Livestock policy analysis

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Foreword

Following demand from NARS (national agricultural research systems) and bilateral and international agencies working in sub-Saharan Africa, ILCA developed a training course for senior and middle-ranking staff working in policy analysis and related fields for the livestock subsector within the region (sub-Saharan Africa). This manual has been written to accompany this course.

A major purpose of the manual is to supplement the instructor-based learning for the ILCA training course on policy analysis and the material used in this English edition was originally developed to meet the specific needs of the ILCA course. However, it has been prepared for use by other institutions, particularly universities and regional training centres to support training in livestock policy analysis. Since the manual uses a modular and learner-driven format, it also provides a self-learning package to update the reader's knowledge and understanding of modern principles of policy analysis and policy making.

Many individuals have contributed to the preparation of the manual. Mr Stephen Sandford, the former Head of the Livestock Economics Division at ILCA, initiated the livestock policy course, planned the preparation of the manual to back up the course and provided technical backstopping and guidance in the development of the manual's content. Many others assisted, including Dr Martin Doran, who prepared the main text of the manual; Mr Steve Staal rewrote the chapter on Marketing and Distribution Systems; Dr John P Hunter revised the chapter on Livestock Production and Marketing in Alphabeta - A Case Study; Professor Hartwig de Haen, Professor Stefan Tangermann, Addis Anteneh, Ray Brokken, John Howell, Stephen Lawry, John McIntire, Alexandra Shaw and Valentin von Massow all made substantial contributions to the technical content of one or more course modules.

As a training material specialist, Dr Bansh Tripathi, the former Head of Training at ILCA, wrote the performance objectives, important points and feedback exercises to make the manual a self-learning package. Dr Simeon Ehui, Head of the Socio-economic Sciences Division at ILCA, read the manual for its correctness and provided valuable technical assistance. Dr Michele Lipner

edited the manuscript and Ato Tekleab Habte Michael typeset the text and prepared the camera-ready pages.

We recognise that the manual will benefit from further improvements and we will appreciate comments and suggestions from users and future participants in the livestock policy course. However, it is hoped that, even in its present form, the manual will prove helpful to the managers, researchers, faculty members and students who are already involved or who intend to become involved in policy analysis and policy formulation work. Suggestions and comments for improvement are most welcome.

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About the manual

This manual is part of ILCA's efforts to prepare appropriate materials for each of ILCA's training courses. The manual has nine course modules, the main text of which serve as lecture notes for the Livestock Policy Analysis Course. Reference lists have been included at the end of each module. The nine modules deal with:

- the definition of policy concepts
- the identification of policy issues
- production systems, supply and demand
- market, price and trade policies
- marketing and distribution systems
- principles of budget and manpower planning
- land tenure
- report writing and communication
- a central case study.

Several design features have been incorporated to make the manual easy to use. All modules begin with a statement of performance objectives. This provides instructors and participants with an overview of what participants are expected to have learned at the completion of each module. Second, examples, practice exercises and important points are provided throughout. Third, at the end of each module, feedback exercises are provided. These are intended to help participants gauge the level of their understanding of key ideas contained in each module.

In addition, important concepts are highlighted in **bold type.** Boxes are used to develop some of these concepts in greater depth. The main text is also punctuated by "hints to instructors". These consist mainly of additional points that are interesting or important, but which, for reasons of simplicity and space, are not dealt with at length in the text.

Module 9 contains a central case study of the hypothetical country Alphabeta. The module is intended to provide a concrete illustration of the problems and concepts introduced in the lecture notes. It uses data drawn from several African countries, and as such, is a composite. Some of the boxes found within individual modules use material from the central case study to support points made in the lecture notes. Exercises found in individual modules also use the central case study as a reference.

It is hoped that readers find the manual useful and interesting.

In addition to scientists' contributions, several individuals contributed to the preparation of the manual. My special thanks go to three secretaries, Sosena Tilahun, Brucktayet W. Mariam and Tsige Amare and graphic artists Mandefro H. Giorgis and Abdulhakeem Mohammed for their valuable assistance.

Dated: 30 September 1993

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1.1 Performance objectives

Module 1 is intended to enable you to:

1. Discuss the importance of policy issues in the livestock subsector of sub-Saharan Africa.
2. Generate an appropriate definition of the term "policy".
3. List two main elements of a policy.
4. Identify two important stages in the process of policy action.
5. Justify why politics and politicians are central to policy issues.
6. Describe appropriate applications of resources and priorities in policy formulation.
7. List seven important roles of the policy analyst.

1.2 The importance of policy issues

The performance of the livestock subsector and of agriculture in general in sub-Saharan Africa has been poor over the past two decades, and is getting worse. Output of livestock products has grown only slowly, exports and per caput consumption have declined and imports have risen, at a time when sub-Saharan Africa can ill afford such trends. Table 1.1 provides performance data on the livestock subsector by region of sub-Saharan Africa for the years 1975-87.

Table 1.1. *The performance of Africa's livestock subsector by region, 1975-87: Annual change (%).*

Performance indicator	Sub-Saharan Africa	West Africa	Central Africa	East Africa	Southern Africa
Total output (q)					
Beef	1.5	2.7	2.7	0.9	0.2
All meat	2.5	3.9	1.7	1.8	1.3
Cow milk (q)	3.1	1.5	1.3	3.7	3.0
Per caput consumption (q)					
Beef	-0.9	-0.2	1.6	-1.9	-0.8
All meat	-0.4	0.7	0.4	-1.1	-0.4
Dairy products	0.2	-1.5	1.5	1.2	0.1
Imports (v)					
Beef	-0.4	-0.5	-1.4	1.1	0.2
All meat	-0.5	-0.5	-1.4	1.2	0.2
Dairy products	3.9	1.2	7.3	12.1	4.9
Exports (v)					
Beef	-	-	-	-	-
All meat	-4.6	-22.2	-45.1	-14.3	-2.7

Source: ILCA (1993).

q = quantity; v = value.

The causes of this poor performance are complex, and differ from country to country. In general, four conditions are essential for satisfactory progress in the livestock subsector:

- adequate resources, both physical (land, labour, good weather) and financial
- new technology to improve productivity
- suitable institutions (for research, extension, marketing, credit etc)
- appropriate **policies,** both in the economy as a whole and in the livestock subsector.

All or nearly all of these conditions have remained unfulfilled in most countries of sub-Saharan Africa over the past two decades. This makes it difficult to pinpoint exactly how important a contributory factor poor policies have been. Nevertheless, there is some evidence. A 1982 study of 30 livestock projects in sub-Saharan Africa financed by a major donor over the previous 15 years revealed that for more than 75% of the projects, policy issues external to them had been major factors leading to poor performance. In addition, two arguments may be adduced:

- Policy issues and approaches tend to be very similar in the livestock subsector to those in other agricultural subsectors (food and cash crops). There is now a substantial body of evidence to

show that policies have been a major determinant of progress or the lack of it in these other subsectors; it seems highly probable that the same will be true for livestock.

- An internal review by ILCA of the published evidence throughout the world on the factors determining progress in livestock production indicated the very large influence of economic factors such as prices (which are heavily influenced by policy) in comparison with technology or other factors. What is true of the world in general is probably also true of Africa.

In short, inappropriate policies have not been the only cause of poor performance, but they have been an important one.

1.3 Definition of policy

The word "policy" is not a tightly defined concept but a highly flexible one, used in different ways on different occasions. Webster's dictionary has a number of closely related definitions. They are:

- A definite course or method of action selected (by government, institution, group or individual) from among alternatives and in the light of given conditions to guide and, usually, to determine present and future decisions.

- A specific decision or set of decisions designed to carry out such a course of action.

- Such a specific decision or set of decisions together with the related actions designed to implement them.

- A projected programme consisting of desired objectives and the means to achieve them.

In English usage, policies are "made" and "implemented" in the same way that decisions are made and implemented. Yet it is possible to have policies that are not or cannot be implemented, so that, conceptually, actions that implement policies need not necessarily be part of policy itself.

Although a policy is like a decision, it is not just a "vie-off", independent decision. A policy is a set of coherent decisions with a common long-term purpose(s). When decisions are one-off, incoherent or opportunistic, complaints are made that a government or minister "does not have a policy". Government policies are often supported by special legislation.

The terms "policy", "plan", "programme" and "project" are progressively more specific in time and place. Policies are usually national policies (not district or provincial) and are not normally limited in time: one does not usually speak in terms of "2-year policies" as one does of "2-year programmes" or "5-year plans".

For the purposes of this manual, livestock policy will be defined as:

A coherent set of decisions with a common long-term objective (or objectives) affecting or relevant to the livestock subsector.

In the countries of sub-Saharan Africa, livestock policy may mean either a complete package of decisions covering all aspects of the livestock subsector or a particular set of decisions dealing with a single aspect. Examples of the former are the Livestock Policy of Tanzania (1983) and the National Livestock Development Policy of Kenya (1980). Examples of the latter are:

- Livestock-related land-tenure policies, such as the Tribal Grazing Land Policy of Botswana, or the policies and related laws covering grazing reserves in Nigeria or group ranches in Kenya.

- Pricing policies, such as those embodied in the purchase prices established by the Cold Storage Commission in Zimbabwe or the Meat Commission in Kenya.

- Disease-control policies, as for foot-and-mouth disease in Botswana, Zimbabwe and Kenya.

1.4 Elements in policy

When analysing government policy, it is often helpful to distinguish between two elements which are essential parts of any policy. These elements are:

- **Policy objectives.** These are the "ends" of a policy and reflect the overall purpose or long-term aim(s); they are what the policy is intended to achieve (e.g. more beef exports or fairer access to grazing lands).

- **Policy instruments.** These are the "means" of a policy, the actions used to carry it out and the methods by which its objectives are achieved (e.g. import tariffs on dairy products or a subsidy on an artificial insemination service).

The distinction is useful because the same objective can often be served by several alternative instruments. It is only by distinguishing between objectives and instruments that one can begin to assess the relative efficiency of different instruments. Conversely, a single policy instrument may affect several policy objectives. For example, an instrument used to raise dairy prices will normally affect the welfare of producers and consumers as well as the level of milk production.

1.5 Policy processes

In order to define the role of policy analysis, we need to distinguish between two major processes. These are:

- **Policy formulation,** defined as the process of considering alternative policy options and deciding to implement one or several of them.

• **Policy implementation,** defined as the process of carrying out the policy (or policies) decided on during the formulation stage.

Within policy formulation, we can further distinguish between **policy analysis and policy making.** Policy analysis is the process of investigating issues and options, and of drawing up and comparing different proposals. Policy making, on the other hand, is the act of deciding which objectives should be met and selecting the instruments by which to do so.

Corresponding to these processes are the people who carry them out, namely:

• policy formulators: policy analysts and policy makers
• policy implementers.

These are not necessarily different people. The same person may analyse policy, make it and then implement it. However, in doing so, he or she is carrying out distinct roles. Awareness of these roles, and an ability to separate them, are important for everyone involved in policy work.

Important points (1.2-1.5)

• Performance of the livestock subsector in sub-Saharan Africa has been poor over the last two decades.

• Four conditions are essential for satisfactory progress in the livestock subsector: resources, technology, Suitable institutions and policies, Inappropriate policies have been major factors in the poor growth of the subsector.

• The term policy refers to a set of decisions and related action to implement them.

• Two basic elements of a policy are:

- policy objectives
- policy instruments.

• Policy processes involve two major steps:

- policy formulation
- policy implementation.

Policy formulation is further subdivided into policy analysis and policy making.

1.6 Policy and politics

The purpose of policy is to affect the real world. To do this, political realities must be fully taken into account. While imagination - and even a degree of daring - may be vital ingredients at the policy formulation stage, there is no point in proposing a policy which is bound to be rejected for political reasons. Policy proposals will not be accepted - and policies will not be effective - unless they have the support of prominent politicians and interest groups. Policy analysts must understand and take into account the concerns of politicians if viable policies are to be formulated. Politics and politicians are, in fact, central to policy issues and should not be viewed as irritating side-issues, to be ignored whenever possible.

1.7 Priorities in policy formulation

The formulation of good policy is not a matter of random chance, but a skill which can be learned. It is also a skill which requires scarce resources to practice. Three main types of scarce resources are required:

• the ability and time of policy **analysts** to identify issues and options with an understanding of their probable consequences;

• the ability, attention and time of policy **makers** who must understand the issues involved if they are to make sound decisions;

• other political and bureaucratic resources to bring about necessary legislation and political or financial support for a policy decision or its effective implementation, *viz*:

- bureaucratic resources such as "legal draftsmen" or "project planners" and
-political resources such as support from politically influential people or organisations.

For policy formulation to be effective, it is important to recognise at the outset that too many policy issues cannot be tackled simultaneously. It is essential that the most important issues be tackled first and that priorities be firmly established. The danger is that governments will utilise scarce resources on issues which are relatively unimportant.

1.8 The role of the policy analyst

In the case of the **livestock subsector,** the tasks of policy analysis can be described as follows:

• to identify and prioritise policy issues

• to clarify government policy objectives relevant to the livestock subsector and to identify potential conflicts in terms of objectives and interests

• to identify current policies and their consequences

• to identify alternative viable policy instruments, their probable direct and indirect consequences and the risk that these may not materialise

• to develop criteria and indicators to assess progress towards objectives

• to design viable policy packages, with associated strategies to obtain political support and to ensure organisational effectiveness

• to advocate these viable policy packages in a clear, brief and persuasive way.

