: Supply refers to how much of a product a farmer makes available for sale at a given price. What quantities would be supplied at a determined price?

Utility: Utility is the process of providing goods that will be useful to buyers. The utility of a good is its usefulness to the buyer. Utility can be form, time, place and possession.
4 Application examples of economic concepts related to typical farmer decisions

4.1 What are the farmer's goals?

In order to encourage the change towards market-oriented farming it is important to understand the "human factor" in farming; farming is not just "economics". This calls for an understanding of the farm household unit. The unit consists of the farmer, his or her family and their goals and preferences (the "family farm"). The farm household unit is both producing and consuming at the same time. The farm itself produces crops and livestock and the household consumes what is produced or part of what is produced. But while the farm is the producer of products, the farm is also the consumer of inputs and materials. These inputs include, for example, seeds, fertiliser, labour and other materials necessary for production. Some of the produce from farming is also used for family consumption (staple food, milk, eggs, etc.). The farm family also consumes products produced by other farmers and sold in the market. On a farm the connection between production and consumption and supply and demand is closely interwoven.

The farm household has multiple purposes and also different goals. The question at hand is that of understanding to what extent the farmer aims at maximising profits, is willing to take risks or desires more leisure. All decisions that farmers make are related to their goals and objectives. It is important to note that farmers may have more than a single goal and these goals guide their choices between different courses of action. But what are the goals that motivate the farm household?

1. Food security: Many small and less commercially-minded farmers may set their goal at producing just enough food for the needs of their family. They often achieve this by either producing much of what their family consumes or by marketing a part of their output and using the cash to buy food.

2. Profit maximisation: When farmers sell more and more of what they produce, they become more commercially minded. Earning money becomes important to them. Most farmers want money to buy products that are not just necessity products. They also want to cover their children's education costs and health expenses. Due to the competitive nature of farming, this means that farmers need to make profits in order to survive. Farmers who do not succeed in generating profits will eventually fail in business.

3. Risk reduction: Although profit maximisation is an important objective it is by no means the only one that motivates farmers. Many farmers are more concerned about reducing risks and variations in income that occur between years. The main objective of poorer farmers is survival rather than maximising their profit. A wish for security is a normal ambition for all people, but the objectives of reducing risk and increasing profit may not always be in conflict. In fact the greater the profit, the more the farm household will be able to survive bad harvest years; the farm will have money on which to live on.

4. Social factors: For many farmers neither profit nor food security are the real goals. In some cases farmers may want an easy life and may not be interested in working hard to get more profit. They may be more interested in making sure that farming gives them leisure time. Other farmers may be more interested in social status and gaining the respect of their community. In some cultures, status is particularly important; for example, status is achieved by buying livestock, which is an expression of wealth. In doing so the farmer may not be concerned by profit.

5. Satisfaction: Whatever the case may be, farmers always aim at maximising an objective and this gives the farmer "satisfaction".
Profits alone may not satisfy family needs. Money from profits only provides satisfaction if it is used in a responsible way; for example, very few farm households would be satisfied if the money earned is not used; that is to say that it is just saved and never spent. Generally, it is the consumption of goods and services derived from profits made, which leads to satisfaction. Hence a more general objective for farmers can then be stated as being maximisation of satisfaction.

It is important that the above non-financial goals of farmers are understood. This should lead to a better understanding of the reasons that are behind many of the decisions that farmers make. For example, the goal of profit maximising may not be so important to the farmer. The farmer may prefer selecting an enterprise that produces a lower but more stable profit. These considerations limit the extent to which profit is the main driving force.

However, the use of profit in farming does have a common purpose. It allows the non-financial goals of the farm household to be expressed in financial terms. Money is simply a common denominator in making decisions. For example, if a farmer insists on carrying on an enterprise that is not justified financially, there is a cost involved and the farmer needs to know this. The difference between the profit that the farmer would have earned "with" and "without" the enterprise reflects the cost of this decision. The profit lost by preferring a non-financial goal can then be calculated and expressed in money. This should provide farmers with information that can assist them in making more balanced judgements.

The bottom line, however, is that market-oriented farming requires a business approach in order to survive over time. Profit is important to bring about a good living for the farm family. It generates the capital needed for reinvestment in the farm. It also provides the purchasing power for food, medical and health services, education, leisure and social functions.

### 4.2 What decisions do farmers make?

Farmers face a number of possibilities between which they have to make a choice:

- Should the farm be specialised in just crops or livestock or be mixed?
- What enterprises should be set up?
- What area of land should be used?
- Which methods and technologies are to be applied in the enterprise(s)?
- What combination of resources should be used?

These questions reflect three basic economic problems that farming for profit entails. They are:

1. What is the optimum combination of enterprises? How should the type of product be selected and what level of output will give maximum profit? (product-product).

2. What combination of resources should be used to set up the selected enterprises? What technologies and practices should be used? How can the factors of production be combined in the cheapest possible way? (factor-factor).

3. What is the optimum combination of factors of production to produce an output? What level of production per hectare or per animal is most profitable? How are resources to be organised so as to generate the greatest possible return? (factor-product).

These relationships are closely interrelated and cannot be easily separated from each other. It is also not easy to distinguish between different enterprises (what to produce?) and the most suitable method of production (how to produce?). All of these questions use economic principles that look at the rela-
tionship between farm inputs and outputs: the production function. They all relate to the production decisions that farmers make.

All of the above decisions have to be taken together, since they are all affected by the limited resources available to the farmer. The decision between different products and their level of production is affected by how they will be produced, and this, in turn, is influenced by how much is to be produced. This also affects how much of any factor of production should be used.

The management dilemma facing the farmer breaks down into two main problems:

- Discovering the best way of organising individual enterprises; and
- Finding the best way of fitting the enterprises together into the farming system.

The first problem requires the farmer to examine the enterprises and decide on the most appropriate method of production. The second requires the farmer to see how they compete and complement one another in their use of scarce resources.

How do farmers make these decisions in practice?

- **Intuition**: Some farmers base their decisions on intuition. They may rely on traditional methods of management and follow old established patterns of farming. These methods may be well tried, having evolved over a long period of time. For example, a farmer may decide on a cropping pattern based on a crop rotation that is widely used.
- **Comparison**: Some farmers base their decisions on comparison with other farmers. For example, a farmer may apply fertiliser at rates of application that are used by other farmers cultivating the same crop.
- **Economics**: Other farmers may base their decisions on economic considerations. They may compare prices of products, their quality and costs of production and marketing, by calculating costs and profit. Often these decisions are taken by farmers without being fully informed and skilled. Farmers may not know the prices and costs of products and inputs. Costs may also be treated differently by different farmers. Confusion may exist as to what are variable and fixed costs. Profit may be calculated without including all the cost items and making a proper assessment of the value of production. These practices mean that farmers may not be maximising profits. This could be unintentional as it could be simply misunderstanding the importance of profit orientation.

In short these considerations mean that there is no typical farmer and no typical way of managing the farm.

For farmers to be competitive they need to introduce changes to their farming system. Farmers may want to diversify their enterprises, for example, by introducing new high value crops. In making these changes they need a better understanding of the market, and what consumers demand. Only then will they be in a position to take advantage of new opportunities. Farmers also need to manage their existing ways of farming more efficiently so that they gain more from less and are better able to compete in the market. Due to continual changes in the market, the level of resources and inputs used by farmers requires constant adjustment. Ongoing adjustment to problems of resource and input allocation call for a shift away from just finding technical solutions, to more concern about profitability.

However, farmers' skills and knowledge of management are limited. Farm records are not kept and information on prices and costs are often unavailable. Farmers also have difficulty in calculating profits and assessing how much input to apply. Improvements in the farmer's managerial knowledge must go hand in hand with improvements in technical skills.
What does the farmer need to ask?

For example, a farmer wants to manage his or her farm better. The farmer is thinking of producing a new crop for the market that could increase profits; for example, soybeans. The farmer decides to introduce soybeans in place of maize which has not been very successful. Producing for the market costs the farmer money which has to be paid out before the produce can be sold. The following are some of the questions that the farmer should ask before making a final decision:

* Where will I market the product?
* Who will buy it?
* How do I find the buyers?
* When should I sell?
* At what price will I sell?
* What will it cost me to market the produce?
* What profit can I make from the crop?
* Will this decision satisfy me and my family?
* Are the local climatic conditions favourable to grow the new crop?
* Is the land fit to grow the new crop?
* What resources do I need to set up the enterprise?
* What resources do I have available?
* What other crop should I give up?
* How much of the crop should I grow?
* How will I grow the crop?
* Are there better ways to grow it?
* Will I need to purchase any other inputs?
* How much will the inputs cost?
* Will growing the new crop require more labour?
* Do I have enough labour available?
* Do I have enough money to buy inputs and hire labour?
* Do I have the skills to cultivate the new crop?
* How much should I produce?
* How much of the produce should I keep for the family?
* How much should I sell?
* Could I perhaps make more money from growing another crop?

4.3 How do farmers select enterprises?

The selection of enterprises is often decided by the natural conditions of where the farm is located. Lowland areas of Asia, for example, have a natural advantage over upland areas for the cultivation of rice. Upland areas with a more temperate climate tend to favour horticultural production. Dairying is attractive in areas close to towns and cities. Even though these natural advantages for certain products exist, there is still plenty of choice open to a farmer in the selection of enterprises to maximise profits. For example, a lowland farmer may have to choose between the growing of cereals for home consumption or for market and home consumption. Similarly, upland farmers may have to choose
between the rearing of livestock and cultivation of horticultural crops. Farmers may also have to adjust the type of enterprises and their scale according to market changes.