In essence, the task of the policy analyst is to help the policy maker take difficult decisions in areas that are often contentious. Senior policy makers must understand the issues involved if they are to make sound decisions. The policy analyst must be able to create and convey that understanding quickly and clearly.

Important points (1.6-1.8)

• Politicians cannot be ignored while formulating implementable policies.

• Three important types of people during the policy formulation stage are:

- policy analysts
- policy makers
- politicians and bureaucrats.

• Prioritising policy issues is essential in utilising scarce resources effectively.

• Two major responsibilities of the policy analyst are to:

- review government policies and design viable policy packages
- help policy makers take appropriate decisions on sensitive issues.

1.9 Feedback exercises

All answers can be found in the text.

1. a. It is generally stated that the performance of the livestock subsector in sub-Saharan Africa in past years has not been satisfactory. Name three indicators for assessing such a trend.

i) _____
ii) _____
iii) _____

b. Two important conditions for satisfactory progress in agriculture are:

i) availability of appropriate technology
ii) existence of appropriate policies
What could be the two other conditions?
iii) _____
iv) _____

2. Circle T for True and F for False.

i) ILCA's review of published research shows that inappropriate policies have retarded progress in the livestock subsector more than the lack of appropriate technologies.

T F

ii) Policy may be defined as a set of decisions with or without related actions designed to implement them.

T F

iii) A policy is not different from a decision in a real sense; it is a "one-off independent decision".

T F

iv) Two main elements of policy are policy objectives and policy instruments.

T F

v) Policy formulation constitutes the main step of policy processes while policy analysis is just a formality.

T F

3. Fill in the blank spaces.

i) The formulation of good policy is not an easy task. It requires meaningful participation of policy analysts,_____ political persons and_____.

ii) If policy issues are not properly prioritised, the danger is that government may utilise resources on_____.

4. List five major tasks of policy analysts in helping policy makers to take decisions.

i) _____
ii) _____
iii) _____
iv) _____
v) _____

1.10 References

ILCA (International Livestock Centre for Africa). 1993. *Handbook of African livestock statistics.* ILCA, Addis Ababa, Ethiopia. 66 pp.

Sandford S. 1985. *Better livestock policies for Africa.* ALPAN (African Livestock Policy Analysis Network) Network Paper 1. ILCA (International Livestock Centre for Africa), Addis Ababa, Ethiopia. 22 pp.

Wyckoff J B and Ngutter L G K. 1984. *Livestock policy identification and formulation: Theory and practice in Kenya.* Paper presented at the Conference on Livestock Policy Issues in Africa, 24-28 September 1984. ILCA (International Livestock Centre for Africa), Addis Ababa, Ethiopia.

2.1 Performance objectives

Module 2 is intended to enable you to:

1. Recall four guiding factors in identifying key policy issues on which to concentrate.

2. Discuss the importance of current livestock sector functions in framing new policies and suggest two ways to classify these functions.

3. Explain the terms "non-economic motivation" and "economic motivation" in the context of framing a new policy restricting herd size of agropastoralists and mixed farmers.

4. List three approaches to differentiating between economic and non-economic reasons for a farmer to increase herd size.

5. Describe five main categories of economic policy objectives common to all governments.

6. Differentiate between declared and undeclared government objectives by citing specific examples.

7. Explain the role of policy analysts in resolving the complexities of declared and undeclared objectives and also in guiding the policy maker to choose sound objectives.

8. Recall a simple qualitative method to assess the livestock sector's current performance in terms of each of the five broad policy objective groups.

9. Describe three main steps involved in monitoring quantitatively the performance of each policy objective.

10. Discuss identification of policy instruments used to tackle policy issues or problems.

2.2 Introduction

Module 1 stressed the need to identify the most important policy issues on which to concentrate. Module 2 provides guidance on how this can be done. Every African country has, to some extent, its own particular problems and priorities. Nevertheless, there is sufficient similarity amongst them to make it possible and useful to draw up common principles for prioritisation.

The simple principle for prioritisation is that one should concentrate on those issues which are inherently most important and where changes in policy are likely to have the most effect. In the end, selecting particular policy issues to concentrate on must be a matter of judgement rather than a wholly objective calculation from facts. Nevertheless, exercising judgement will be less arbitrary and more efficient if the factual groundwork has first been well done. Essentially, this is a matter of knowing one's livestock sector, particularly in terms of its current functions, its future roles, how well it will perform without policy change and the scope for policy change.

For any particular country, we can tackle this in a straightforward way by systematically asking:

- What function(s) is the livestock sector currently serving, and are there major functional differences among regions, ethnic groups or social and economic classes?

- What objectives is the livestock sector expected to achieve in the future? Are there major incompatibilities between present functions and future objectives or among the objectives of different interest groups, e.g. government and pastoralists?

- How well is the livestock sector performing in terms of its present functions or objectives?

- If performance is already, or is likely to prove, inadequate, what alternative policy instruments are available to improve it?

It is not possible to formulate just one single rule or procedure for deciding whether a particular issue is more important than another; but by asking and answering the questions set out above, the scope for disagreement or uncertainty about relative importance can be reduced. In doing so, one can add greatly to the clarity of the debate about policies. For example, a discussion about the relative priority to be given to milk or beef production will be much better focused if all parties know in which regions of the country the growth of milk output in recent years has outstripped beef production, and vice versa.

2.3 Functions of the livestock sector

It is necessary to know the present functions of the livestock sector in order to gauge how well it is performing in relation to policy objectives, and to ensure that new policies designed to achieve new objectives do not, unintentionally or to an unexpected degree, disrupt the performance of existing socially desirable functions. Analysts should be aware of the multiple functions of livestock and of the complex relationships between those functions. They should know which

functions are important to which social classes or ethnic groups in which areas of their country. They should understand the different kinds of production systems found in their country and how those systems are changing over time. Finally, they should understand that expanding the output of one function may diminish the output of another.

2.3.1 Two ways to classify livestock sector functions

A first step in the classification process is to quantify the relative importance of different present functions as a prelude to judging how much they may be disrupted by new policies. Livestock sector function(s) can be classified in several ways. However, two widely used classifications are conceptualised in terms of:

- kinds of output produced
- uses to which these outputs are put.

Among the kinds of output produced are: food (i.e. meat, milk, eggs); inputs to cropping (i.e. manure and farm power in the form of animal traction); and raw materials (e.g. wool and skins to make other goods). Among output uses are: subsistence consumption by the livestock holder's household; direct supply of inputs (e.g. traction and manure to crop production); cash income through sales of live animals or their output; savings and investment through increasing the size and quality of the herd; and social functions such as paying bride wealth, helping destitute families by lending them livestock or providing animals for communal feasts or sacrifices.

2.3.2 Relative importance of livestock sector functions in sub-Saharan Africa

Table 2.1 shows, for sub-Saharan Africa as a whole and for different geographical regions within it, the relative importance during the late 1970s of different kinds of outputs when these are calculated in terms of monetary value. The table shows that for sub-Saharan Africa, meat is the most valuable output, accounting for 47% of the total. Of this meat, beef accounts for 57% and small ruminant meat for 22%. The second most valuable output is animal traction, accounting for 31%; milk, the third most valuable output, accounts for 15%. At the same time, regional variations in terms of the relative contributions of outputs can be noted. For example, animal traction is very important in East Africa but is much less so in other regions.

Table 2.1. ***Share of different kinds of output of the total livestock output in sub-Saharan Africa and its regions.***

Kind of output[1]	**% share of total output**[2]				
	West Africa	**Central Africa**	**East Africa**	**Southern Africa**	**Sub-Saharan Africa**
Animal traction	21	3	39	26	31
Manure	4	1	3	2	3
Meat	56	79	38	58	47

Milk	11	12	17	9	15
Eggs	8	5	3	5	4
Total %	100	100	100	100	100
Total value (US$ millions)	1460	349	3747	930	6486

Source: Addis Anteneh et al (1988).

[1] Excludes hides, skins, wool and slaughterhouse by-products.

[2] Share of output in 1975 US$ at uniform continent-wide prices.

Table 2.2 presents sample-based data on types of output in a mixed peasant farming system in the Ethiopian highlands. It also presents data on the use to which livestock output is put. Note the importance of livestock in generating cash for the farm (responsible for 87% of farm cash income), even though only a small proportion (24%) of the gross value of livestock output is sold for cash. Note also the importance, in overall livestock output, of the value of its contribution of inputs, in the form of animal traction and manure, to cropping. As stated earlier, policies can have unintended (and potentially adverse) effects. The data provided in Table 2.2 indicates how policy could negatively affect the welfare of certain groups. For example, policy changes intended to produce higher quality meat for export, which ignored the role of livestock in providing inputs into the farm and generating cash, could run into severe problems in terms of both peasant acceptance and domestic food security.

Table 2.2. ***Types and uses of livestock output in the Ethiopian highlands, 1979-83.***[1]

	1979	**1980**	**1981**	**1982**	**1983**	**Annual average**
Gross value of livestock output						
Food output of ruminants[2]	301	340	397	401	427	373
Crop inputs[3]	584	621	591	661	788	649
Raw materials[4]	19	22	33	26	30	26
Others[5]	330	249	542	424	341	377
Total	1234	1232	1563	1512	1586	1425
Uses of livestock output						
Sold for cash	230	412	432	274	334	336
Crop inputs used on farm	552	589	542	612	739	607
Raw materials used on farm	7	7	15	15	15	12
Other outputs consumed or retained on farm	445	224	574	611	498	470
Total	1234	1232	1563	1512	1586	1425
Investment in livestock						
Value of livestock held	1343	1375	1491	1522	1850	1516

No. livestock held (TLU)[6]	5.9	6.6	6.8	7.3	7.9	6.9
Some ratios (%)						
Livestock gross output/farm gross output	60	43	50	55	50	51
Livestock cash income/farm cash income	90	84	82	85	96	87
Livestock cash income/livestock gross output	19	33	28	18	21	24

Source: Gryseels (1988).

[1] Value in Ethiopian Birr per farm.
[2] Milk, butter, meat and live animals sold.
[3] Manure and animal traction including transport of products and feed.
[4] Wool, hides and skins.
[5] Residual category includes eggs, chicken, value of young stock born and unidentified items.
[6] TLU = tropical livestock unit of 250 kg live weight. The TLU is a common unit in which different kinds of livestock (cattle, small ruminants etc) can be compared.

Box 2.1: Construction of regional output tables.

It would be relatively simple to construct tables similar to Table 2.1 for different regions within a country. To do so, one would need to have data for the different regions on:

- Size (numbers) of total regional herds (flocks).
- Sex and age composition of herds (flocks).
- Offtake rates for slaughter of different ages/sex.
- Live weights at slaughter of different ages/sex and dressing-out percentages.
- Milk yields per lactation.
- Calving rates and lengths of lactations; or, if there is no marked seasonality, proportion of breeding females lactating at any point in time and average daily milk yield.
- Meat or liveweight and milk prices (see module 4 for further discussion of which prices to use).
- Area (ha) cultivated by animal traction and the per ha rental cost of such cultivation; or number of ploughing animals (e.g. oxen), number of days on average worked per year and daily hire charge per animal.
- Value of manure; this might be expressed in terms of quantity of manure (e.g. US$ per half-tonne cart-load) or of animal-nights, where, under contractual arrangements, for a fee, animals

are kept in night enclosures to fertilise fields.

It is more difficult to construct reliable tables, such as Table 2.2, showing how total output is allocated to different uses. However, while accurate data are always desirable, even quite rough guesses yield interesting insights. Table 2.3 shows examples where the mixed farming system of the Ethiopian highlands is compared to a pastoral system. Such regional comparisons are useful not only in terms of identifying functions of various outputs across different production systems, they also help analysts define the potential impact of their policies amongst these varied systems.

Table 2.3. ***Types and uses of livestock output in two systems in Ethiopia.***

	Highland system	**Pastoral system**
Composition of livestock output by value (%)		
Food	26	61
Crop input	46	<1
Raw material	2	3
Other (includes values of young stock borne)	26	35
Total	100	100
Uses of livestock output by value (%)		
Sold for cash	24	31
(within which exported)	(0)	(13)
Crop inputs used on farm	42	<1
Other raw materials used on farm	<1	3
Other outputs consumed or retained on farm	33	65
Total	100	100
Some ratios (%) by value:		
Livestock gross output/farm gross output	51	>90
Livestock cash income/farm cash income	87	>90
Livestock cash income/livestock gross output	24	33

Source: Table 2.2 and ILCA (unpublished data).

2.3.3 Farmers' tendency to increase herd size: An important policy issue

Non-economic motivation vs economic motivation

One issue with policy implications is the tendency of African pastoralists and mixed farmers to invest their savings in increasing herd size. This investment may take the form of purchasing additional animals or allowing "natural" measures (i.e. births into the herd exceed deaths and

other exits) to take their course. The tendency to increase herd size is often attributed to "non-economic motivation", in particular to the prestige and status which large herds imply and to the need for large payments of bride wealth. Because governments are worried about desertification caused by overstocking, they tend to be unsympathetic to these non-economic motivations and to feel they should compel stockholders to limit their herd sizes.

Let us, for the moment, accept that some individuals or groups increase their herd size for "economic reasons" and others for "non-economic motivations" and that governments may be more justified in interfering to control the latter than the former. In a particular situation, how do we decide the relative importance of different forms of motivation? The first step is to find out the actual size of the herd. Knowing the average herd size is not very useful since herd sizes often vary enormously between families and the motivations of the wealthy may be quite different from those of the poor. Thus, we need to know the statistical distribution of herd sizes.

Because households with large herd sizes often have more persons than households with small herds, it may also be useful to know the distribution of herd sizes per person as well as, or instead of, per household. Table 2.4 presents examples of herd size distributions per household and per person. The appendix of this module shows how to compare the relative distribution of herd sizes in two situations, using Lorenz curves.

Table 2.4. ***Household size and distribution of cattle holdings in north-eastern Senegal.***

	Herd size group (number of cattle)					
	0-9	**10-24**	**25-49**	**50-99**	**100+**	**Total**
Percentage of households	21	27	22	17	13	100
Percentage of people	19	26	22	18	15	100
Percentage of cattle	1	9	17	27	46	100
Average number of people/household	7.6	7.9	8.3	9.2	9.4	8.3
Average number of cattle/household	3	15	33	71	146	43

Source: Sutter (1987).

One reason why pastoralists and farmers in Africa invest their savings in livestock is that, because of unreliable weather, their farm output fluctuates enormously from year to year. Therefore, part of the income made in good years needs to be kept in an easily cashable form (in "liquid assets") so that, in bad years, it can be used to purchase essential food for the family. Banking services are not well developed in rural Africa and investment in livestock is often the next-best alternative. Livestock can easily be converted into cash and earns a return. Figure 2.1 shows the relationship, over six years, between the yields of the main cereal crop (barley) and the number of small ruminants kept by peasants in the Ethiopian highlands. The figure demonstrates that, in the year after a poor barley yield, the number of small ruminants declined as lambs were sold in order to generate cash to purchase grain. In deciding whether investment takes place for economic or non-economic reasons, one needs to take into account this pattern of offsetting investment and encashment.

Approaches to determine non-economic and economic motivations

Three main approaches may be used to help us decide whether investment in increasing herd size arises from economic or non-economic motivations. Specifically:

- Assess the minimum herd size necessary to support the dependent population at a particular standard of living.

- Examine herd management efficiency and ratio of return.

- Verify, by surveys, the validity of claims that herd-size increases are for non-economic (e.g. social, political, cultural) reasons.

Figure 2.1. Crop yield and holding of small ruminants in the highlands of Ethiopia, 1979-85.

Each of these will be discussed in turn. However, it should be noted that economic and non-economic motivations are not necessarily mutually exclusive. Both may be operating at the same time. In addition, as the following points will demonstrate, it is not always easy to identify whether economic or non-economic motives are guiding farmer decisions to increase herd size.

Minimum herd size. Dahl and Hjort (1976) showed that in a typical pastoral society, wholly dependent on food obtained from their own herds, a minimum of 10-11 cattle (or their equivalent in other kinds of livestock) per person is required to provide the necessary calorie intake to support life. Sandford (1982) estimated that in mixed farming systems in Zimbabwe, where it is difficult to buy draft oxen, a minimum herd size of 8-10 cattle is required by a household. With this number, the household can breed replacement oxen so that it can survive as an independent farming unit. This suggests that households which are striving to increase their herd size, but have yet to reach the minimum required, are operating from purely economic motivation. Conversely, for those whose herd size exceeds the minimum, non-economic motives may be operating. Table 2.5, showing the proportions of households to cattle in a farming system in Zimbabwe, demonstrates who, by this criterion, are subject to economic or non-economic motivation, respectively. Obviously this criterion is an extremely severe one in restricting the definition of economic motivation.

Table 2.5. ***Distribution of cattle holdings in Wedza District, Zimbabwe, 1982.***

	Herd size (head of cattle)						
	1-3	**4-6**	**7-9**	**10-19**	**20-29**	**30+**	**Total**
Proportion of cattle holders with this size herd	36	32	16	*14*	*1*	*1*	100
Proportion of cattle held in this size herd	13	27	22	*32*	*5*	*1*	100

Source: Sandford (1982).

The box within Table 2.5 indicates the proportion of cattle holders who may be operating for non-economic reasons.

Herd management efficiency and ratio of return. This approach examines the way in which herds are managed and the returns to investment they offer to the owner. Evidence from Kenya, as shown in Table 2.6, can be used to illustrate this point. The table indicates that wealthier households (i.e. those with more livestock per household member) with larger herds milk their animals less intensively and extract less output from them than medium and poor households. This provides, at first sight, some evidence that wealthier families may be less "economically motivated" than medium or poor households. Yet the complexity of the issue is illustrated by the lower half of the table which shows that, although less time per animal is spent on livestock management by wealthy than by other households, the actual time spent per person in managing animals is more. It is possible, therefore, that the lower economic output of the wealthy households' herds reflects not so much lack of economic motivation as an acute labour constraint.

Table 2.6. ***Economic output and labour input by wealth of household among the Maasai in Kenya, 1981-83.***

	Household wealth category		
	Poor	**Medium**	**Wealthy**
Mean herd size (no. of TLU[1])	29	62	272
Percentage of lactating cows actually milked	96	60	30
Gross value of output per TLU in the herd (Kenya shillings/year)	460	334	159
Net return (% yearly) on capital invested in livestock	24	15	9
(result of long-term simulation model)			
Hours spent managing livestock: per TLU	0.8	0.5	0.2
per male adult worker	4.5	4.6	6.9
per household	24.0	32.0	48.0

Source: Solomon Bekure et al (1991).

[1] TLU = tropical livestock unit of 250 kg live weight.

Verification of non-economic motivations. One way to test the validity of claims that large herds are kept for non-economic reasons, such as payment of bride wealth, is to examine what proportion of the herd has actually been subjected to these transactions. Evidence from Zimbabwe (Sandford, 1982) suggested that bride wealth *(lobola)* accounted for only about 5% of transactions in male cattle but possibly as much as 20% in female cattle.

Important points (2.2-2.3)

• In prioritising policy issues, knowledge of one's livestock sector is essential in terms of:

- its current functions
- its future objectives
- its current performance and problems
- the scope of policy change.

• Knowledge of current functions helps ensure that new policies do not disrupt the performance of existing desirable functions.

• Livestock sector functions are classified in terms of:

- kinds of outputs
- the use of these outputs.

• The relative importance of the livestock sector's present functions in sub-Saharan Africa in terms of kinds of output and uses of outputs are:

- kinds of output: meat, traction and milk
- uses of outputs: crop inputs used on farm, household consumption, cash income through sale and raw material.

• Restricting the tendency of farmers to increase herd size is an important policy issue for African governments.

• The tendency of farmers to invest savings in increasing the size of their herds could be due to both economic and non-economic motivations.

• Three approaches to deciding if the tendency for farmers to increase herd size is due to non-economic or economic motivations are:

- assessing the minimum herd size needed to support the dependent population

- calculating herd management efficiency and ratio of return

- verifying, by surveys, the validity of claims that herd increases are for non-economic e.g. social, political, cultural) reasons.

2.4 National policy objectives

A key step in identifying the most important policy issues on which to concentrate is to identify the government's own policy objectives and to gain some idea of the relative importance of each of these objectives. While they are sometimes difficult to prioritise, a rough ranking is both

possible and essential if overall policy is to be effective and not deflected by internal or external interest groups.

Government objectives for the livestock subsector are determined partly by an overall political philosophy and partly through an assessment of the direction and speed at which change in the current functions of the subsector is desired.

2.4.1 The broad groupings of government policy objectives

The terms in which governments state their objectives vary in each country. However, most objectives can be classified as falling into one of five broad groups:

- independence objectives
- economic efficiency objectives
- resource conservation objectives
- stability objectives
- equity objectives.

Independence objectives are concerned with obtaining and preserving a satisfactory degree of political and economic autonomy. Independence implies that a country neither depends on foreign aid to meet the basic needs of its population nor is susceptible to external political interference (the former is often linked to the latter). Meeting the independence objective requires a high degree of self-reliance, in the sense that a country will wish either to be entirely self-sufficient in basic food commodities or to dispose of sufficient foreign exchange to meet part of its demand through imports. "Self-sufficiency" in all basic foodstuffs, meaning that the country produces domestically enough to meet its entire demand, is sometimes advocated. But self-sufficiency in this sense can involve very high costs if the country does not have the natural or other resources to produce a particular food commodity at low cost. It may be better to produce some other (e.g. non-food) commodity for which it does have the appropriate resources and to sell that to raise the foreign exchange to buy the food commodity. This point is dealt with in more detail in module 4.

Economic efficiency objectives (hereafter just "efficiency") are concerned with increasing the level of real national income and its growth rate over time. Economic efficiency is a very complex concept and only some aspects of it will be discussed in this manual. Efficiency implies that a country use existing, and generate new, technology to minimise costs per unit of output, and seek a combination of outputs consistent with its comparative advantage in the international market. Efficiency will usually be closely related to the appropriateness of price signals conveyed through the market mechanism. Government intervention often distorts these signals, resulting in a mix-allocation of resources within the economy. However, the market mechanism alone will not necessarily lead to optimum long-term development. Carefully thought out government interventions are often needed to ensure that the conditions for long-term efficiency are fulfilled.

Resource conservation objectives are concerned with preserving the natural resource base in order to ensure long-term efficiency and independence. These objectives are of particular importance to African livestock policy makers because of serious environmental problems, such as overgrazing, often attributed to livestock.

Stability objectives are concerned with avoiding abrupt and large changes in incomes, in the price and availability of domestically produced basic commodities and inputs, and in the consequent need for foreign exchange to buy essential imports. Since stability is rarely secured without cost, absolute stability of prices and quantities should not be the aim. Indeed, absolute price stability when production is inherently unstable can worsen both supply problems and farmer viability. Nor should food security be confused with self-sufficiency in the production of all food types. Agricultural markets, in particular, are inherently unstable. As a result, agricultural policy should be directed towards achieving an adequate degree of stability.

Equity objectives are concerned with the fair distribution of income and wealth within society. Important equity considerations in relation to agriculture and livestock include the distribution of income and assets among different types of farms within and among regions, and the allocation of land use rights between producers. The equity objective also concerns the relative well-being of producers and consumers, the distribution of purchasing power between different groups of consumers and the availability of employment opportunities. The market process alone will not normally lead to greater equity. Indeed, it may actually increase inequity, especially when the *status quo is* already inequitable or when economic power is becoming increasingly concentrated. Improving equity is, ostensibly, considered essential to policy formulation in many African countries.

These five broad classes will account for the declared objectives of most governments and can be gauged from public statements and documents such as national development plans. Table 2.7 shows the results of one investigation into what goals the governments of selected African countries claim to be pursuing in their livestock sectors. In the second column of Table 2.7 these goals have been reclassified to match the broad groups of objectives set out above. However, analysts will often find that specifying the real objectives underlying current policy is not as simple as this. The objectives actually pursued by policy makers may differ from the government's declared objectives. These real or undeclared objectives can often only be identified from the day-to-day decisions made by governments.

Perhaps the most frequently encountered and best known example of an undeclared objective is evinced by fixing food prices at levels that favour urban consumers rather than rural producers. While governments publicly espouse equity, efficiency or independence, their real objective may be self-preservation which could favour the interests of certain groups over others.

A government's real objectives may thus be at variance with its declared objectives. Moreover, whether declared or undeclared, governments' objectives may be incompatible with those of certain social groups or classes, whose interests may, in turn, also clash. Political reality is such that governments are frequently "captured" by interest groups which, through their superior wealth, power or ability to organise, have developed greater political leverage. Thus, in Africa, urban consumers of livestock products often have greater leverage than rural mixed farmers who

account for the bulk of production. These, in turn, tend to have more influence than the pastoral groups, who produce less, are fewer in number and inhabit more remote areas.

Table 2.7. ***Major livestock policy goals in selected countries, 1975-85.***

Goal	Country						
	Policy objective categories[1]	**Côte d'Ivoire**	**Ethiopia**	**Mali**	**Nigeria**	**Sudan**	**Zimbabwe**
self-sufficiency	(a)	X	X	X	X	X	X
Export promotion	(b)		X	X		X	X
Stabilisation and inflation control	(d)	X	X	X	X	X	
Government revenue generation	(b)	X	X	X	X	X	X
Improved nutrition	(e)					X	X
Employment creation	(e)				X	X	X

Source: Williams (1993).

[1] Broad objective categories: (a) independence; (b) economic efficiency; (c) resource conservation; (d) stability; (e) equity.

2.4.2 Ranking policy objectives

It will frequently fall to the livestock policy analyst to unravel the complexities resulting from the co-existence of declared and undeclared objectives. For instance, the analyst may find that one set of policy instruments, geared to a declared objective, has been overlaid by another, geared to an undeclared objective. Both sets of instruments are in force, but each counteracts the other.

The analyst's job will be to clarify, by specifying which instruments are directed towards which objectives, by pointing out the incompatibility between government objectives and those of specific groups/classes and by identifying the extent of any conflicts. The analyst may also be asked to find ways in which conflicts can be reduced. For example, he or she might suggest that government stop pursuing a universal low-price policy favouring all consumers and develop instead a system of direct transfers in cash or kind to particularly vulnerable consumer groups.

In some cases, conflicts between different interest groups may appear more pronounced than they really are, owing to the use of inappropriate past policies. Conflicts of this kind can sometimes be redressed through policy reform. In other cases, giving one group what it wants will inevitably mean taking something away from another group, and difficult choices will have to be made.