How does the farmer adjust the enterprise combination to maximise profits? Farmers often decide by using some of the economic principles and concepts discussed in this book without even knowing it. Selection of enterprises takes place through looking at supply and demand.

On the one hand the farmer needs to have a good knowledge of the quality and types of soil found on the farm and of water sources and topography. As well as some idea of the type of crops which can be grown. The farmer also needs to verify if s/he has sufficient capital and labour to run the enterprises and whether the farmer will require more labour and machinery during harvesting periods. Further, the farmer also needs to have a sense of the gross margin that can be earned. For this to be calculated s/he must have basic information on inputs, outputs, costs and prices. These are the factors that affect supply.

On the other hand there is demand. The farmer needs to know, for example, what consumers want. What retailers or wholesalers want. What distribution channels are available. What is the cost of transport? What crops and livestock enterprises can obtain high prices? Market oriented farming requires matching the demand with the supply. Thus the farmer in selecting enterprises should be concerned about their suitability to both the market and their resource base i.e. the land, labour and capital available.

There are other questions the farmer faces which relate to the combination of enterprises on the farm. A common problem facing a farmer is whether or not to specialise in a single or limited number of enterprises or alternatively go for a diversified farming system. A farmer may have to decide whether or not to concentrate on running one or two enterprises. The economic principle for choosing what to produce is called "comparative advantage" (in some texts referred to as resource use differentiation). Very simply this concept explains how farmers select those enterprises where profits are likely to be greatest.

Farmers often have a choice of enterprises which tend to compete with one another for land. An expansion of one enterprise means a reduction in another. This principle explains how farmers decide on which plots to grow crops in a way that is most beneficial to them.

**An example of enterprise choice**

A farmer has to decide between three crops sorghum, millet and maize, on three plots of land that are the same size, but have varying soil fertility. The question is: what crops should be selected for what plots?

A farmer needs information on yields, prices, inputs, costs and gross margins to help him or her decide which crop to select. The levels of gross margin (yield multiplied by the price minus the costs of production) for the three crops on the three plots are as follows.

**Table 7: Gross margin (in $/ha) for combinations of crops and plots of land**

<table>
<thead>
<tr>
<th>Plot</th>
<th>Sorghum</th>
<th>Millet</th>
<th>Maize</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>71</td>
<td>68</td>
<td>59</td>
</tr>
<tr>
<td>B</td>
<td>54</td>
<td>57</td>
<td>51</td>
</tr>
<tr>
<td>C</td>
<td>31</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>156</td>
<td>145</td>
<td>150</td>
</tr>
</tbody>
</table>

The figures in the table show that plot A has an absolute advantage over the other plots for all three crops. The level of profit generated from the plot is higher than that of the others. This increase is largely due to increased yield as a result of better soil fertility on the plot. Out of the three crops sor-
Economic concepts in market-oriented farming

Sorghum has the biggest gross margin. On plot B millet generates the highest profit. Plot C generates lower profits than both A and B for all three crops and maize is here relatively speaking the best crop.

The farmer may choose to *specialise* in growing a single crop on all three plots or, alternatively, choose a crop mixture: strive for *diversification*. In this example the size of each plot is the same and the gross margin that the farmer can earn by specialization or diversification of the three crops can be seen here:

**Specialisation:** One crop is grown on all three plots

- for sorghum the farmer earns $156
- for millet the farmer earns $145
- for maize the farmer earns $150

**Diversification:** By diversifying the cropping pattern and following the principle of comparative advantage:

the farmer could generate $168 from a combination of the three crops: $71 for sorghum in plot A, $57 for millet in plot B and $40 for maize in plot C.

In principle, farmers should allocate their inputs to the enterprise that yields the highest return.

Another thing that has to be considered is the location of the farm in relation to the market and the transportation network. This also has an important influence on enterprise selection. It is often profitable to farm land more intensively the closer it is to the market. Transport costs also influence the choice of what to produce; the produce can be transported more cheaply the closer the farm is to the market. Another factor affecting transportation costs is the method of transport, such as by road or by river. It is important to include transportation cost to and from the market in the cost calculation of the enterprise.

### 4.4 How do farmers allocate resources?

Farmers who want to maximise their profits have to make the best use of their many scarce resources: seeds, fertilisers, pesticides, land, labour and machinery. The most efficient use of the resources can only be calculated if the physical relationship between the resource inputs and outputs produced, the production function, are expressed in economic terms. The typical decisions that farmers have to make are:

- What quantity of inputs should be used to maximise farm profit?
- What technology should be applied?
- How best to produce?

These questions are closely interrelated and it is not easy to separate one from another. This section of our notes considers four different situations of allocating scarce resources:

- the optimum or 'best' use of one factor of production or resource
- the optimum use of two or more factors of production
- two or more factors of production and a change in output
- the allocation of capital among different enterprises.

Each of these situations is discussed in turn; see next page.
4.5 Single resource decision

Many farm decisions are concerned with how much of a single factor of production should be used to maximise profits. For example, how much fertiliser to apply? How much seed to sow? How much labour to hire? These questions deal with the use of seed, fertiliser, or labour in producing an output. Asking these questions is the same as asking: which level of output (yield) per hectare or gain per animal will give the greatest profit?

There are many farmers who still talk of the biggest yield per hectare, the highest output per animal, and so forth. However, it is the biggest profit per hectare (or per animal) which counts; in other words, which level of input gives the highest profit. Farmers need to think in terms of the levels of inputs and their costs related to the levels of output and the returns that are achieved.

The relationship between inputs and outputs rests on what economists call the "law of diminishing returns". The law of diminishing returns is used to estimate the level of input use needed to maximise profits for the farmer. The law is useful in assessing the level of output that can be produced, for example, from either a single plot of land or from the entire farm land, where the land area is treated as a fixed resource (factor of production). Fixed resource means that it does not change in size. Variable resources such as labour, water, seed and fertiliser are applied to a fixed area of land. The law shows that after a certain level of yield, as levels of an input are increased, the rate of increase in output diminishes.

This can be better understood by the following example.

Example 1: Growing maize and adding fertiliser

A farmer has only two resources: land (= fixed resource) and fertiliser (variable resource) and the farmer is growing maize. Land is a fixed resource as the farmer has no way of changing its size. Different levels of fertiliser are applied to the crop.

Table 8: The marginal return on maize output adding different levels of fertiliser

<table>
<thead>
<tr>
<th>Quantity of fertilizer (kg)</th>
<th>Total maize production (bags)</th>
<th>Marginal return of maize (bags)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>31</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>37</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
<td>3</td>
</tr>
</tbody>
</table>

In this example, as additional amounts of fertiliser are applied to maize, the total production of the crop increases but at a diminishing rate. With 1 kilogram of fertiliser, 7 bags of maize can be produced. Increasing the fertiliser to 2 kilograms increases the total production of maize to 20 bags; and 3 kilograms of fertiliser increases the production of maize to 31 bags. Although the production of maize continues to increase, the extra unit of fertiliser adds less and less to the total maize production. At some point the change in production from one application of fertiliser to another will even decrease. This is shown by calculating what economists call the marginal return per unit of input. "Marginal" is often used in economic language. It has the same meaning as added. The marginal return is simply the amount added to total yield or product by adding one more unit of input.

The marginal return is given as the changes in output between the different levels of production. For example, in column 2, when bags of maize increase from 7 to 20 bags, the marginal return is equal to 13. The difference between 20 bags and 7 bags is 13. This appears in the third column. The marginal return increases from 7 to 13 bags up to the point when 2 kilograms of fertiliser is applied. At this point the marginal return starts to diminish as more and more kilograms of fertiliser are applied. At 3
kilograms of fertilisers the marginal return drops from 13 to 11. Successively it drops from 11 to 6 and then from 6 to 3.

This tells the farmer the effect different levels of fertilizer has on production of maize. This is the first step in deciding how much fertiliser to use. The next step is to look at this in terms of income and costs.

To do this we can apply the law of diminishing returns. The physical amounts of fertiliser and maize are converted into costs and returns. This allows us to calculate the level of input that maximises the profits of the farmer. In this example the price of maize is $20 per bag and the cost of fertiliser $140 per bag. With this information the following table is constructed.

**Table 9: Maize costs and returns**

<table>
<thead>
<tr>
<th>Total output of maize (bags)</th>
<th>Total value of maize ($) (a)</th>
<th>Marginal value of maize ($)</th>
<th>Quantity of fertilizer (bags)</th>
<th>Total cost of fertilizer ($) (b)</th>
<th>Marginal cost of fertilizer ($)</th>
<th>Gross Margin ($) (a-b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>140</td>
<td>0</td>
<td>1</td>
<td>140</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>400</td>
<td>260</td>
<td>2</td>
<td>280</td>
<td>140</td>
<td>120</td>
</tr>
<tr>
<td>31</td>
<td>620</td>
<td>220</td>
<td>3</td>
<td>420</td>
<td>140</td>
<td>200</td>
</tr>
<tr>
<td>37</td>
<td>760</td>
<td>140</td>
<td>4</td>
<td>560</td>
<td>140</td>
<td>200</td>
</tr>
<tr>
<td>40</td>
<td>800</td>
<td>40</td>
<td>5</td>
<td>700</td>
<td>140</td>
<td>100</td>
</tr>
</tbody>
</table>

The total value of maize per bag is the quantity of maize multiplied by its price. One bag of maize is priced at $20, 7 bags will be priced at $140. Thus the total value for 7 bags of maize is $140.