It is the policy maker's job to make these choices. The analyst's role is to present the policy maker with alternatives, showing the costs and benefits to different groups implied by each alternative and pointing out the trade-offs between different objectives. For instance, one alternative might imply meeting the resource conservation objective, but at great cost in terms of equity; another alternative might imply enhanced independence in the short term, but depleted resources (and hence reduced independence and efficiency) over the longer term. It is also the analyst's role to try to identify the policy makers' rough ranking in respect to the different objectives. Experienced politicians may be able to state these explicitly in private. The less experienced may be either unable or unwilling to specify priorities. A skilful analyst is one who can deduce the policy makers' real preferences, either from analysing their past decisions or by presenting choices in a sufficiently concrete way for policy makers to see the necessity and implications of their choices.

2.5 Current performance and problems

The logical next step in identifying the most important policy issues is to assess the sector's current performance in terms of each objective. At this stage, no particularly complex or detailed analysis is required; that may come later when the key issues have been identified. Rather a broad monitoring system that keeps an eye over the whole field will suffice.

2.5.1 Qualitative monitoring

At a very basic level, performance can be monitored simply in terms of the presence or absence of easily identifiable "problems" formulated mainly in qualitative rather than in quantitative terms. Since most people and politicians conceive of policy issues in terms of "problems" rather than "unfulfilled objectives", this approach has much to recommend it. We list below some of the most commonly perceived problems. Table 2.8 sets out the probable relationship between these problems and the broad groups of objectives already discussed.

- inadequate supplies of livestock products to the consumer (queues and empty shelves at shops, black markets, sky-rocketing prices)

- excessive dependence on imports of livestock products

- unproductive resources (under-utilised or low yielding land or livestock)

- desertification (erosion, overgrazing etc)

- unstable supplies and consumption (due to weather conditions, disease outbreaks etc)

- inefficient livestock services (e.g. animal health, feed supplies, artificial insemination, water supplies)

- distorted prices (too high or too low, discriminatory, excessive marketing margins)

• inadequate market outlets (too few, unreliable, do not cater for some products)

• undesirable concentration of livestock ownership

• unfair pattern of access to land (between livestock holders, or between pastoralists and cultivators).

Table 2.8. ***The probable relationships between policy problems and policy objectives.***

	Objectives				
Problems	**Independence**	**Efficiency**	**Resource conservation**	**Stability**	**Equity**
Inadequate supplies	-[1]	- -[2]			-
Excessive imports	- -	+/-[3]			
Unproductive resource		- -	+/-		
Desertification		- -	- -		
Unstable supplies	-			- -	-
Inefficient services		- -		-	-
Distorted prices	- -	- -			-
Inadequate markets		- -			-
Concentrated livestock ownership		+/-	+/-		- -
Unfair access to land		+/-	+/-	+/	- -

[1] One negative (-) indicates a negative relationship.

[2] Double negatives (-) indicate a strong negative relationship.

[3] Positive and negative signs together (+/-) indicate that the relationship may be either positive or negative.

2.5.2 Quantitative monitoring

More sophisticated performance monitoring of the livestock sector is both desirable and possible. For each broad group of policy objectives, there are three main steps to monitoring performance:

• Set up one or more fairly simple quantifiable for evaluating performance.

• Establish a minimum level of performance which is regarded as "acceptable", i.e. one which does not require priority attention to rectify.

• Identify existing sources of data, or generate new data, with which to measure the performance of a particular country's livestock sector.

Setting up quantifiable criteria

Box 2.2 gives an example of how a particular criterion could be made to work. Tables 2.9-2.13 list summary suggestions for appropriate quantified criteria for each broad objective group.

The objectives set, especially in the case of the economic efficiency objective, often involve a complex group of concepts and considerations. These can only seldom be fully captured by a single quantifiable criterion. It is usually preferable to use criteria which can be made to work in practice and then to make subjective adjustments in one's evaluation, knowing that the criteria chosen may not capture the full complexity of an objective or may even distort it. For example, in Table 2.9 we suggest "changes in per caput production" as one criterion by which to evaluate performance in terms of the efficiency objective. In most situations this is correct, e.g. increasing meat output increases national income. But there are cases where the opposite may be true, i.e. increasing meat output decreases national income. Such would be the case if domestic meat production was heavily protected or subsidised and if the cost of imported inputs (e.g. feed, fencing etc) exceeded the cost of importing the meat. The use of several criteria simultaneously can help to mitigate the effects of such situations.

Box 2.2: An independence criterion.

A possible quantified criterion for assessing performance in terms of the independence objective would be the **self-sufficiency ratio** in the main livestock products, i.e. meat of cattle, goats, sheep, pigs and poultry, and fresh, powdered, condensed and evaporated milk plus butter. The self-sufficiency ratio is defined as the ratio:

domestic production/domestic consumption.

Domestic consumption is assumed to be equal to domestic production plus net imports (including imports of live animals). Net imports are gross imports minus gross exports. We can calculate self-sufficiency ratios separately for different commodities in quantity terms (e.g. tonnes). But, if we want to do it for all the main food commodities (i.e. meat, milk, dairy products) together, it is better to do so in value terms (i.e. dollars). However, both domestic production and net imports (of similar quality) of any one commodity (e.g. beef) must be valued at the same prices (for example at the price of imports - the issue of the appropriate prices to use is discussed in module 4). If we do these calculations, for example in the case of Nigeria, we find that total domestic production of the commodities concerned in 1985 had a value (at import prices) of about US$ 1033 million, and net imports had a value of US$ 175 million. Thus the self-sufficiency ratio in the principal livestock products is 1033/(1033 + 175) x 100, or 86%.

Table 2.9. ***The independence objective: Some quantified criteria for evaluating performance.***

Summary formulation of criterion	Point of reference	Possible data source
Self-sufficiency ratio (S.C.)	Absolute	FAO P. and T.Y-B
Per caput imports (S.C.)	Own past performance	FAO T.Y-B

Ratio of livestock imports to agricultural exports (by value)	Own past performance	FAO T.Y-B
Change in livestock exports (S.C.)	Own past performance	FAO T.Y-B

S.C. = selected commodities only (e.g. beef and milk).
FAO P.Y-B = FAO Production Year-Book.
FAO T.Y-B = FAO Trade Year-Book.

Table 2.10. ***The efficiency objective: Some quantified criteria for evaluating performance.***

Summary formulation of criterion	Point of reference	Possible data sources
Change in per caput domestic supply (S.C.)	Absolute	FAO P.Y-B
Change in per caput domestic supply (S.C.)	Similar countries	FAO P.Y-B
Change in per caput domestic supply (S.C.)	Own past performance	FAO P.Y-B
Domestic/international price ratios (S.C.)	Similar countries	Annual survey
Yield of land and livestock	Similar countries	FAO P.Y-B
Marketing margins (S.C.)	Similar countries	Special surveys

S.C. = selected commodities only (e.g. beef and milk).
FAO P.Y-B = FAO Production Year-Book.

Table 2.11. ***The resource conservation objective: Some quantified criteria for evaluating performance.***

Summary formulation of criterion	Point of reference	Possible data sources
Vegetation composition and cover on monitoring sites	Own past performance	Annual surveys
Comparison of aerial photographs (% cover)	Own past performance	Annual surveys

Table 2.12. ***The stability objective: Some quantified criteria for evaluating performance.***

Summary formulation of criterion	Point of reference	Possible data sources
CV of annual output (S.C.)	Similar countries	FAO P.Y-B
CV of per caput annual consumption	Similar countries	FAO P. and T.Y-B

CV = coefficient of variation, defined as: (standard deviation/mean) x 100.
S.C. = selected commodities only (e.g. beef and milk).
FAO P.Y-B = FAO Production Year-Book.
FAO T.Y-B = FAO Trade Year-Book.

Table 2.13. ***The equity objective: Some quantified criteria for evaluating performance.***

Summary formulation of criterion	Point of reference	Possible data sources
Lorenz curve of livestock holdings (selected species)	Similar countries	Special surveys
Lorenz curve of livestock holdings (selected species)	Own past performance	Special surveys
Ratio of winners in pastoral/cultivators crop damage	Own past performance	Special surveys cases
Ratio of retail and producer prices to international	Own past performance	Annual surveys prices (S.C.)
Ratio of retail and producer prices to international	Similar countries	Annual surveys prices (S.C.)
Rate of gifting livestock from poor to rich households	Own past performance	Special surveys

S.C. = selected commodities only, e.g. beef and milk.
CV = coefficient of variation, defined as: (standard deviation/mean) x 100.
Lorenz curve = A graphical device to demonstrate equity of distribution. See the appendix for a detailed explanation.

Establish minimum level of performance

We need to consider what minimum standard should be set for the level of acceptability of performance. Remember that the point of the whole exercise is to identify priority issues. If standards are set too high, performance in every respect becomes unsatisfactory and everything then becomes a priority issue. If set too low, then everything is acceptable and there is no priority to change anything. We need to set standards at a level that draws attention to a small number of really poor performances. The "setting of standards" may not be a formal, public or long lasting exercise. It is more likely to be one of continuous informal discussion amongst the few policy makers and analysts most concerned.

Broadly speaking, there are three types of reference points in relation to which some minimum acceptable standard can be set. Let us take as an example the efficiency objective and use as a criterion "growth in per caput domestic beef supply". One possible reference point would be an absolute one. We might set a 1% annual increase in per caput domestic beef supply as the minimum acceptable level. Another reference point could be one that is relative to the performance of similar countries. We might, for example, set the average annual change in per caput beef supplies, experienced by all sub-Saharan African countries, as the minimum acceptable level. The third reference point would be one that is relative to that country's own past performance. For example, we might set the minimum acceptable level as being at least equal to the country's own average annual performance over the last decade.

Identify existing sources of data

Performance monitoring on the basis of quantifiable criteria requires available and pertinent data. The FAO Production and Trade Year-Books include FAO estimates for some national-level data (e.g. livestock populations, production, imports and exports). Some of the data, however, are not reliable. As well, while national data is important, it is often the case that regional and/or social group within-country data is also needed. It is unlikely that many countries will be able to adopt immediately all the criteria (and their attendant data requirements) listed in Tables 2.9-2.13. However, unless progress is made towards adopting many of them, governments concerned will remain vulnerable to internal and external pressure to adopt someone else's priorities in the policy making arena.

2.6 Policy instruments and options

The final step in laying a factual groundwork for choosing key policy issues is the identification of policy instruments by which a given situation could be improved. Three general points should be made. First, sometimes there are no feasible policy instruments available to a national government with which to tackle policy issues or problems. In some cases, e.g. with land reform, entrenched domestic interest groups may be simply too strong for effective action. In other cases, e.g. with the price of export or import commodities, it may be international market forces that override the efforts of national governments. Change, in such cases, may be very slow.

The second and third general points repeat what was said in module 1. The same objective can often be served by several alternative policy instruments; and the same policy instruments can affect the attainment of several policy objectives.

It is very easy to believe that there is only one way (instrument) to tackle a problem or set an objective. This can lead to governments fruitlessly trying to do things they have no resources or advantage in doing. For example, suppose the "problem" is that consumers in country A cannot buy as much milk as they want. The "obvious" solution is for country A to produce more milk. But if country A has serious livestock disease problems and an unfavourable climate, it may make much more sense for it to grow and export agricultural products which its climate does favour and to use the foreign exchange earned by those exports to buy the milk it needs.

To prevent ourselves from getting caught in the "single instrument" trap, it is useful to search systematically for alternative instruments. This search can be assisted by grouping the possible instruments into broad categories. Tables 2.14-2.15 provide alternative ways of categorising instruments. Table 2.14 categorises the instruments in two ways: first, at the level of direct impact (border, domestic market - i.e. retail or wholesale, the point of production on farm or on range); and second, by whether the instrument has its entry point through input/production activities or the outputs and their processing.

Table 2.14. ***Policy instruments classified by level of direct impact and entry point.***[1]

Level of direct impact	**Associated with entry points through**	
Border level (International trade)	Inputs or production activities	Outputs or output-processing activities

	• Procurement through aid funds	• Export subsidy (tax)
	• Bulk buying by government to achieve economies of scale	• Inter-government export contract or similar agreements (e.g. Lomé)
	• Allocation of foreign exchange	• Parastatal export-oriented abattoir
		• Protectionist import tariffs or quotas on competing imports
		• Food aid
		• Export or import livestock health quarantines or regulations
Domestic market (Internal trade or distribution)	Price control regulations	
	• Licensing of trader (e.g. pharmaceutical firms)	• Auction or other regulated market
	• Input subsidies	• Infrastructure/regulations to ensure purchase by grade and/or weight
	• Quality control regulations	• Price control regulations
	• Input rationing systems	• Market information service
	• Special credit systems for inputs (e.g. loan to purchase half-bred heifers)	• Credit scheme to livestock trade
	• Government provision of direct services (e.g. veterinary, artificial	• Direct purchasing by parastatal from producer insemination)
		• Guaranteed price/commodity stock scheme
		• Provision of transport infrastructure (e.g. stock routes)
On farm/on range	• Land tenure legislation	• Research and extension in on-farm processing
	• Farmers' training and extension	
	• Production research	
	• Government-supplied water points	
	• Government-supplied fire-breaks	
	• Progeny testing, bull culling and similar schemes for genetic improvement	
	• Range management regulations	

[1] The list is illustrative and not intended to be all-inclusive.

Table 2.15 looks back at the problems listed in Table 2.8 and categorises the instruments which might be used to tackle each of these in terms of the **nature** of the instruments themselves, e.g. whether they are legal/institutional, involve public investments etc. Both Tables 2.14 and 2.15 are intended essentially to act as check-lists or memory-aids. The method of categorization is only good or bad insofar as it helps people identify different ways of tackling the same problem or objective.

Table 2.15. ***Policy instruments categorised by nature of instrument and problem to be solved: Some examples.***

	Nature of instrument				
Problems	**Legal and institutional framework**	**Price policies**	**Quantity controls**	**Public investment and services**	**Research and extension**
Inadequate supplies		Support for prices of output and subsidies on inputs	Minimum market quotas, forced deliveries	Road building in inaccessible areas	Expanded research and extension services
Excessive imports	Licences to import matched to domestic purchase	High import tariffs and consumption taxes	Import quotas		
Unproductive resources	Reform of land tenure to prevent open access		Maximum stocking quotas		Improved livestock breeds
Desertification	Erosion control regulation	Subsidies for non-use of vulnerable land		Public fuel forests and shelter belts	
Unstable supplies		Counter-cyclical pricing subsidies and taxes	Conservative stocking quotas	Long-term refrigeration and storage facilities	Development of drought-resistant forage species
Inefficient services	Privatisation	Material incentives for performance			Programmes to promote awareness of user rights

Distorted prices	More competitive markets		Counter-distortion import licensing		Market information services
Inadequate markets	More competition			Improved communication and transport facilities	
Concentrated livestock ownership	Open up alternative investment opportunities	Progressive cattle taxes	Maximum herd size quotas		
Unfair access to land	Land tenure reform	Progressive tax on land holdings	Maximum land holdings	Open up inaccessible land e.g. by developing new water supplies	

Important points (2.4-2.6)

• Information about a government's policy objectives and the ranking of these objectives is essential in prioritising policy issues on which to focus.

• Government policy objectives for the livestock subsector are guided by overall political philosophy and the envisaged changes in the present functions of the subsector.

• Government policy objectives are broadly classified into five groups:

- independence objectives
- economic efficiency objectives
- resource conservation objectives
- stability objectives
- equity objectives.

• Often, policy objectives pursued by a government differ from the declared objectives.

• Policy analysts must resolve the problems arising from conflicts between declared and undeclared objectives and present sound choices to the policy maker.

• The analyst should try to identify the policy maker's rough ranking of policy objectives.

• After knowing and ranking policy objectives, the next step in identifying key policy issues is to assess sector performance with respect to each objective.

• Sector performance can be judged qualitatively in terms of problems rather than "unfulfilled

objectives".

• Quantitative performance monitoring of the livestock sector will require appropriate quantifiable criteria, an acceptable minimum standard and pertinent data.

• The final step in prioritising policy issues is the identification of policy instruments by which a situation can be improved.

• Three points to remember in identifying policy instruments to tackle policy issues or problems are:

- Sometimes, no feasible policy instruments may be available to a government to tackle the problem.

- The same objective can often be served by several alternative policy instruments.

- The same policy instruments can assist in the attainment of several policy objectives.

2.7 Feedback exercises

All answers can be found in the text.

1. Tick (√) the correct answers.

Adequate knowledge of one's own livestock sector is important in prioritising livestock policy issues on which to focus because this enables us to know:

i) its current function.
ii) its future objectives.
iii) its importance in relation to the total agricultural situation.
iv) its performance in terms of its current functions.
v) the scope of policy change.

2. List two major ways of classifying the livestock sector's function in sub-Saharan Africa.

i) _____
ii) _____

3. Column I lists three major outputs of the livestock sector. Match each with the appropriate per cent contributions of the outputs towards the total output given in Column II:

Column I	**Column II**
Meat	15%

Milk	47%
Traction	31%

4. Name three approaches to deciding whether the tendency of a farmer to increase herd size is due to non-economic or economic motivations.

i) _____
ii) _____
iii) _____

5. Fill in the blanks.

i) The independence policy objective of a government is concerned preserving political and _____ autonomy.

ii) The economic efficiency objective aims at increasing the real national _____and its growth rate over time.

iii) A government's objective to preserve natural resources such as soil, water, plants and animals is known as the _____objective.

iv) The equity objective is concerned with fair _____of income and wealth within society.

v) Besides declared policy objectives, governments often have_____objectives.

6. Circle T for True and F for False.

i) Most politicians conceive of policy issues in terms of problems rather than "unfulfilled objectives".

T F

ii) Three elements in quantitative monitoring of livestock sector performance are quantifiable criteria, a minimum level of performance and data source.

T F

iii) A possible criterion for assessing performance in terms of the economic efficiency objective is the self-sufficiency ratio.

T F

iv) The change in per caput production of milk or meat would be a suitable criterion for evaluating performance of the livestock sector in terms of the independence objective.

T F

7. List two broad groupings of policy instruments.

i) _____
ii) _____

2.8 References

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Appendix: The Lorenz curve

Introduction

The Lorenz curve is a graphical device used to demonstrate the **equity of distribution** of a given variable such as income, asset ownership or wealth. For example, one might be interested in the equity of cattle ownership since this is often taken as an indicator of the distribution of wealth, particularly for pastoral and agropastoral societies. The distribution of cattle **ownership** is, however, often extremely difficult to determine so that the cattle **holding** per household **(or per holder**) is often used as the proxy measure of wealth in the derivation of a Lorenz curve.

Holding implies the right and responsibility to manage on a day-to-day basis but not necessarily to dispose of (e.g. by slaughter, sale or gift).

In the following example, a Lorenz curve for cattle holdings to households **holding** cattle is therefore constructed. The principles outlined in the derivation of the curve can be applied to any data set in which the equity of distribution for a given variable is being calculated.

Derivation of the Lorenz curve

In the derivation of the example Lorenz curve, the following procedure has been adopted:

- All individual units (households) are ranked from the lowest to the highest according to the number of cattle held (Column 1, Table 2.A1) and the number of households in each cattle-holding category is given (Column 2).

- From this data, the percentage of households falling into each cattle-holder category is derived (Column 3).

- The cumulative percentage of households in each cattle-holder category is then estimated (Column 4).

- By multiplying the number of cattle in each category by the number of households holding those cattle (Column 1 x Column 2), we then obtain the total number of cattle held within each category (Column 5).

- From this latter figure, the percentage of total cattle held (Column 6) and the cumulative per cent of cattle held in each category (Column 7) are obtained.

- The cumulative percentage of cattle held in each category (vertical axis) is then plotted against the cumulative percentage of households for each category (horizontal axis) to derive the Lorenz curve (Figure 2A.1).

- This plotted curve is then compared with the line of perfect equity (drawn at 45° from the origin of the graph) to provide an indication of the equity of distribution of cattle holdings within the area concerned.

Table 2A.1. ***Data required for derivation of the Lorenz curve of cattle holdings to households.***

(1) Cattle-holding category (no. of cattle held)	(2) No. house-holds holding cattle in each category	(3) % households holding cattle in each category	(4) Cumulative % of households in each category	(5) Total no. of cattle in each category	(6) % total cattle within each category	(7) Cumulative % of cattle within each category

0	30	23.07	23.07	0	0.00	0.00
1	5	3.85	26.92	5	0.73	0.73
2	5	3.85	30.77	10	1.46	2.19
3	5	3.85	34.62	15	2.20	4.39
4	7	5.38	40.00	28	4.10	8.49
5	8	6.15	46.15	40	5.86	14.35
6	10	7.69	53.84	60	8.78	23.13
7	12	9.23	63.07	84	12.30	35.43
8	15	11.54	74.61	120	17.57	53.00
9	15	11.54	86.15	135	19.77	72.77
10	12	9.23	95.38	120	17.57	90.34
11	6	4.62	100.00	66	9.66	100.00
	130	100.00		683	100.00	

Exercise 2.A: Drawing and interpreting a Lorenz curve (estimated time required: 20 minutes).

Question 1. Using the data in Table 2.3, draw, on the same piece of paper, Lorenz curves for the distribution of cattle per cattle-owning households and per cattle-owning person.

Question 2. Is the distribution of cattle per cattle-owning people more or less inequitable than the distribution per cattle-owning household? Use the Lorenz curves drawn in response to Question 1 and the note to Figure 2A.1 to provide you with the answer.

Note to Figure 2A.1: The 45° line drawn from the origin of the graph represents the line of perfect equity where the percentage of cattle held corresponds exactly to the percentage of households in the area, where each household has the same number of cattle, i.e. where 10% of the households hold 10% of the cattle etc. The more bowed the Lorenz curve from this line (indicated by the hatched area in Figure 2A.1), the more inequitable is the distribution of cattle holdings. The calculation of **equivalent** Lorenz curve data for two different areas, regions or countries can provide a useful basis for equity comparisons.

Figure 2A.1. ***Lorenz curve of cattle holdings to households holding cattle.***

Exercise 2.1: Group exercise: Identification of policy issues: Central case study (estimated time required: 1.5 hours).

Question 1. Read the central case study carefully and list the various criteria/problems confronting the livestock sector in Alphabeta. Where possible, cite evidence from the report for the criteria/problems you have identified.

Question 2. What evidence can you obtain from the report to demonstrate that the government's objectives are similar to those given in the lecture notes?

Question 3. On the basis of your previous answers, what policy issues (criteria/problems) would you now isolate for more detailed analysis? Why?

Question 4. For the particular issues you have isolated as most important, what broad policy strategies/instruments could be appropriate? How would you make a start in an evaluation/analysis of these alternative strategies? What strategies/instruments has the government of Alphabeta adopted? Are they effective? If not, why not?

Exercise 2.2: Identification of policy issues - Country specific study (estimated time required: 1 hour).

Question 1. What are your country's broad objectives for the livestock sector? Whose objectives are they?

Question 2. In what document, or equivalent, are these objectives set out? How do you know these are your country's objectives? Are they declared or undeclared objectives? Which are more important?

Question 3. In your country, are there specific goals or targets set for the livestock sector? How? Where?

Question 4. Which of the criteria/problems listed in the lecture notes are relevant to your country? Are there problems which you consider urgent in your country? Could you assign priorities to your country's problems in the livestock sector?

Question 5. Which policies/instruments does your country pursue in order to solve the most urgent problems listed in your answer to Question 4? Are these instruments appropriate? Identify some other instruments which might be used instead to solve the same problems.

Question 6. What is your professional responsibility? How does it relate to overall policy objectives? What particular policy issues would you prefer to see discussed in this manual and why?

3.1 Performance objectives

Module 3 is intended to enable you to:

1. List and describe major livestock production systems in Africa in terms of their market integration, basic economic relationships within a farming system and policy entry points at the farm level.

2. Discuss the use of input-output tables in characterising production systems. This should include drawing an input-output table using hypothetical data.

3. Name two indicators to evaluate the performance of a production system and demonstrate how these indicators can be computed from a given input-output table.

4. Recall two main types of price-production responses and discuss three adjustment mechanisms to increase agricultural production under positive price-production response.

5. Given hypothetical data from a case study, demonstrate proficiency in working out responses in farm production and farm income to price changes.

6. Discuss three key propositions of the economic theory of consumption.

7. Describe the distinguishing consumption characteristics of producing households and non-producing households.

8. Discuss the nature of market supply response to price signals in different production systems. This should include both individual and aggregate supply responses.

9. Describe the relationship of price with supply, demand and market equilibrium. Explain relevant concepts.

10. Describe techniques for forecasting future production and consumption of a particular product.

3.2 Introduction

In order to assess the likely effects of agricultural policy on production, market supply and demand, it is important to have a basic understanding of the different farming systems which exist in a country. Farming systems respond to government policy interventions according to their degree of market integration and the factors which influence individual household goals and aspirations. Accordingly, this module is devoted to understanding major livestock production systems in Africa and how policies and market signals govern production, consumption and supply in different production systems..

3.3 Major livestock production systems in Africa

In most African countries, the livestock subsector comprises several or all of the following major small- and large-scale production systems:

- Small-scale:

- pastoralism
- agropastoralism
- mixed smallholder farming.

• Large-scale:

- ranching
- large-scale commercial farming
- co-operative farming
- state farming.

The large-scale system, introduced only during this century, still accounts for a relatively small proportion of agricultural output in sub-Saharan Africa. The bulk of production occurs in the traditional small-scale system. Devising appropriate policies for such systems is therefore of utmost importance in increasing African food production.

3.3.1 Production systems and market integration

Smallholder farming in Africa is predominantly carried out by small, autonomous family units with a labour force averaging between one and three adult-equivalents, cultivating an area ranging from 0.5 to 5 ha (somewhat larger in drier parts of the Sahel) under an individual land tenure system (module 7). The degree to which each farm is integrated into the market economy varies according to a host of factors, perhaps the most important of which is geographical location.

The influence of geographical location on market integration is twofold: partly agro-ecological and partly infrastructural. Some areas may have a higher degree of market integration because rainfall and soil conditions are conducive to cash cropping and the production of surpluses; others may lack one or both of these advantages but are compensated by their relative proximity to urban markets and other facilities. In terms of market integration, three broad subsystems of the mixed smallholder farming system may thus be described:

• **Mainly subsistence-oriented producers.** Such producers are typically remote from urban markets and more than half a day's walk from a main road. Often they are resource-poor farmers inhabiting drier areas where crop production is risky. The bulk of their production is consumed at home, but small surpluses are sold or bartered locally in good years. Access to purchased inputs is low or non-existent and demand for them is also low (for reasons of risk aversion).