Similarly the total cost of fertiliser is the quantity of fertiliser applied multiplied by the cost of fertiliser. One bag of fertiliser is priced at $140. So the total cost of fertiliser in producing the 7 bags of maize is 1 bag multiplied by $140 per bag (1 x $140). The cost equals $140. This calculation is done for each level of fertiliser used and maize output.

The marginal value and marginal costs are constructed in the same way as in calculating the marginal return of maize as shown in table 4.2. The marginal value is the added value of an extra bag of maize. In table 4.3 we can see that when output of the maize in bags increases from 7 bags to 20 bags, the value of maize increases from $140 to $400. But in this case the marginal value of the maize increases from $0 to $260 (400-140=260). When total costs rise from $140 to $280, the marginal costs rise from $0 to $140 (280-140=140)

- The critical question here is
  - "How much of each resource will the farmer use?"
- The answer is
  - "This depends upon the cost compared to the return"

The marginal value of maize and marginal costs are constructed in the same way as in calculating the marginal product of maize (see table 4.8).

Now, how much of each resource the farmer uses depends upon the cost compared to the return. The solution to this problem is the point of optimum level of output. This is where the value of the extra production (marginal) is just sufficient to cover the cost (marginal) of the resource used. This occurs at a level that lies between 3 to 4 bags of fertiliser (presented in bold). The amount of gross margin generated is $200.
Any application of fertiliser below this level results in a marginal value that is greater than the cost of fertiliser. This means that the farmer would increase profits if more fertiliser were applied. With 2 bags of fertiliser, profits are $120. At levels of fertiliser above 4 bags, profit begins to decrease because the value of production is less than the cost of fertiliser.

So long as the extra value of production exceeds the extra cost, profit is increased by using more of the fertiliser input. But there comes a point when it is not profitable to apply any more fertiliser to the crop. This is where the value of the extra production of maize just covers the cost of the fertiliser used. In other words, the farmer gets maximum profits where the marginal cost of fertiliser equals the marginal value of maize. This is the point in the production process where marginal value of production equals marginal costs. When this position has been located, then the question raised earlier as to how much of a resource should be employed in a production process can be answered.

The essential principle is this:

- Add the variable resource to the fixed resource as long as the extra return is greater than the extra cost.
- Profit maximisation level occurs where the value of the marginal return is equal to the marginal cost of the unit of input.

The most profitable level of fertiliser depends on the relationship between the input and output prices (added costs and returns also need to be compared). As prices often fluctuate for both farm inputs and outputs, the optimum level of output where marginal costs equal marginal value will vary from year to year. The optimum level of one year may not be the same in another year.

**Example 2: The labour requirements for a farmer growing maize**

In this example labour is assumed to be the variable resource. The problem facing the farmer is: How much labour to apply?

The following gross margins can be produced for different levels of labour input, as given in table 4.4 below. Where 3 units of labour are applied to cultivate maize a gross margin of $200 can be generated. With 5 labourers the gross margin drops to $100. This happens because the cost of labour is higher than the gain in value of product.

<table>
<thead>
<tr>
<th>Costs, revenues and gross margin</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs of labour ($)</td>
<td>140</td>
<td>280</td>
<td>420</td>
<td>560</td>
<td>700</td>
</tr>
<tr>
<td>Costs of seeds</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Purchased inputs</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total variable costs ($)</td>
<td>140</td>
<td>280</td>
<td>420</td>
<td>560</td>
<td>700</td>
</tr>
<tr>
<td>Maize yield per ha (bags)</td>
<td>7</td>
<td>20</td>
<td>31</td>
<td>37</td>
<td>40</td>
</tr>
<tr>
<td>Price of maize ($ per bag)</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Value of product ($)</td>
<td>140</td>
<td>400</td>
<td>620</td>
<td>740</td>
<td>800</td>
</tr>
<tr>
<td>Gross margin ($)</td>
<td>-</td>
<td>120</td>
<td>200</td>
<td>180</td>
<td>100</td>
</tr>
</tbody>
</table>

From this example the farmer should apply 3 units of labour ($140 x 3 units) in order to maximise the gross margin. This is the optimum amount of labour. The task of the farmer is to apply these principles of economics so that better decisions can be taken; decisions that will result in lower costs and greater profits.
The above examples show that factors of production are best allocated by what economists call *marginal change*. Many decisions in life involve making small adjustments to an action. In many situations people make the best decisions by thinking "at the margin".

Some people might argue that the marginal concept is theoretical and it doesn't reflect farmers' real actions. This is incorrect: the principle applies to farming as in any other business. It simply shows that the idea of maximising output does not make economic sense and affects the level of profit attained.

The task of the farmer is always to ask himself: *will I add more to costs than to returns by using this extra quantity of resource?*

This question plays a role many in farm decisions. Will feeding pigs or poultry an additional 5 kilograms of feed add more to returns than to costs? Will costs or returns increase more if the output of milk per cow is increased to 100 kilograms? If we add another hired labourer or expand the area under cultivation, will we add more to returns than to costs?

The basic rule to follow is:

\[
\text{Optimum Production} \quad \text{is reached when} \quad \text{Marginal Costs} \quad = \quad \text{Marginal Returns (Revenues)}
\]

The practical experience of farmers also follows closely the concept of marginal analysis. Farmers who economise do not usually completely favour one product or resource over another. They normally decide to have a little bit more of one and not quite so much of the other. Farmers tend to apply inputs in small steps. Farmers sometimes might test the application of fertiliser or seeds over a number of years, gradually trying out different combinations of inputs and outputs before deciding on an optimum level. As more experience is gained over the years through demonstrations or trials, an optimal allocation of fertiliser can be reached. It is up to the farmer to test the combinations and arrive at his/her own decision as to the most profitable application. These are all adjustments that are made at the margin.

### 4.6 Two or more resources

The *law of diminishing returns* can also be used in more complex situations where more than a single resource is used. Since there are many possible techniques of production, the farmer must choose the method that will produce the highest profit. This problem is common to farmers and is known as the dilemma of resource substitution.

*What methods or techniques should farmers choose under different conditions of farm size, cropping patterns and capital availability?*

This is a genuine problem that farmers face. For instance, choices may need to be made between two feeds such as maize and sorghum; two kinds of labour, hired and family labour, and chemical fertiliser versus organic manure. Each can substitute for the other. Machinery can substitute for labour as well as for draught power.

The question here is "*which of the alternative methods should the farmer use?*"

The answer is to assess:

- what the cheapest combination of resources is in order to produce a product; and
- the best combination of resources and technologies that result in maximum profits.
Some decisions are very straightforward. For example, the way of fertilising a crop. The farmer could decide on the most suitable technology by comparing whether it would be cheaper to buy chemical fertiliser or apply compost.

In other cases, the choice of inputs is more complicated, particularly when a combination is involved. For example, livestock may be fed various combinations of feed (roughage and concentrates). The problem facing the farmer is simply what combination of resources is the best to use? Farmers have to decide between different practices and technologies that require combinations of resources. The solution to this problem draws on the principles of diminishing returns, marginal analysis and substitution. An example follows below.

**Example 1: A farmer growing maize and having to decide between fertiliser and compost**

In the production of maize, for example, we can apply fertiliser and compost. In order to produce 80 bags of maize, we can apply a small amount of fertiliser and a large amount of compost, a medium amount of both, or any combination of the two. This is illustrated in the table below.

<table>
<thead>
<tr>
<th>Bags of improved compost ($10 each)</th>
<th>Bags of fertilizer ($20 each)</th>
<th>Rate of technical substitution (1 bag of fertilizer replaced by 1 bag of compost)</th>
<th>Total cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>F1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7.0</td>
<td>0</td>
<td>150</td>
</tr>
<tr>
<td>2</td>
<td>2.8</td>
<td>4.2</td>
<td>76</td>
</tr>
<tr>
<td>3</td>
<td>1.8</td>
<td>1.0</td>
<td>66</td>
</tr>
<tr>
<td>4</td>
<td>1.3</td>
<td>0.5</td>
<td>66</td>
</tr>
<tr>
<td>5</td>
<td>1.0</td>
<td>0.3</td>
<td>70</td>
</tr>
<tr>
<td>6</td>
<td>1.1</td>
<td>-0.1</td>
<td>82</td>
</tr>
<tr>
<td>7</td>
<td>1.3</td>
<td>-0.2</td>
<td>96</td>
</tr>
</tbody>
</table>

Columns 1 and 2 show several combinations of fertiliser and compost which all produce 80 bags of maize. We can use 1 bag of compost and 7 bags of fertiliser, 2 bags of compost and 2.8 bags of fertiliser and so forth.

The third column shows the amount of fertiliser replaced by a bag of compost (the rate of substitution); as we go from 1 bag of compost and 7 bags of fertiliser to 2 bags of compost and 2.8 bags of fertiliser, each bag of compost substitutes for 4.2 bags of fertiliser. A jump to the next combination allows one bag of compost to substitute for 1 bag of fertiliser. Here we have diminishing rates of substitution of compost for fertiliser; each added bag of compost substitutes for or replaces less fertiliser than the previous one.