• **Semi-subsistence producers.** These producers are typically closer to main roads and urban markets. Subsistence cropping remains the major enterprise, but surpluses of a wide range of products are more frequently available for sale and significant efforts may be devoted to a minor cash-crop enterprise. Such farmers are somewhat wealthier and tend to inhabit more productive areas, but access to inputs and credit remains low. They continue to spread risk through diversification.

• **Mainly commercial, specialized producers.** Such producers are typically close to (or within) major urban markets. Most of what they produce is sold at market, but small amounts are consumed at home. Most labour is devoted to a specialised enterprise such as feed, dairy, coffee or vegetable production, for which purchased inputs are available. If they inhabit dry areas, such farmers usually have access to irrigation. Typically, however, they inhabit high-potential subhumid, humid or highland areas where both soils and climate are favourable.

Pastoralism in Africa is also practiced predominantly by small family units. Herds and flocks are raised that vary considerably in size, from a few sheep and goats in the poorest families to many hundreds of cattle and/or camels in the wealthiest. The size of the herd/flock determines the share of feed resources obtained from pastures grazed communally under an open access or common property tenure system (module 7) characterised by mobility (nomadism or transhumance) as a survival strategy. The degree to which each family unit is integrated in the market economy varies according to a host of factors, but is generally less related to geographical location than in the case of smallholder farming. There may be forced integration in the market economy during times of drought, as herders are compelled to sell for slaughter animals which might die of natural causes.

Agropastoralism in Africa is carried out by pastoral families or their descendants who have, to varying degrees, settled and taken up cropping. Often inhabiting dry areas where cropping is a high-risk enterprise, agropastoralists live under conditions resembling those of the mainly subsistence-oriented smallholder farmer. Apart from ethnic differences, the only major difference between the two groups in terms of production is the emphasis on livestock, which will be greater among agropastoralists, who frequently retain some degree of mobility as a survival strategy. The degree of market integration will be similar to that of the mainly subsistence-oriented producer, but again there may be emergency sales of livestock during droughts.

There are exceptions to the general rule that the market integration of agriculture increases with proximity to urban centres. Sometimes the reverse is true: the closer to the city, the more its superior employment opportunities draw labour (usually male) away from agriculture. In such cases, surplus production for market may be almost non-existent, but some subsistence cropping around the homestead may be continued as before (usually by women and children). This tends to happen particularly in economies where agriculture is disadvantaged compared to the manufacturing sector. Moreover, in the case of livestock, the city may act as a magnet for the sale of animals trekked over longer, rather than shorter distances, as urban and pert-urban dwellers increasingly turn to livestock as a way of investing their cash savings.

As infrastructure and markets expand with rising population, the degree of market integration varies through time and in space. Thus, each producing household occupies a point in a continuous transition through time from pure subsistence to pure commercial production. Pure subsistence production is now virtually non-existent in Africa, a greater or lesser degree of market integration having occurred almost universally in areas where cropping is practiced, as well as in those areas where livestock only are raised. Pure commercial production is also still rare, however, and the vast majority of households occupy an intermediate point in the

continuum. Within the long-term trend towards increased market integration through time, there are substantial short-term fluctuations according to year and season.

3.3.2 Basic relationships within a farming system

Figure 3.1 depicts the main economic relationships governing activities in mixed smallholder farming systems. Two major circuits can be identified: the **physical circuit,** with flows of factor services and products and the cash flow or **monetary circuit.** Each will play a different role in determining a household's response to policy measures, depending on the point the household occupies in the continuum between subsistence and commercial farming.

Figure 3.1. ***Basic relationships in mixed smallholder farming systems.***

Mainly subsistence-oriented production systems

For the subsistence-oriented household, land and labour are the principal factors of production. Capital investment is limited to non-monetary self-produced equipment, land improvement and livestock raised through natural reproduction. Increases in production are mainly dependent on the weather and on the quantity and quality of those factors of production controlled by the household. These, for example, may include:

- use of surplus labour for bush clearing and erosion control
- use of animal manure to raise soil fertility
- better livestock management practices.

Progress in production is likely to be slow but improvements are possible through farming systems research, education and extension programmes. There are few local off-farm employment opportunities. The monetary circuit plays little role in the economy of the mainly subsistence-oriented household. For the subsistence-oriented farm, output and consumption are identical. Such households thus remain largely (but not wholly) unresponsive to price and market signals.

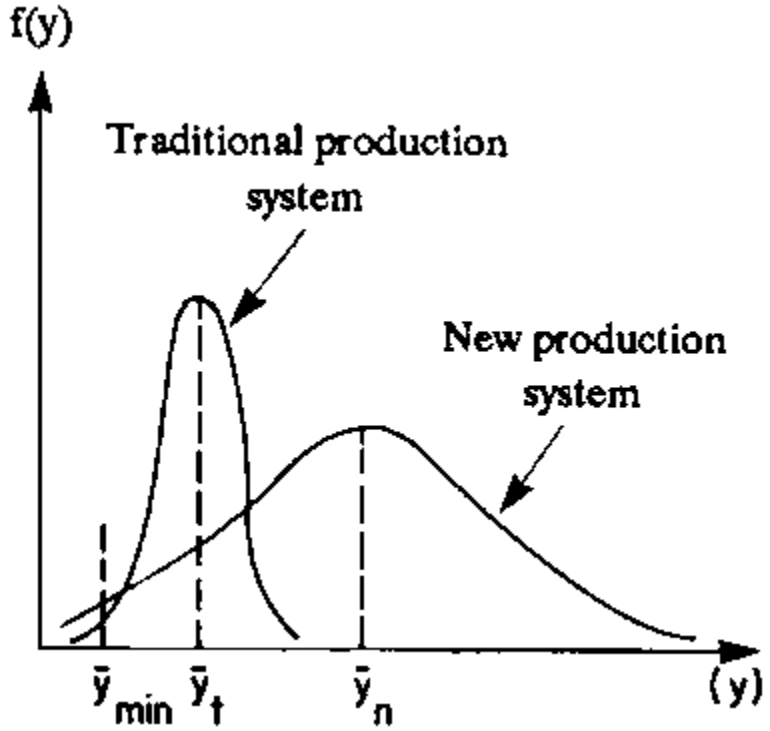
Families living under these conditions rarely aim to maximise production, since this would imply specialisation, with its attendant risks. Rather, the goal is to maximise the chances of survival. A mainly subsistence-oriented farmer will be reluctant to shift from a traditional practice to a new technology if doing so incurs greater risk of failure (Box 3.1).

Box 3.1: Subsistence, risk and innovation.

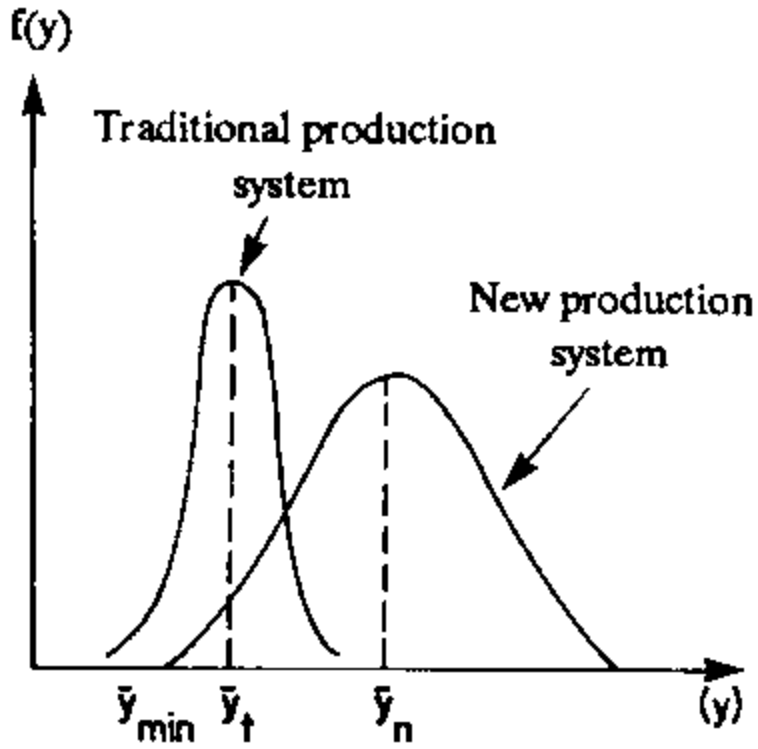
Figure 3.2a depicts a case where a new technology is associated with both higher potential production and higher risk of failure. The new technology in Figure 3.2b, on the other hand, both reduces the risk of failure and raises mean production above the level of the traditional technology. To mainly subsistence-oriented farmers, this technology will be preferable, although its potential is not as high as the new technology in Figure 3.2a.

Figure 3.2. *Income and risk of innovation.*

a. Innovation with higher mean production. but higher probability of failure below minimum consumption.



b. Innovation with higher mean production and lower probability of failure.



f(y) = relative frequency of level of production
(y) = mean level of production

$\bar{y}_{min}$ = minimum mean value under traditional production system

$\bar{y}_t$ = maximum mean value under traditional production system

$\bar{y}_n$ = expected mean value under new production system

Attitudes towards risky innovations will depend on how close to bare survival current production lies. This is illustrated in Figure 3.3. Farm A, due to its limited production potential, has always produced close to its minimum consumption requirement (MCR). Farm B. on the other hand, has operated closer to (though always below) its minimum desired consumption level (MDCL). Farm A will have more incentive to minimise risk than farm B. which is more likely to innovate because the chances of falling below its MCR are relatively low. Despite its higher yield variability, the new technology will be attractive to farm B provided adoption increases output above MDCL.

Whether or not it adopts new technology, farm A is unlikely to produce a surplus for sale. Farm B. on the other hand, is much more likely to do so, and may eventually move out of the mainly subsistence-oriented group of producers to become a semi-subsistence farm.

Figure 3.3. ***Risk of innovation close to (A) and well above (B) minimum consumption requirements.***

Source: Adapted from Miracle (1986).

Semi-subsistence production systems

A semi-subsistence household produces a considerable proportion of its consumption requirements (60-80%). In addition, it will produce cash crops such as vegetables, coffee and tea and keep livestock for sale. The semi-subsistence producer will therefore be confronted with the risks associated with price fluctuations and with variations in the natural environment. The monetary circuit thus assumes an important role in the semi-subsistence production unit (Figure 3.1). Such units tend to be more responsive to market and price signals than the subsistence-oriented producers. The higher the share of output being sold on the market, the greater the importance of the monetary circuit in the semi-subsistence production system. The impact of market and price signals will ultimately depend on the degree of market integration.

What are the reasons behind a household's desire to enter the monetary circuit? Answering this question will help us understand the factors which influence production responses. The first step in the transition process from subsistence to more commercialised production may be a need to obtain cash to meet legal or social obligations, such as the payment of school fees or the hosting of a wedding reception. Insofar as such needs are the only purpose of sales, there will be a negative relationship between price and market supply. In other words, the higher the market price, the smaller will be the amounts that need to be sold and vice versa.

As the transition process continues, market supply responses become positive as producers recognise that increasing their cash income enables them to buy other consumer goods which improve their welfare. If these goods are regularly available at local markets, income growth may become an important family goal. Higher income also enables a household to purchase more external inputs (fertiliser, seeds etc), thus increasing output still further in the future. Finally, cash can also be used to pay interest and principal on credit, opening up greater opportunities for investment and hence the development of new enterprises.

Thus, the transition from pure subsistence, through semi-subsistence to more commercial farming will have two interrelated effects on consumption and production in the rural household, namely:

- the direct acquisition of consumer goods and services
- the further growth of income through increased use of external inputs.

For families living under these systems, risk aversion remains an important determinant of household decisions. These producers confront the risks associated with price fluctuation as well as those resulting from climate. Sometimes these will offset one another, as when low yields lead to scarcity, causing market prices to rise, and vice versa. At other times, factors bearing no

relationship to yield variations will influence prices. For semi-subsistence producers, innovations with minimal input of external factors of production could be offered.

Mainly commercial, specialised production systems

In these systems, the monetary circuit becomes more important than the physical one, which may become less complex as a result of specialisation. These production units tend to be highly responsive to price and market signals, switching enterprises and increasing or decreasing their market involvement in accordance with them. Increases in production are almost certain to involve the use of external inputs and services. Progress in production can be rapid, but dramatic setbacks may occasionally occur. Off-farm employment opportunities are more common and are found nearer home.

For families living under these conditions, the allocation of resources will be determined largely by the profit rather than the survival motive. However, although risk aversion plays a smaller part in decision making, households will tend to refrain from fully commercial production if markets are unreliable or if institutional support (access to credit, price stabilisation schemes, animal health services etc) is inadequate.

3.3.3 Policy entry points at farm level

The number of effective entry points for policy interventions increases as we move across the continuum from subsistence to commercial farming. For mainly subsistence-oriented producers, interventions should be geared to making it both possible and attractive to enter the market. Convenient market outlets for their products, easy access to consumer goods and the rapid payment of good prices against sales would help achieve this; In the case of producers whose degree of market integration is unlikely to increase, equity-oriented interventions such as improving rights of access to water may be beneficial. Guaranteeing the provision of famine relief or wage employment in hard times may reduce the need to keep large herds in pastoral societies and persuade resource-poor producers to take the risk of adopting new technology.

For semi-subsistence producers, interventions geared to the producer prices of outputs are probably more important than measures concerned with the price of inputs. This is because the value of purchased inputs still forms a relatively low proportion of the total value of outputs in semi-subsistence systems. Interventions increasing labour productivity, which accounts for a relatively high proportion of the output value, would also be important. The provision of a wider range of goods and services on which to spend cash earned should stimulate further market integration.

For commercially-oriented producers, the relative prices of both inputs and outputs are crucial determinants of profitability, since purchased inputs account for a much larger proportion of the total value of output. Stable supplies of inputs and reliable services will also be important.

Important points (3.2-3.3)

• Livestock farming in Africa can he divided into two broad categories: small-scale and large-scale. Traditional small-scale production systems still account for most agricultural output on the continent.

• Small-scale production systems comprise pastoralism, agropastoralism and mixed smallholder farming.

• In terms of market integration, mixed smallholder farming systems are divided into: mainly subsistence-oriented systems; semi-subsistence, systems; and mainly commercially-oriented systems.

• Location is one of the main determinants of market integration. The influence of geographical location is twofold, being partly agro-ecological and partly infrastructural.

• With the expansion of infrastructure and markets, there is more or less continuous transition of farming systems from pure subsistence through semi-subsistence to commercially-oriented systems.

• Farm household responses to policy initiatives can be explained in terms of physical factors and monetary factors.

• The higher the share of output being sold on the market, the greater the importance of the monetary circuit in farm household systems. The impact of market and price signals will thus depend on the degree of market integration of the household.

• Policy entry points at the farm level differ according to the farming systems being examined.

3.4 Describing production systems: input-output tables

3.4.1. Format of the table

In order to gauge their probable response to interventions, smallholder production systems can be characterised in terms of a simple input-output table, as shown in Table 3.1.

Table 3.1. *A standard production input-output table for a mixed smallholder farming system.*

Item	Farm activity				Input utilisation		
	Maize	**Coffee**	**Sheep**	**Cattle**	**Total used**	**Total available**	**Residual**
Inputs:							

	Seed							
	Fertiliser							
	•							
	•							
	Land							
	Labour							
	•							
	•							
	•							
Outputs:								
	Maize							
	Coffee							
	•							
	•							
	•							
	Beef							
	Milk							
	Draft power							
	•							
	•							
	•							

Each farm enterprise (maize, coffee, livestock etc) provides one or more outputs and requires various inputs. The inputs used for each enterprise can be added to give total inputs used (by category) for each year, which can then be compared with the total level of inputs available. The balance obtained will indicate whether there are resource deficits or surpluses. A resource surplus may not necessarily imply a potential to increase production. For example, unused land may need to remain fallow or unused labour may be required for social activities or communal work. Nevertheless, resource surplus and deficit figures will often provide useful information about the potential for increasing production, with or without changes in technology.

For production systems dependent on the use of communal resources (pastoral and agropastoral systems), household-level input-output tables will not provide a complete picture of the factors constraining the expansion of production. Regional input-output tables may need to be computed as well.

3.4.2 Relevant exercises

Exercise 3.1: Input-output tables.

Example: The following data apply to an agropastoral household in a semi-arid region.

Household characteristics:

Size and structure: nine people, consisting of four adults (two male, two female), and five children (two male and three female).

Location of members: three adults on farm, one adult in off-farm employment; five children on farm (four in school).

Crop production:

The table below summarises relevant information for the different crops grown on a total area of 5 ha.

Item	Crop			
	Maize	**Beans**	**Groundnuts**	**Sorghum**
Area (ha)	3.0	0.5	0.5	1.0
Yields (kg/ha)	250	200	150	300
Labour (p.d./ha)				
Male	3	2	2	1
Female	15	60	60	20
Input levels				
Fertiliser (kg/ha)	nil	nil	nil	nil
Seed (kg/ha)	30	90	90	10

p.d. = person-days.

Livestock production:

The household owns 10 cattle and 4 goats; the cattle herd consists of 4 cows, 2 calves, 2 oxen, 1 heifer and 1 young bull. Milk production is 150 kg/year per cow but half of this is consumed by the calves and the other half is extracted by the household. The offtake rate of animals for sale is 10% of the total herd. Mature oxen and cows dress out at *50%* of body weight (i.e. 50% of 250 kg). The offtake rate for smallstock is 25%; a mature goat dresses out at 20 kg. The average production of dry manure from cattle (excluding calves) is 0.75 t/year per animal. The herd requires 145 person-days/year for herding, watering and other tasks, 100 of which are allocated

to male household members. Both cattle and smallstock are grazed on communal pasture. Veterinary costs amount to $ 5.00/year.

Total labour availability:

The total amount of labour available for farming operations is:

Males: 350 person-days
Females: 350 person-days

Study the input-output table (Table 3.2), making sure you understand the reason for each of the figures entered. This table will be used as a basis for the subsequent exercise.

Table 3.2. *Sample household input-output table for an agropastoral production system.*

p.d. = person-days.

Exercise: (estimated time required: 2 hours).

Question 1. Draw an input-output table for the following data set obtained from a 2-ha, medium-intensity dairy operation in the Kenyan highlands:

Household characteristics:

Size and structure: seven people, consisting of four adults (two male, two female), and three children (one male and two female).

Location of members: three adults on farm, one adult in off-farm employment; three children on farm (all in school).

Crop production:

Item	Crop			
	Maize	**Beans**	**Groundnuts**	**Coffee**
Area (ha)	0.5	0.2	0.1	0.2
Yields (kg/ha)	2200	400	400	500
Labour (p.d./ha):				
Male	4	2.5	5	100
Female	38	80	80	50
Input levels				
Fertiliser (kg/ha)	100	-	-	200
Seed (kg/ha)	30	100	100	-

Insecticides ($/ha)	-	-	-	15

p.d. = person-days.

Livestock production:

Dairying is the only livestock enterprise on the farm. The enterprise consists of one cow plus one calf and one heifer. Artificial insemination is used and the calving interval is about 15 months. Feed resources consist of one ha of fertilised pasture, supplemented by maize stover, concentrates and minerals. Bull calves are slaughtered for home consumption. Inputs and outputs are as follows:

Item	Annual level
Outputs:	
Milk (net of calf)	1500 kg
Meat (average from slaughter of bull calf)	15 kg
Manure	1.5 t
Inputs:	
Fertiliser/ha	150 kg
Minerals/ha	5 kg
Concentrates	150 kg
Calf rearing costs	$ 10
Veterinary costs	$ 10
Labour: male	50 p.d.
Labour: female	50 p.d.

p.d. = person-days.

Total labour availability:
The total amount of labour available for farm work is:

Male: 350 p.d. (one man full time)
Female: 350 p.d. (two women half-time each; the other half spent on household work)

3.5 Household income, subsistence consumption and expenditure

Input-output relationships alone are not sufficient to evaluate the performance of a particular production system. The information contained in an input-output table needs to be converted to indicators which demonstrate how production and the use of resources contribute to a family's

goals. Two such indicators are: the direct contribution made by production to home consumption and the income generated on and off the farm.

3.5.1 Computation equations for consumption, net income and cash income

As the example given in Exercise 3.2 demonstrates, the two indicators can be computed using data from an input-output table together with additional information on subsistence consumption and prices. First we must calculate what is called a **supply disappearance** equation for each product produced on the farm:

TC =TP+P-S or TP=TC+S-P
SC = TC - P + S where:
TC = total consumption
TP = total production
P = gross purchases
S = gross sales
SC = subsistence consumption
P - S = net purchases if P > S.

Net purchases are treated as negative net sales and appear in brackets () in Table 3.3.

For simplicity, internally produced inputs produced on farm, e.g. seed, feed or milk are treated as if they were first sold and then repurchased.

The first part of Table 3.3 shows how the total value of output is calculated by multiplying the quantity of each commodity produced by its price and summing the results. Note that the total output value consists of both the value of cash sales and the value of subsistence consumption. In order to compare incomes earned by different farm groups (and between farm and non-farm sectors), it is necessary to ensure that both components are properly accounted for, since estimates based on sales and cash expenditures alone would bias results.

The common practice of using producer prices to value farm output is inappropriate where the income of a semi-subsistence farm is being calculated. Instead, the producer price should be used only for the portion of production actually sold. The consumer price should be used for the portion consumed on the farm, the reason being that reduced subsistence production would force the household either to reduce consumption or to buy the deficit at the prevailing consumer price. However, in the exercise that follows, the common practice of using the producer price to value home consumption is maintained in order to reduce complexity.

The second part of the table is concerned with the calculation of **total net income:**

total value of output - total variable costs - total fixed costs = net income from farm sources + non-farm income = total net income

Fixed costs are costs which remain constant irrespective of the level of output produced, such as depreciation, rent etc. while **variable costs** are those which vary directly with the level of output, for example fertiliser, seed and insecticide.

Calculating the **net total cash income** (as opposed to the net total income) will provide an indication of the liquidity position and the degree of market integration. Net total cash income is computed as follows:

total value of sales - value of purchased inputs (variable costs) - fixed costs (excluding depreciation) = net cash income from farm sources + cash income from non-farm sources = net total cash income

3.5.2 Relevant exercises

Exercise 3.2: Estimating total net income.

Example: Refer to the example given in Exercise 3.1. We will now convert the information contained in Table 3.2 into financial terms using the following additional information:

Consumption, purchases and sales:

Resident household members consume all maize produced on the farm; the average requirement (regardless of age) is 0.5 kg/person per day. Sorghum is regarded as an additional source of starch and all domestic production is consumed by the household. An additional 25 kg of sorghum is purchased for beer production. A surplus of 10 kg of beans is available for sale, but there is a deficit of 20 kg of groundnuts. Cattle are sold for slaughter, but cattle and goat milk and goat meat are consumed by the household. No additional milk or meat is purchased.

Cost and price data:

Item	Sale price (cents/kg)	Purchase price (cents/kg)
Maize	3.0	3.01
Beans	12.0	12.0
Groundnuts	5.0	50
Sorghum	3.0	3.0
Meat:		
Beef	18.0	n.a.
Smallstock	25.0	n.a.
Milk	5.0	n.a.
Manure	0.001	0.001

n.a. = not applicable.

[1] Assume maize is locally available for purchase at the producer price, implying that there are surplus producers within the area. If this were not the case, the purchase price would exceed the producer price, in which case output would have to be valued at the consumer price.

Annual fixed costs amount to $ 15.10, of which depreciation accounts for $ 10. Non-farm income consists of $ 28.00 from handicraft sales.

Using these data and the data in Table 3.2 (Exercise 3.1), it is possible to derive a total income table as shown in Table 3.3.

Table 3.3. *Sample household total income table for an agropastoral production system.*

	Quantities			Values		
	Produced/used	Consumption		Net sales[1]	Total cash value ($)	Total value ($)
		Total	Subsistence			
Output:						
Maize (kg)	750	1160	750	(410)		22.50
Beans (kg)	100	90	90	10	1.20	12.00
Groundnuts (kg)	75	95	75	(20)		3.75
Sorghum (kg)	300	325	300	(25)		9.00
Cattle:						
Meat (kg)	125			125	22.50	22.50
Milk (kg)	300	150	150			15.00
Small stock:						
Meat (kg)	20	20	20			5.00
Manure[2] (t)	6			6	6.00	6.00
Subtotal					29.70	95.75
Variable costs:						
Maize seed (kg)	90				2.70	2.70
Bean seed (kg)	45				5 40	5.40
Groundnut seed (kg)	45				2.25	2.25
Sorghum seed (kg)	10				0.30	0.30
Calf milk (kg)	150				7.50	
Veterinary ($)	5				5.00	5.00
Manure[2] (t)	6				6.00	6.00
Subtotal					21.65	29.15

Fixed costs ($)					5.10	15.10
Net farm income ($)					2.95	51.50
Non-farm income ($)					28.00	28.00
Total income ($)					30 95	79 50

[1] The value of the quantity (shown in brackets) of net purchases (negative net sales) of purchased food consumed is not deducted from farm income.

[2] Used on farm, but treated in accordance with section 3.5.1, thereby exaggerating the importance of the monetary circuit.

Exercise: (estimated time required: 2 hours).

Study the input-output table calculated for the small-scale dairy model in Exercise 3.1 and the following information on consumption, costs and prices:

Consumption, purchases and sales:

The resident household requires 0.5 kg/day per caput of maize, 40 kg of beans in total and the same amount of groundnuts are purchased to meet the household's need. All coffee produced is sold, but all meat and 40% of the milk produced is consumed at home.

Cost and price data:

Item	Producer price (cents/kg)	Consumer/input price (cents/kg)
Maize	3.0	50.0[1]
Beans	12.0	12.0
Groundnuts	5 0	5.0
Coffee	15.0	n.a
Livestock:		
Milk	5.0	n.a
Meat	18.0	n.a
Concentrates	10.0	
Minerals		30.0
Fertiliser (compound)		12.0
Manure	0.001	0.001

n.a. = not applicable.

[1] Hybrid seed.

Fixed costs amount to $ 24.90/year, $ 20 of which are for depreciation. Income from non-farm sources amounts to $ 32. For other cost details, refer to the input-output table for the small-scale dairy operation in Exercise 3.1.

Question 1. Calculate an income table using the above information.