Choosing between different practices that substitute for each other requires finding the practice which results in the lowest cost of production. For example, the farmer may have 3 hectares of maize under cultivation and the possibility of applying fertiliser or compost to the fields. Which combination of fertiliser and compost will allow the farmer to farm at the lowest cost and produce 80 bags of maize?

The answer to the question of the best substitute depends partly on the costs of the resources which make up the practice. If fertiliser is high in price relative to compost, the costs may be lessened by substituting compost for fertiliser. But the costs of substitute inputs only show part of the picture. We also need to know the number of units of an input replaced by the substitute.

The total cost of each combination of compost and fertiliser is given in the last column of the table 4.5. Improved compost costs $10 per bag and fertiliser costs $20 per bag. With a level of production of 80 bags of maize, a least cost combination occurs where 3 or 4 bags of compost and between 1.3 and 1.8 bags of fertiliser are applied. The cost calculated is $66. Cost is at a minimum because the
extra cost that comes from substituting compost for fertiliser is less than any savings that can be made to the cost of fertiliser.

Therefore with a level of production of 80 bags of maize, a least cost combination of $66 is calculated. This occurs where 3 or 4 bags of compost and between 1.3 and 1.8 bags of fertiliser are applied. Cost is at a minimum because the extra cost that comes from substituting compost for fertiliser is less than any savings that can be made to the cost of fertiliser.

The principle is that in substituting one method for another, farmers must be certain that savings in the method of production will be greater than the cost of the resources added. The cheapest combination of factors to produce an output is found when the cost of any factor replaced is just greater than the cost of the factor introduced. By following the conditions shown above the lowest cost method of production can be selected.

Two resources and a change in production

There is another situation, somewhat more complex, where alternative resources, technologies or practices not only substitute for each other but also have an effect on production. An example is two kinds of fertiliser. One bag of compost may substitute for chemical fertiliser in producing the same amount of maize per hectare of maize but may also affect the per hectare yield. In this situation profit can be affected by both:

- the value of the resource replaced
- the value of the added yield

The decision to choose between different practices requires information on the changes in costs of production and the value of additional yield. The decision calls for detailed calculations on the profitability of each practice.

Example: A farmer who produces maize under four possible technologies and input use

Table 12: Maize production under different inputs of fertilizer.

<table>
<thead>
<tr>
<th>Costs, returns and gross margin</th>
<th>Input of fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compost only</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>0</td>
</tr>
<tr>
<td>Labour (for fertilizer)</td>
<td>0</td>
</tr>
<tr>
<td>Labour (for farm yard manure)</td>
<td>400</td>
</tr>
<tr>
<td>Total variable costs ($/ha)</td>
<td>400</td>
</tr>
<tr>
<td>Average yield (kg/ha)</td>
<td>1,600</td>
</tr>
<tr>
<td>Product price ($/kg)</td>
<td>2</td>
</tr>
<tr>
<td>Total value product</td>
<td>3,200</td>
</tr>
<tr>
<td>Gross margin / ha</td>
<td>2,800</td>
</tr>
</tbody>
</table>

A farmer can apply only chemical fertiliser, only compost or combinations of the two.

Which of the alternative methods should the farmer use?

In making this decision the farmer needs to consider:

- the yield of the crop using each of the production methods
- the cost of each
- and the change in production
There are four different options arranged in order of increasing costs. Gross margin per hectare is used to measure profitability. The mixed technology of compost and the application of 25 kg of fertiliser produce a maximum gross margin of $3,548 which is the highest gross margin compared to the others. This should be the farmers choice; technology 3 with compost plus 25 kg of fertiliser.

However, the calculation above is not exact. There are likely to be a number of combinations of fertiliser and compost that could even produce a higher gross margin. A way is needed to show how the gross margin increases further as fertiliser is applied. This is also done through marginal analysis. It requires finding the marginal value of the gross margin; the increases in gross margin as fertiliser is applied.

### 4.7 Allocation of capital among different enterprises

For most farmers capital is a limiting resource. The challenge for some farmers is to allocate their limited capital among their different enterprises in a way that produces maximum profits. Since farmers’ resources are limited, all the enterprises have to be considered together; expanding one enterprise comes with a reduction of another.

*The issue is to determine where each unit of resource (land, labour, capital) brings the greatest return.*

The answer is given in the principles of *opportunity costs and marginal returns*.

These principles simply state that profits will be greatest if each unit of labour, capital and land is used where it will add most to returns i.e. where they will bring the greatest extra returns. This is common sense: if $1 spent on buying fertiliser returns more than $1 spent hiring casual labour, then the additional fertiliser should be purchased up to that point where the last $1 spent on fertiliser will return exactly the same as the last $1 spent on hired labour.

**Example : A farmer with limited capital (money) having to decide what to grow.**

The example below shows that maximum profits can be earned when the farmer applies inputs up to a point where marginal cost is equal to the marginal value of production. In the table 13 below the total value of production from three crops: sorghum, millet and maize is given for different applications of capital input.

**Table 13: Capital constraint on three enterprises**

<table>
<thead>
<tr>
<th>Marginal cost inputs</th>
<th>Capital available</th>
<th>Total value of production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sorghum</td>
<td>Millet</td>
</tr>
<tr>
<td>First $100</td>
<td>100</td>
<td>280</td>
</tr>
<tr>
<td>Second $100</td>
<td>200</td>
<td>340</td>
</tr>
<tr>
<td>Third $100</td>
<td>300</td>
<td>450</td>
</tr>
<tr>
<td>Fourth $100</td>
<td>400</td>
<td>555</td>
</tr>
</tbody>
</table>

Row one assumes that the farmer has only $100 of capital available for purchasing inputs. This is a capital constraint. In such a situation the farmer could earn either $180 from sorghum, $150 from millet and $200 from maize. With an additional $100 of capital available to buy other capital inputs the total value of production increases to $340 in the case of sorghum, $280 for millet and $340 for maize.

With the various levels of capital available a decision needs to be taken which of the three crops to grow.
The first question the farmer has to decide upon is between the three crops - which crop should s/he grow?

The response to this question can best be calculated through the application of marginal analysis.

Hence table 13 is presented again in marginal or added terms. See table 14.

Table 14: Marginal analysis and capital constraint

<table>
<thead>
<tr>
<th>Marginal cost inputs</th>
<th>Capital available</th>
<th>Total value of production</th>
<th>Sorghum</th>
<th>Millet</th>
<th>Maize</th>
</tr>
</thead>
<tbody>
<tr>
<td>First $100</td>
<td>100</td>
<td></td>
<td>180</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>Second $100</td>
<td>200</td>
<td></td>
<td>160</td>
<td>130</td>
<td>140</td>
</tr>
<tr>
<td>Third $100</td>
<td>300</td>
<td></td>
<td>110</td>
<td>105</td>
<td>50</td>
</tr>
<tr>
<td>Fourth $100</td>
<td>400</td>
<td></td>
<td>105</td>
<td>103</td>
<td>30</td>
</tr>
</tbody>
</table>

The marginal cost of inputs is the difference between the capital available at different capital levels. This is simply $100 for each level. The marginal value of production is the difference between the total value of production for each capital expenditure level. The marginal value of production for sorghum between the first and second $100 of capital expenditure is $160 (taking the figures of sorghum from table 13; $180 is the first value of production for sorghum, while $340 is the second value of production, by taking $180 away from $340, the result is $160). The marginal value of production is calculated in the same way for all values.

In the case of sorghum it pays the farmer to spend up to $400 on inputs but no more than that. In this situation the extra value of production is $105. This is generated from the extra expenditure of $100. The return is greater than the cost by $5. By spending up to four levels of capital expenditure of $100 i.e. $400 profits are maximised.

In the case of millet, the farmer maximises profits also by spending $400 (the extra returns are $103 and costs are $100 i.e. a surplus of $3).

But in the case of maize it only pays the farmer to spend $200 (the extra value of production is $140 and the costs are $100). If the farmer spends another $100 on capital items i.e. up to $300 in expenditure, the marginal value of production drops to $50. The farmer would make a loss.

But the question facing the farmer is:

What is the optimum combination of crops that maximises profits?

The answer is a combination of the individual decisions given above.

If the farmer spends the entire $400 on inputs for sorghum, the total value of production is $180 + $160 + $110 + $105 = $555. The total variable costs for the crop are $400. To calculate the gross margin, variable costs must be subtracted from the total value of production, in this case $555-$400. This gives a gross margin of $155. The same calculations are done for all the crops. The results are given in the table below.
Table 15: Variable costs and gross margin of sorghum, millet and maize.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Total value of production (a)</th>
<th>Total cost (b)</th>
<th>Gross margin (a–b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorghum</td>
<td>555</td>
<td>400</td>
<td>155</td>
</tr>
<tr>
<td>Millet</td>
<td>488</td>
<td>400</td>
<td>188</td>
</tr>
<tr>
<td>Maize</td>
<td>340</td>
<td>200</td>
<td>140</td>
</tr>
<tr>
<td>Total</td>
<td>1,383</td>
<td>1,000</td>
<td>383</td>
</tr>
</tbody>
</table>

With a combination of the three crops on the farmland, the gross margins generated would increase to $383. This assumes that the total land area of the farmer is divided amongst the three crops based on the amount of capital available. In this way 20% of the land should be under maize and the remainder divided between sorghum and millet; 40% of the land each.

It must be remembered that the most profitable combination of enterprises and resources used depends on:

- the prices received for the different products,
- the variable costs attached to each enterprise
- the amount of production sacrificed as one enterprise is substituted by another.

4.8 How do farmers decide if they can finance a new initiative?

We have previously discussed gross margin as a way of assessing the profitability of an enterprise. This indicates how worthwhile a change in enterprises may be if the planned quantities and prices occur. When a new enterprise is introduced into the farming system, a cash flow also has to be prepared to evaluate whether the enterprise generates enough income to cover expenditures.

The cash flow simply guides farmers in evaluating whether they will have enough money to carry out their plan or if they are likely to be short of money in any month. It enables the farmer to calculate which time of the year additional financial resources may be required.

Example: A farmer's financial evaluation of introducing a new enterprise

A farmer is thinking of introducing a new enterprise to the farm and has decided on planting tomatoes. Even though the farmer knows that growing tomatoes is profitable, the farmer may not be certain whether s/he has enough funds to finance the enterprise. The farmer needs to find answers to a number of questions:

- How much money is likely to be generated from producing tomatoes and how much will it cost?
- What enterprises will have to be reduced as a result of its introduction?
- When will the money be received from sales of produce and when will money be needed to purchase inputs?
- If the amount of money expected to be received over the year does not cover the amount needed, what can be done?

In order to answer these questions the farmer needs to make a plan showing income and expenses for the various farm operations. This is done in the form of cash flow.

In order to do this the farmer divides the cash inflow and outflow into quarterly periods of time over the year. The first quarter, for example, might cover the period January to March. The farmer then lists the sales and expenditures for the different commodities in that quarter. The farmer then subtracts the expenses from the income for each quarter. This gives what is called the net cash flow.
From this information the farmer works out the quarterly balance. The balance is positive if income is greater than expenses; and negative if income is less than expenses. This procedure produces the cash flow schedule.

Table 16: A farmer's sample cash flow

<table>
<thead>
<tr>
<th>MONEY COMING IN</th>
<th>Quarter 1</th>
<th>Quarter 2</th>
<th>Quarter 3</th>
<th>Quarter 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales of farm products:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>250</td>
<td></td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td>60</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Chicken</td>
<td>130</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned sale of tomatoes</td>
<td></td>
<td>60</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Total cash inflow</td>
<td>380</td>
<td>60</td>
<td>380</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MONEY GOING OUT</th>
<th>Quarter 1</th>
<th>Quarter 2</th>
<th>Quarter 3</th>
<th>Quarter 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase of inputs:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize inputs</td>
<td>--</td>
<td>--</td>
<td>56</td>
<td>--</td>
</tr>
<tr>
<td>Farm inputs livestock</td>
<td>30</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Chicken feeding expenses</td>
<td>20</td>
<td>--</td>
<td>--</td>
<td>20</td>
</tr>
<tr>
<td>Tomato inputs</td>
<td>--</td>
<td>30</td>
<td>40</td>
<td>--</td>
</tr>
<tr>
<td>Total cash outflow</td>
<td>50</td>
<td>80</td>
<td>146</td>
<td>70</td>
</tr>
</tbody>
</table>

| Net cash flow            | 330       | -20       | 234       | -10       |
| Cumulative balance       | 330       | 3190      | 544       | 534       |

The farmer then has to assess whether s/he has enough cash over the year to cover the costs of growing tomatoes. This is done by calculating the cumulative cash flow.

Over the first quarter the net cash flow (difference between inflows and outflows) is positive at $330. Over the next quarter the net cash flow is negative ($ -20). The cumulative balance is $310 ($330 - $20). This still shows the farmer that s/he has enough cash available to cover expenses in that period. In quarter 3 the net cash flow is $234, again showing that the farmer has adequate funds. The cumulative balance increases to $544 ($310+$234=$544). But over the next quarter period the net cash flow shows a deficit of $10. This reduces the cumulative balance for that period to $534.

The overall cash flow shows the farmer that s/he has enough money available from the sales of maize, milk, chicken and tomatoes to cover the increased expenses of the new enterprise. In other words the farmer's cash flow is positive. The farmer does not need to adjust the farm plan or take out a loan to cover any financial shortfall. The farming system produces enough cash to cover any additional expenses. The proposed change is not only profitable but the farmer has the cash available to finance it.

4.9 How do farmers combine enterprises for maximum profits? (limiting resource constraints)

As farm inputs and resources are scarce, farmers face the problem of deciding what enterprises to produce and what level of resources to use. While farmers have a number of resources under their management control, such as land, labour and capital, there may be one or two resources that are really in short supply and prevent the farmer from expanding profits on the farm.

The farmer needs to identify what economists call the most limiting resource constraint. This is the resource that limits production and consequently limits additional profits from being made even though the other resources that the farmer has are underutilised.

Once the limiting resource is found the problem facing the farmer is knowing:
"How much of an enterprise to produce?"

and

"What resources are needed in order to maximise profit?"

Example: A farmer's choice, sunflower or cotton? How do some farmers allocate resources to maximise profits?

Consider a farmer with 1 hectare of land. On this land the farmer can grow a choice of two crops: cotton and sunflower.

What crop does s/he choose? and how much land and labour should be allocated?

The farm is run by the whole farm family. The farmer knows his or her farm and the resources available and is aware that labour is the resource in short supply and which limits production. This is illustrated by the following table. The per hectare gross margin of the two crops together with their labour requirements in person working days at the peak time of the season are given below:

Table 17: Gross margin and labour

<table>
<thead>
<tr>
<th>Crop</th>
<th>Gross margin ($/ha)</th>
<th>Person working days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>75</td>
<td>20</td>
</tr>
<tr>
<td>Sunflower</td>
<td>56</td>
<td>18</td>
</tr>
</tbody>
</table>

The profit maximising farmer should select the crop that produces the highest gross margin, but in this particular situation the highest gross margin for the limiting resource constraint. This means the gross margin per person working day for the month of peak labour demand. For cotton the gross margin per person day is $75 divided by $20; $75/20 = $3.75. For sunflower the comparable figure is $56/18 = $3.1. Cotton is the more attractive crop. In this example it is attractive both in terms of gross margin per hectare and gross margin per person day. But the second situation is more important as labour is more of a resource constraint to the farmer than land.

The next problem facing the farmer is to know: What should the cultivated area of cotton be? and What should the cultivated area of sunflower be?

This can be calculated simply if the farmer knows how much labour s/he has available in each month. If 25 person working days are available for growing either cotton or sunflower, the maximum area of land under cotton would be 20/25 = 0.8 hectares. This would produce a gross margin of $75 x 0.8 = $60. In the case of sunflower the maximum area of land would be 0.72 (18/25) hectares but this would only produce $40.3 in gross margin. The management strategy of the farmer should be to grow cotton and expand the enterprise until the limiting resource is used up. This increases the overall profits on the farm.

This approach is simple. The idea is to expand the enterprise according to the gross margin per unit of the limiting resource and to do so until the limiting resource is all used.

However, the main problem that farmers face is knowing which resource is the most limiting. In this example it seems to be quite simple because the peak labour demand occurs for both crops in the same month December.
Example: A farmer’s choice revisited, sunflower or cotton? How do some farmers allocate resources to maximise profits?

If we have a situation where the peak labour demand for sunflower occurs in a different month, then it becomes a more difficult decision for farmers to make. In this more complex situation, what do they do? Again, the most limiting resource is found by estimating the maximum gross margin which can be earned by using each resource up to its limit. This requires estimating the monthly labour requirements for each crop; the gross margin per person working day for each month; and taking the lowest value. This indicates the most limiting resource.

In this example the labour requirements and availability are given as follows:

**Table 18: Labour availability and requirements**

<table>
<thead>
<tr>
<th>Months</th>
<th>Labour available (2) (person working days)</th>
<th>Labour requirements (3) (person working days)</th>
<th>Cotton (4)</th>
<th>Sunflower (5)</th>
<th>Gross margin (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>GM per person working day</td>
<td>Total GM</td>
<td>GM per person working day</td>
</tr>
<tr>
<td>January</td>
<td>28</td>
<td>10 14</td>
<td>7.5</td>
<td>210</td>
<td>4.0</td>
</tr>
<tr>
<td>February</td>
<td>26</td>
<td>8 -</td>
<td>9.3</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>26</td>
<td>- -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>24</td>
<td>12 -</td>
<td>6.25</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>20</td>
<td>22 -</td>
<td>3.4</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>24</td>
<td>24 16</td>
<td>3.1</td>
<td>74.4</td>
<td>3.5</td>
</tr>
<tr>
<td>July</td>
<td>24</td>
<td>117 12</td>
<td>4.4</td>
<td>105.6</td>
<td>4.6</td>
</tr>
<tr>
<td>August</td>
<td>24</td>
<td>17 8</td>
<td>4.4</td>
<td>105.6</td>
<td>7.0</td>
</tr>
<tr>
<td>September</td>
<td>25</td>
<td>- 7</td>
<td></td>
<td></td>
<td>8.0</td>
</tr>
<tr>
<td>October</td>
<td>22</td>
<td>- 8</td>
<td></td>
<td></td>
<td>7.0</td>
</tr>
<tr>
<td>November</td>
<td>30</td>
<td>15 15</td>
<td>5.0</td>
<td>150.0</td>
<td>3.7</td>
</tr>
<tr>
<td>December</td>
<td>47</td>
<td>25 20</td>
<td>3.0</td>
<td>141.0</td>
<td>2.8</td>
</tr>
</tbody>
</table>

The gross margin per person working day for cotton and sunflower for each month are given in columns 4 and 5. This is obtained by dividing the gross margin per hectare by the labour requirements in each month. Thus the gross margin per person day for cotton in April is $75/12 = $6.25. $ 75 is from table 3.9 and is the Gross Margin per hectare of cotton. 12 is the labour requirements for that month.

The gross margin per person working day is multiplied by the number of person working days available. This gives us the total gross margin that could be produced if all the labour in that month were used for the cultivation of cotton.

Since the gross margin per person working day of labour in April is $6.25 and there are 24 person days available in that month, the total gross margin is $150 (24 x $6.25). This calculation is done for each month where labour is used.

The lowest total gross margin is taken as an indication of the maximum gross margin that can be earned from that crop. In the case of cotton it is $68 which occurs in May. The farmer only has 20 person days of labour available to grow cotton in May. This is the limiting resource constraint. Increases in gross margin beyond this figure are limited by the labour supply in the month. For sunflower the lowest value is in June ($84). Although the farmer can earn a greater gross margin in other months as s/he does not have the labour available within the farm family this becomes difficult.

*How does the farmer decide which of the two crops to grow?*
*How much land should the farmer use?*
*How much money can the farmer make?*
The farmer simply compares the maximum gross margin that can be earned from cotton with that from sunflower. The gross margin produced when May labour is used solely in cotton production is $68. This is compared with the gross margin of sunflower in June, when all the labour for the month is used in its production. This is $84. In this example, sunflower is the most profitable crop and should be selected.

But how much land should be placed under cultivation of the crop? This is simply determined by the farmer after dividing the person days available in June by the labour requirement i.e. 1.5 hectare (24/16). Once the enterprise is expanded to the maximum level, other supplementary enterprises may be introduced to use up other unused resources.

These are some of the decisions that farmers make when deciding on the best possible cropping pattern to use. The farmer might also look for ways to "break" the limiting resource by hiring in casual labour in a peak month or renting out more land if land is recognised as the constraining factor. Each decision taken leads to others that also need to be confronted by the farmer when managing the farm.

4.10 How do farmers assess whether to buy a capital asset?

If a farmer wants to buy a piece of equipment or machinery, how does s/he decide what to do? This is a different decision from the others raised in the previous sections. Why? A tractor or piece of farm equipment last longer than a single season or year. It is not used up immediately. It requires a long term decision to be taken.

The concept that is frequently used in economics to decide whether or not to buy the item of machinery or equipment is called the return on capital. In our case it means assessing the amount of profit a farmer can earn after the capital is bought. The return on capital is used as a simple indicator of profit. The profit expected to be generated from the asset is related to the cost of the capital itself. This is expressed as a percentage.

Example: A farmer increasing dairy production

A 20 hectare farm has 8 dairy cows at present. The farmer is considering doubling the herd to 16 animals. This requires buying more animals, increasing the machinery and buildings used in livestock production, and making sure that enough fodder is grown to feed the additional cows. The decision calls for a number of changes to be made on the farm. The additional capital is as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings and fixed equipment</td>
<td>$500</td>
</tr>
<tr>
<td>Machinery</td>
<td>$120</td>
</tr>
<tr>
<td>Livestock</td>
<td>$720</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,340</strong></td>
</tr>
</tbody>
</table>

Guidelines for making the assessment are as follows:

- Each capital item is normally valued at its price of purchase or cost of production.
- The profit is determined by calculating the additional income compared to additional costs.
- The additional profit that the farmer can make as a result of this change is estimated by calculating the increase in gross margin of the extra head of livestock.

As this decision involves a change in the cropping pattern, the effects of this also has to be considered. The farmer will have to grow more fodder to feed the increased livestock, and, some land presently under crop cultivation will have to be given up in order to cater for this.
The cost is estimated as an *opportunity cost* of the alternative use of the land.
Profit is then calculated as the increase in profit from the dairy cows minus the opportunity cost of the land needed to grow more fodder. This, for the sake of the example, has been calculated at $208. This figure needs to be divided by the cost of capital which is $1,340.

In other words the rate of return expresses the increase in profit as a percentage of the capital cost. As we saw above in this particular case the return on capital is roughly 15% ($208 on $1,340).

\[
\text{Rate of return} = \frac{\text{Additional profits}}{\text{Purchase price of the machinery or equipment}} \times 100\%
\]

The rate of return expresses the increase in profit as a percentage of the capital cost.

*Is it worthwhile for the farmer to make the investment?*

A minimum rate of return needs to be assessed in order to answer this question. This is also done by using the concept of opportunity cost. The farmer needs to know the real cost of buying the assets. This is the cost of tying up the money in the purchase of the capital items. Sometimes farmers take out loans to finance the need to buy equipment. When they take out a loan they are usually charged a rate of interest. The interest payment is called the *cost of capital*.

Farmers may decide not to take out a loan and use their own savings to purchase the asset. In this situation, even though there is no cash payment of interest to be made by the farmer, there is still a cost involved. This is the cost of the earnings which would have been given up by not putting money into an alternative use (*opportunity cost*). A farmer might have used that very same capital in a way that could also have earned money. The farmer could have kept the money in a savings deposit in the bank. The interest earned from doing so would reflect the cost of the capital. Each farmer has a different opportunity cost and each one has to decide the rate of return that s/he would find acceptable.

In practice most farmers select a minimum rate of return of between 50 to 100% (in the above example only 15% was achieved, so the farmer may well be discouraged from taking such a decision). Between 50 to 100%, the exact figure depends on whether the farmer has an alternative use of the money or whether s/he is interested in taking a risk, and whether the capital items purchased require new skills and training. If this is the case the farmer may want a larger rate of return to justify going to the trouble of developing new skills and possibly even having to undergo training. Alternatively, if it is relatively simple to operate new equipment or machinery, then a minimum rate of return around the lower limit of 50% may be acceptable.

**4.11 Why do some farmers keep their capital assets?**

Farmers often have to make far-reaching, long term decisions that, once taken, influence the day to day management decisions on the farm. Farmers are regularly faced with decisions whether to purchase capital items such as machinery or equipment, start with livestock or plant tree crops.

Once decisions are taken by farmers and money has been spent, resources are already *committed* and the costs become "*unavoidable*". For instance, once durable capital assets such as machinery or equipment are purchased, the resources are tied up and the costs are regarded as fixed.

After the items have been purchased they begin to depreciate in value over the period of time that they are used. As time goes by there will be a need to replace these assets. If a farmer buys a capital item but wishes to sell it before the end of its useful life, the value that the item is worth is called the *salvage value* (or *scrap value*). If a farmer sells his asset after two years even though it has a useful
life of 5 years, the asset has a salvage value, estimated as the original price of the item minus the annual value of depreciation.

Then, *why do some farmers keep their capital assets very often beyond the useful life of the item?*

This question of course refers to durable capital items. These items can take many forms. Some machinery and equipment are highly specialised and can only be used for a particular enterprise; an example is a tomato harvester. Other capital items such as a tractor can be more generally used on the farm. It can be used for all enterprises as well as for transportation of produce to the market e.g. It has multiple uses. The more specialised a capital item is, the lower its opportunity cost. As a result the farmer often finds that it's not worth his/her while to get rid of the asset. This point can be explained by means of a simple example:

*Example: A farmer and a fruit harvester*

A farmer invests in tree crops and purchases a specialised fruit harvester. S/he does this in order to sell produce to a local fruit processing plant. The processor pays the farmer $5,000 per year for the sale of fruit. The annual depreciation on the asset of the fruit harvester is $3,000. The farmer has $1,000 variable costs per year. In this example the farmer makes an annual profit of $1,000 ($5,000 - $3,000 - $1,000 = $1,000)

The profit $1,000, becomes the opportunity cost if the farmer wanted to use the machinery in another manner. Let us suppose that the processor reduces the price offered to the farmer for produce to $2,000. With this figure it is still in the interest of the farmer to continue supplying the processor with fruit even though this action results in a capital loss of $2,000.

<table>
<thead>
<tr>
<th>Income</th>
<th>Price of fruit $2,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>Depreciation on machinery $3,000</td>
</tr>
<tr>
<td></td>
<td>Variable costs $1,000</td>
</tr>
<tr>
<td></td>
<td>--------------------- +</td>
</tr>
<tr>
<td>Gross Margin</td>
<td>minus $2,000</td>
</tr>
</tbody>
</table>

The farmer is in a dilemma. Even if the farmer wanted to use the machinery in another activity it is not feasible to do so. While the opportunity cost of change would be $1,000 there would also be an adjustment cost involved in making a change. A decision to use it differently would result in an even higher loss of $3,000. (price of fruit $2,000 + opportunity cost of last profit $1,000 + other costs associated with the change over, let us say $5000)

<table>
<thead>
<tr>
<th>Income (opportunity cost)</th>
<th>$1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>Depreciation $3,000</td>
</tr>
<tr>
<td></td>
<td>Variable costs $1,000</td>
</tr>
<tr>
<td></td>
<td>Change over costs $500</td>
</tr>
<tr>
<td></td>
<td>--------------------- +</td>
</tr>
<tr>
<td>Gross Margin</td>
<td>minus $3,500</td>
</tr>
</tbody>
</table>

The problem of asset *fixity* is more serious the more *specialised* the equipment is and the more perishable the produce.
The rule is that if the value of the asset lies between the original price of the equipment and the salvage value, the farmer will keep it in its current use, even with price changes for products produced.

The farmer will have no incentive to either invest more in the asset or disinvest as a result of product price changes.

Thus asset fixity occurs when returns to current use are higher than the salvage value of the asset, but the current returns are not sufficient to allow the farmer to profitably expand production.

That is why some assets continue to be used, even though they may be obsolete. The current use is still higher than the salvage value and it continues to be worthwhile to use the capital and not to sell it.

4.12 How do farmers deal with risk?

Farm profitability is often affected by yield failure due to changes in climate and the occurrence of diseases and pests. Farm profitability is also affected by changes in costs of inputs and prices of products. These changes are often the result of market changes as well as government policies. As a result of these risks, the outcome from farming is often worse than what was originally expected. These failures may occur as a result of either bad luck, but more commonly derive from bad decisions taken by the farmer.

With all the risks involved in farming, farmers do not have clear knowledge about the future. Some farmers do try to understand the risks better and they may even make plans to reduce them if they can. However, farmers can never be certain about all the information they require in order to make a decision. They try to weigh up the amount of "riskiness" in any decision.

Farmers often make plans to deal with risk. For instance, a farmer might decide to plant a more drought resistant variety in order to reduce the risks of low rainfall. The farmer may know that the yield from that variety is lower than what could have been attained if a higher producing variety had been selected, but the farmer doesn't want to take the risk of low rainfall. In the back of the farmer's mind the choice between higher producing and drought resistant varieties is weighed up. Selection of the drought resistant variety is included as part of the farmer's plan.

The farmer as manager of the farm business has to cope with the many different risks that occur daily. The ways that farmers deal with risk depends on the farmer's personality and the extent to which the farmer wishes to gamble. No two farmers are the same. Some farmers like to take more risks than others. We say that farmers have a different "attitude" to risk. The difference in the attitude of farmers to deal with risk explains the difference in decisions taken by farmers.

The difference in the farmers' decisions also depends on the monetary situation of the farmer. For example, the farmer may have savings in the bank to ensure that if the crop fails the family won't go hungry. In some cases that farmer may have the money reserves, but the money may be tied up in a deposit account. Perhaps the money reserves that they have are from bank loans or from moneylenders. In which case the debts will have to be repaid. Hence the farmers' decision is complicated and depends on many factors. In simple terms, the higher the demands on the farmer for cash, the less likely the farmer will be able to absorb risk.

Although decisions as to what to do vary between farmers there are common ways of dealing with the risks of farming. These are called risk reducing strategies. Some of these strategies may call for a reduction in the level of production, or an increase in the costs of production, over a period of years. This means that for farmers to manage risk, they may have to give up a part of their profits.
Some of the common ways to manage risk are:

- selecting reliable farm enterprises
- diversifying the farming system by introducing more than one enterprise
- keeping reserves of food, cash or even inputs in case prices rise

A list of risk reduction strategies is given below; but all of these strategies listed are derived from the consideration that good management practices are fundamental to reduce risk.

**Risk reduction strategies**

Using risk reduction inputs: materials that control crop pests and diseases effectively; measures reducing water use and drugs to prevent animal diseases.

Selecting low risk enterprises: enterprises that are more stable than others (e.g. reliable crop varieties, crop prices that do not vary excessively, etc.).

Ensuring system flexibility: this allows the farmer to move from one cropping pattern to another smoothly and easily (e.g. for some enterprises land can be expanded or reduced easily without effecting its profitability).

Commodity diversification: increasing the number of enterprises on the farm so that if one enterprise fails the income from the other enterprises is expected to be sufficient to keep going. Not all enterprises are likely to fail at the same time.

Maintaining input, money and product reserves: reserves can be kept by farmers in the form of money, physical inputs, final products and food. Keeping reserves of inputs and products could protect farmers from the risk of price changes. Food reserves also provide some security against the risk of crop failure.

Contract farming: price uncertainty could be eliminated if the farmer could make advance contracts with the buyer of the produce and the seller of inputs. Some farmers make contracts with suppliers so that inputs are provided at specified prices. This avoids the risk of price increases and the unavailability of key inputs at critical times.

Insurance: a private company or the state guarantees to pay a substantial sum in the event of a major catastrophe, in return for a relatively small annual premium. In some countries it is possible to insure against crop loss by hail or hurricanes. Farmers forgo a certain amount of income each year by paying a premium in return for the security offered.

Collection of market information: the more knowledge a farmer has about price changes and the past profitability of enterprises, the better position s/he is likely to be in predicting the future. Better information on seasonal variations in prices and changes in prices over the years can be used to plan when produce should be marketed.

Better management practices: for example, if a farmer recognises early on that the crops and livestock have a disease s/he could respond quickly through crop spraying or vaccination of livestock. However, these precautions are likely to increase the farmers’ costs of production and reduce profits. These disadvantages would need to be compared with the greater security that the farmer gains. The farmer may prefer to sleep better at night.

---

**Case Study: Potato farming and price variation in Tunisia and India revisited.*

---

* Application examples of economic concepts related to typical farmer decisions
Potatoes are crops that can perish. Unlike grains, potatoes cannot be stored from one year to the next due to potato deterioration, but unlike many vegetables and fruits, potatoes can be stored for several months. In Tunisia potatoes are produced on small, irrigated farms usually less than five hectares. Potatoes can be grown year round except during the hot summer months between June and September. The main production seasons are from spring to May June (harvest) and in the autumn, with harvest in November. There is also a small winter crop. In India most of the potato crop is produced during the winter season on small, irrigated farms in the Indo Ganges Plain. Harvest begins in November and is mostly concentrated during January to March. In lowland areas, because of the hot weather during the rest of the year, production is not possible, though a small summer crop is produced in the highland areas.

Typically at harvest time, in both Tunisia and India prices for potatoes fall. This is because there is a large supply of potatoes to markets and demand for potatoes typically stays the same. As time passes from harvest time, until the next harvest, prices start to rise because the quantities available for supply diminish. Farmers in Tunisia and in India put some of their crop in storage so that they can avoid the low harvest price and then wait to sell their potatoes when the price is higher. In India, for example, the average price at the end of the storage season is typically more than double the price at harvest. In Tunisia, the storage season following the spring harvest, May-June lasts only four months until the autumn crop harvest in November. Potato prices increase on average 80 percent over the storage period.

Hence farmers in Tunisia and India counteract price risk during harvest, by placing some of the crop into storage to get a higher price later at the end of the storage period and before the new harvest supplies markets. But farmers have to consider, when putting potatoes in storage and not selling them immediately, the following concerns:

- **Risks from price movements during the storage season.** Price at the end of storage could be lower then expected and not cover the storage costs
- **Risk from loss of potatoes in storage due to deterioration, rodents etc**
- **Not having sold the potatoes, hence loss of cash in hand.** If the farmer sold all the crop at once he would have more cash in hand to use. Putting some potatoes in storage means that the farmer is putting away some "cash" which he/she could have used
- **Costs of storage.** Storage space does cost something. In Tunisia on-farm rustic storage facilities are used, but these also have a cost. In India on-farm rustic facilities are used as well, but also cold storage is used. Cold storage is usually expensive.
- **Costs of labour.** Labour has to be used to handle the crop in storage. For instance, in India potatoes are first stored on the farm and are then moved into cold storage. In this case there are both labour and transport costs.
- **Cost of materials.** Certain materials may be needed for storage, such as sacks, wooden crates, materials to build on-farm storage facilities, these all have costs.

Small farmers in India and Tunisia try to avoid the effects of price risk by looking at price movements on potato prices over time. This they do by looking at supply and demand and what happens to price at harvest and over time, and thus then decide whether to place some of their potato crop into storage.


For a more in-depth review of risk and how small farmers can manage risk, refer to the book by M. Hilmi "Risk in market oriented farming: Basic Risk Management for small-scale-farmers"
additional notes:
4.13 Glossary of important terms in Chapter 4

Asset fixity: The rule is that if the value of the asset lies between the original price of the equipment and the salvage value, the farmer will keep it in its current use, even with price changes for products produced. The farmer will have no incentive to either invest more in the asset or disinvest as a result of product price changes. Thus asset fixity occurs when returns to current use are higher than the salvage value of the asset, but the current returns are not sufficient to allow the farmer to profitably expand production.

Allocation of resources: If farmers want to maximize profits and get the most out of their scarce resources, they need to use their resources in the most efficient way. Resource inputs and the relative output will have to be expressed in economic terms. Farmers will have to look at the effects of decisions on applying various levels of resources and see what happens to output.

Business approach in farming: A farm has to be profitable if it is to survive over time as a business unit. The business approach will enable farmers to earn a profit and this profit will not only enable the survival of the farm as a business, but the profit will also pay for such things as health care, children's education etc.

Basic economic farmer decisions on enterprise production:

a) What is the optimum combination of enterprises? (product product)

b) What combination of enterprises should be used to produce the selected enterprises? (factor factor)

c) What is the optimum combination of factors of production to produce an output? (factor product)

Combining enterprises for maximum profits: This means increasing the production of enterprises according to the gross margin per unit of the limiting resources. This process should be continued until the limiting resource is fully utilized, or fully used.

Comparative advantage: The principle simply states that farmers should consider the following factors when producing: produce what one is best at producing; concentration enterprises that produce maximum profit; take into account yields, cost and prices of production.

Change in production: Substituting resources for others can affect levels of production. For example, using varying quantities of chemical fertilizer and compost, i.e. substituting one for another, can affect crop yield. Clearly variations in level of production will also as a result cause variations in levels of profits.

Decision-making by farmers: Farmers, when taking decisions about their farm, are influenced by intuition, tradition, comparison and economics. For example, some farmers apply rates of fertiliser to their crops, by comparing the rate of fertiliser the neighbouring farm may use.

Dilemma of resource substitution: This is related to the fact that farmers can substitute one resource for another. Which combination of resources will create maximum profit? The question that farmers should pose is: what is the cheapest combination of resources that will result in maximum profits?

Diversification: This simply means that the farmer is trying to be different from other farmers. For example, a farmer may grow crops in an organic way. This in an attempt to be different from other farmers in what s/he produces.
Farmers goals: Farmers have diverse goals and they have to do with 1) food security, 2) profit maximization, 3) risk reduction, 4) social factors, 5) maximization of satisfaction.

Farm management dilemma: The dilemma is twofold; a) Discovering the best way of organizing individual enterprises and b) Finding the best way of fitting the enterprises together into the farming system.

Farmers selecting enterprises: Farmers when deciding on which crops to grow or which livestock to keep, have to analyze the demand for the products, which will be produced, but also their supply side. In other words the farmer has to look at prices and conditions of demand and supply.

Farmers assessing buying capital assets: Farmers will buy capital assets according to the rate of return on such assets, measured in terms of what additional profits can be gained from owning that capital asset. The rate of return on capital is calculated as follows:

\[
\text{rate of return on capital} = \frac{\text{additional profit}}{\text{purchase price of asset}} \times 100\%
\]

Farmers keeping capital assets: Farmers will keep Capital assets particularly if the capital asset is specialized to carry out a specified function. The rule is that if the value of the asset lies between the original price of the equipment and the salvage value, the farmer will keep it in its current use, even with price changes for products produced. The farmer will have no incentive to either invest more in the asset or disinvest as a result of product price changes. Thus asset fixity occurs when returns to current use are higher than the salvage value of the asset, but the current returns aren’t sufficient to allow the farmer to profitably expand production.

Farmers and risks: Farmers who deal with risk, will deal with it according to their personality and their attitude toward risk. E.g. if they have a family, if they have money reserves or savings, etc.

Influence of farmer’s goals: Farmers and their goals will be influenced not only by economic factors, but also by the "human side" of the goals. The farm household unit, the presence of a wife or husband, children and extended family, will influence them. It has to be remembered also that a farm is a place of production and consumption. For example a farmer will buy inputs, but will also consume some of the food grown on the farm and may even buy from other farms. This production and consumption on the farm will also have an influence on the farmer’s goals.

Law of diminishing returns: This law states that after a certain level of output, as levels of inputs are increased, the rate of output will diminish. For example, by increasing the production of tomatoes, adding extra bags of fertilizer, the production will reach point where adding more bags of fertilizer, will not increase the levels of output any further.

Limiting resource constraint: Farmers have a number of resources under their management control, but there may be one or two resources which are really in short supply on the farm preventing the farmer from increasing production and thus increasing profits. This is a resource constraint that limits production. Once the limiting resource is found, the problem facing the farmer is to know how much of an enterprise to produce and with what resources in order to maximize profit.

Maximization of satisfaction: This particular goal of a farmer is important, because instates that farmers and their farm household units, are not just satisfied with profit earned, but with what is done with it. If the profit earned is used appropriately the farmer will be satisfied. It is the spending of money earned from profit that will bring satisfaction, not just profit itself.
Marginal analysis: This type of analysis is used in economics to measure the small increase or decrease in some input applied to a total output. It measures the change recorded between one level of output and another, by applying a small increase in inputs.

Marginal return per unit of input: This is the return a farmer achieves on output, by adding one more unit of an input. For example, if a farmer adds one more bag of fertilizer to a tomato crop, his return may be 100 kg more of tomatoes. Marginal returns are given as the changes in output between the different levels of production.

Marginal cost: This is the change in cost that occurs by adding one more unit of input. For example by adding an extra bag of fertilizer to produce more tomatoes, the farmer will be adding on an extra cost. Marginal cost is given as the changes in costs in output between the different levels of production.

Optimum level of production: The optimal level of production is where the farmer is maximizing profits. This is the point in production output, where it is unnecessary to add any more inputs, as any more inputs will diminish returns. This is because the cost of adding any more inputs will be higher than the returns. In simple words, this point is where marginal costs equal marginal returns.

Questions that farmers should be asking themselves: Farmers should be asking themselves such questions as where will I market my produce? Who will buy it?, how will I find a buyer? Etcetera.

Return on resources: This simply states that profits will be greatest if each unit of labour, capital and land is used where it will add most to returns; where they will bring the greatest extra returns. For example, if $1 spent on buying fertiliser returns more than $1 spent hiring casual labour, then the additional fertiliser should be purchased unto that point where the last $1 spent on fertiliser will return exactly the same as the last $1 spent on hired labour.

Risk strategies: Farmers can implement strategies to try and counteract risk. Some of the strategies are as follows: using risk reduction inputs; selecting low risk enterprises; ensuring system flexibility; product diversification; maintaining resource inputs, money and product reserves; contract farming; insurance; collection of market information; better management practices.

Types of risks: Farmers are faced with numerous risks. For example climate changes, diseases, pests, crop failure, changes in prices of inputs, changes in market prices, etc.
Additional notes:
5 Summary & conclusions

Summary
Maximisation of profit or satisfaction. Generally speaking farm businesses are planned for maximum profit consistent with good husbandry. However, when objectives other than profit maximisation are considered, for example, the satisfaction of family interests, reduction of risks, increased leisure which might reduce the potential profit, the costs of doing so also need to be shown. Economic principles should be used to indicate the best allocation of resources for attaining the chosen objectives. Supply and demand. A market exists when buyers wishing to exchange money for goods are in contact with sellers wishing to exchange the product for money. A market is made up of people who use, need, or want, a product and who have the money to buy it, and suppliers who are willing, able, and have the desire to sell goods for money. In other words the market consists of producers and consumers. Prices are set by producers and consumers coming together to exchange goods. The exchange functions of buying and selling involve price determination.
Variable and fixed resources. The distinction of farm resources between variable and fixed inputs underlies much of the economic thinking about farm production. Variable inputs are those which change with the amount of output over a given period of time (e.g. fertiliser, seeds, pesticides, fuel, harvest, labour, etc.). Fixed inputs are those which remain the same regardless of the volume of the output actually achieved (e.g. land rent, labour required for cultivation irrespective of final yield, bullocks, tools, machinery and buildings). The same distinction lies between variable costs (which vary with output) and fixed costs (which are incurred irrespective of the level of output).
Diminishing marginal returns. The principle of diminishing marginal physical and financial returns is vital to understanding farm production economics. Without it no "production problem" could be identified as increases of output would be the same or greater than increases in variable input(s) (i.e. there would be no resource constraint). It is the existence of diminishing returns which determines the best level for any production practice or activity on the farm.
The principle of substitution. The principle of substitution applies whenever farm output can be produced by different combinations of inputs or what is more easily understood as the different methods of production.
The principle of opportunity cost. This principle states that by transferring resources from one activity to another, there is a cost that is often not always measured. This is the income lost as a result of reducing the level of output from which resources are withdrawn. The strict definition of opportunity cost is the maximum income that the resource(s) could have given in an alternative use.
The principle of comparative advantage. This principle refers to the distribution of physical resources geographically. The principle suggests that for greatest efficiency farm activities should take place in those locations where the climate, soils, terrain, labour availability, etc provide advantages of the lowest costs of production compared to other geographical sites.
Risk and uncertainty. This principle recognises that events cannot be predicted with absolute accuracy. The existence of risk affects the level of inputs and resources used by the farmer. Risk also affects the future levels of product prices. The basic cause comes from seasonal variations in outputs leading to fluctuations in prices. The result of these variations in prices is that farm profits are often uncertain. Farmers' decisions often call for a trade off between maximising profit and ensuring stable returns after accounting for risk.
Conclusions
People who have a clear understanding of the principles of economics as explained throughout these lecture notes will be able to take more rational decisions than people who have no such understanding. By using these concepts you will be in a better position to understand farm management, but more importantly in how to deal with the liberalisation and globalisation trends in farming which are now observed worldwide.
However, it should also be pointed out that the principles of economics only take you so far in dealing with the changing farm environment. Farmers often have very practical considerations that also
need to be addressed. Farmers are concerned about the quality of inputs and materials as well as their availability. Any final decision that farmers make must take these practical considerations into account. The real life conditions that farmers face need to be well understood. It is hoped that this book goes some way towards helping the farmer to help himself.

These notes have illustrated the use and importance of marginal analysis. In practice, however, a difficulty faced is that farmers do not have enough information on combinations of inputs and technologies for marginal analysis to be widely used. The question is posed of the extent to which farmers are able to estimate the output which can be produced from different combinations of inputs. More often than not farmers have to make do with limited information of a number of simple combinations of substituting inputs or technologies.

Although the data necessary to make exact estimations are rarely available, simple budgeting tools such as gross margin analysis can be used by farmers as a rough guide to estimate the optimum combination of inputs and outputs required for profit maximisation. Gross margin is simple and can be used flexibly with practically any data, ranging from near guesses to information which has been accurately collected and analysed. If farmers provide some information on the relationships between inputs, or, alternatively between inputs and outputs, then a near to optimal combination can be calculated.
Further reading