Question 2. What proportion of total net farm income is total net cash income? What does this imply in terms of market integration? Is this farmer more or less integrated in the market than the farmer in Table 3.3?

(Hint to instructors: In the sections on input-output tables and consumption purchases and sales and in Exercise 3.1 and 3.2, very simple examples of mixed farming enterprises have been given in which there are no livestock purchases and no changes in the value of the herd. Changes in the value of the herd may come about through transfers of livestock in and out (e.g. sales, purchases, gifts/bride wealth given and received) and through births and deaths, or by changes in the value of individual animals as they mature or decline through age. Such changes in the value of the herd can be very important in livestock-dominated farms.)

A full table of farm income for such farms would have a separate livestock section in which the following items would be distinguished:

+Sale of livestock produce (milk, meat, manure, draft power)
+Home consumption of livestock produce
+Sales of livestock
+Gifts of livestock given away
-Purchases of livestock
-Gifts of livestock received
+Closing (i.e. end-of-year) value of the herd
-Opening (i.e. beginning-of-year) value of the herd

The "opening" value of the herd should include the value (at the start of the year) of animals later given away or sold. Similarly, the "closing" value should include the value (at the end of the year) of any animals purchased or received as gifts during the year.

The "sale of livestock produce" entry should include internal transfers of, e.g. manure and draft power to the crop activities of the same farm, with the same items being shown as "purchases" by those crop activities.

If you have some spare time, you may want to demonstrate some examples of this full reckoning. They have not been included in the manual in order to keep it as simple as possible.

Important points (3.4-3.5)

- input-output tables are used to show specific production patterns, input-output relationships and resource deficits or surplus of a farm. The tables help to characterise production systems and

assess the potential for increasing production.

• Subsistence consumption and cash income earned on and off the farm are the important performance indicators of a production system.

• Subsistence consumption = production - sales + purchases.

Total net income = total value of output - total variable costs - total fixed costs + non-farm income.

• Net total cash income = value of sales - value of purchased inputs fixed costs + cash income from non-farm sources.

3.6 Responses to policies and market signals

Different production systems will respond to government policy interventions according to their degree of market integration and factors which influence individual household goals and aspirations. This section analyses the effects of price policy on semi-subsistence and commercial production systems in terms of production, consumption and supply.

3.6.1 Production response

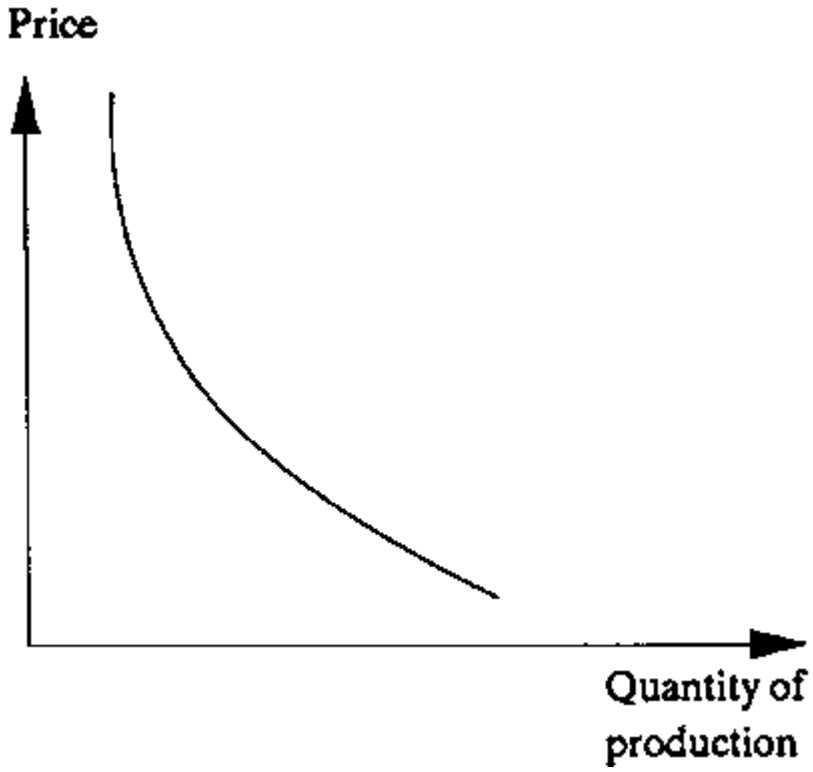
Types of price-production responses

When assessing production responses to price, bear in mind that the desire to increase cash income is not the only (and sometimes not even the most important) determinant of the pattern of production. A rise in the price of a product will not necessarily result in an expansion of production. Many food crops (and livestock products such as milk) are primarily produced for subsistence and are more or less independent of market prices. In these circumstances, prices may have a negligible effect on production decisions. In some cases, production for sale will be based on the need to meet fixed cash obligations (ceremonies, school fees, tax etc) or to fulfil particular aspirations (e.g. to purchase certain commodities). In other cases, sales will tend to be opportunistic in nature, occurring only when surpluses above subsistence needs are obtained. Sales will thus be either inversely related to prices (Figure 3.4a) or wholly independent of them.

However, inverse relationships between production and price are unlikely to persist over the long term as the transition towards greater integration in the economy occurs. As rural markets for goods and services develop, price increases usually begin to have a positive influence on production. In the following discussion, we will assume that price/production responses are positive, as shown in Figure 3.4b. A positive long-term production response does not, however, preclude a negative short-term market supply response. This will be discussed later with particular reference to the impact of prices on herd development.

Figure 3.4. *Inverse and positive production responses.*

a) Inverse production response



b) Positive production response

Adjustment mechanisms to increase production

In considering positive responses, profitability will be the driving force to increase the quantity of output or agricultural production. This can be achieved in three possible ways, namely:

- by utilising slack resources
- by substituting enterprises
- by intensifying production.

- **Utilising slack resources.** Land, labour or other resources available to a production unit may not be fully used. Utilising slack resources implies strategies such as expanding the area under cultivation, shortening fallow periods, building up herd numbers and working longer hours. Such strategies for increasing production have been Africa's traditional response to the rising demand for food caused by population growth, but they are now putting severe pressure on the natural resource base.

- **Substituting enterprises.** Commodities produced on a farm compete for the use of resources such as land and labour. When the profitability of one commodity increases relative to another, resources can be shifted to it. Substitution is common between cropping enterprises but may also occur between crops and livestock or between different livestock species or products (e.g. cattle and smallstock, meat and milk).

• **Intensifying production.** Opportunities for intensifying production depend predominantly on the availability of external inputs and new technologies. Intensification means that producers respond to a rise in the price of a commodity by seeking to raise yields rather than by expanding the area cultivated or, in the case of livestock, the number of animals kept. It is difficult to begin intensifying highly extensive production systems such as pastoralism because the delivery of external inputs is hampered by the lack of infrastructure. Technologies are also less well developed for such systems.

The decision to substitute one enterprise for another depends on their **relative profitability.** This, in turn, depends on the physical productivity of the inputs and resources used and on the relationship between input and output prices.

The **gross margin** of an enterprise is a measure of profitability which takes these factors into account. Gross margin also provides a basis for analysing the likely impact of a price change on production. It is defined as:

Gross margin = gross value of output - variable costs

Since purchased inputs are used in limited amounts in semi-subsistence systems, the gross margin for an enterprise in such systems is often closer to the gross value of its output than in more commercial systems, where substantial amounts of inputs may be used. In theory, comparisons between enterprises should be based on a calculation of gross margin per unit of the scarcest resource. In practice, however, several resources (e.g. both land and labour) may restrict the opportunities for substitution, and personal factors such as risk aversion will also play their part. For these reasons, a simple ranking of enterprises on the basis of gross margins per unit of land or labour used may not be sufficient. In such cases, more complex techniques such as linear programming will be needed, but these will not be discussed here. For our purposes, the essential principles of substitution can be demonstrated using a simple gross margin planning model as explained in Exercise 3.3.

The profitability of adopting intensified production methods, and the amounts produced by these methods, will depend on three main factors:

• The **marginal physical productivity** (MPP) of the inputs used (i.e. how much more output one gets per additional unit of input). In many cases, MPP declines per extra unit of input used, especially when not all the inputs can be increased simultaneously or to an equal extent.
For example, if we add more cows to the same farm size or more oil cake to the same cow, each extra unit of input is likely to bring about less extra output (milk) than the previous one.

• The **marginal revenue** (MR) generated by each extra unit of output. For the individual farmer, MR is usually identical to the producer or market price and usually the same per unit sold however many units are sold. Sometimes - for instance when a farmer is selling under a minimum or maximum quota system or to a customer who obtains reductions for additional purchases - market price will differ from MR, reflecting the new price level used when the extra

unit is sold. The **marginal value product** (MVP) is obtained by multiplying MPP by MR.

• The **marginal factor cost** (MFC) per extra unit of input used. For the individual farmer, MFC is usually identical to the purchase or market price, and is usually the same however many units of input are used. Sometimes, for instance when the input is difficult to obtain and can only be bought on the black market, the MFC will exceed the market price of the previous unit used. Or, for example, when discounts are offered for bulk purchases, it will be less.

As a general rule, a farmer wishing to maximise profits through intensification should use extra inputs to increase output so long as MVP exceeds MFC.

To give a simple example, a farmer has two half-bred cows and no capacity to keep any more. She can buy a special dairy mix feed at a special farmers' price of 105 cents/kg if she restricts her purchases to 1 kg/day, but she has to pay an unsubsidised price of 210 cents/kg if she exceeds this rate. She card sell up to 10 litres of milk a day locally (2 litres to each of five families) at 100 cents/litre, but has to sell amounts above this level to the government milk collection scheme which, because of limited market outlets, will only buy up to 6 litres/farmer at a price of 80 cents/litre. Thus, she has to make amounts of milk higher than 16 litres into butter, which she sells at a price equivalent to 40 cents/litre of milk.

Without being fed concentrates, our farmer's cows each give only three litres/day. This rises rapidly to five litres when they are fed 0.5 kg daily of dairy mix, but the yield response to feed levels higher than this is limited by the cow's low genetic potential. At a daily feed level of 3 kg of dairy mix, the cows will not yield more than 9.5 litres each.

Table 3.4 presents the effects of feeding different levels of dairy mix on milk output, revenue and cost. The table indicates that, given current government policy, our profit maximising farmer should feed 1 kg of dairy mix daily to each of her cows, giving a total milk output of 13 litres daily. A new policy intervention in the form of an initial 15% rise in the price of milk paid by the government collection scheme (from 80 to 92 cents/litre) should evoke a rise in feeding level to 1.5 kg and in milk output to 15.5 litres (a rise of 19%). A further milk price rise of 15% (to 106 cents/litre) should not evoke any more output unless it were accompanied by a lifting of the maximum supply quota of 6 litres/farmer. If this were relaxed, the feeding level should rise to 2 kg/cow per day and milk output to 17.5 litres (a rise of 13%).

Table 3.4. *Feeding dairy mix to milking cows: Effects on productivity, revenue and cost, with and without policy interventions.*

Productivity revenue and cost	**Feed intake/cow (kg of dairy mix/day)**						
	0	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
Yield/cow (litres/day)	3.00	5.00	6.50	7.75	8.75	9.25	9.50
MPP of intake (litres/kg)	n.a.	4.00	3.0	2.5	2.0	1.0	0.5
MR (cents/litre)							

Pre - new policy	100	100	80	80	40	40	40
Post- new policy	100	100	92	92	40	40	40
			106*	106*	106+	106+	106+
MVP of intake (cents/kg)							
Pre - new policy	n.a.	400	240	200	80	40	20
Post - new policy	n.a.	400	276	230	80	40	20
			480*	265*	212+	106+	52+
MFC of intake (cents/kg)	n.a.	105	210	210	210	210	210

MPP = Marginal physical product. n.a. = not applicable.
MR = Marginal revenue * = further 15% price rise.
MVP = Marginal value product. + = maximum quota lifted.
MFC = Marginal factor cost.

We need to distinguish between the concepts of **the marginal** and **the average.** The marginal is the additional product/revenue/cost brought about by adding one more unit of input or output. The average is the total production/revenue/cost divided by all the units of input or output involved. For example, in Table 3.4, the marginal physical product of feeding an extra half kg of feed, raising feed intake from one half to one kg daily, is 1.5 kg of milk/half kg of feed. The average physical product of half a kg of feed at that feeding level is 3.25 kg of milk (i.e. 6.5 kg of milk divided by 2 half kg of feed; see third column of figures in Table 3.4). The total product per cow at that feed level is 6.5 kg of milk.

In summary, an increase in the price of a product will affect production through one or more of the adjustment mechanisms outlined above, such that:

Total production response = resource expansion effect + enterprise substitution effect + intensification effect

(Hint to instructors: Ask the participants what a person-day is. Does the concept provide a sensible basis for assessing labour requirements in African agriculture?)

3.6.2 Relevant exercises

Exercise 3.3: The effect of product and input price changes on farm production and income.

Example: Refer to the example given in Exercise 3.2. Excluding, for the moment, data on the cost of manure (a within-farm transfer), fixed costs and non-farm income, the original situation with regard to total gross margin is shown in the table below. The table also presents information on the constraints imposed on crop and livestock production by land availability.

Box 3.2: Short-term supply and long-term production responses

The response to a price change in the short term may be quite different from that in the long term. This is particularly true of livestock production systems.

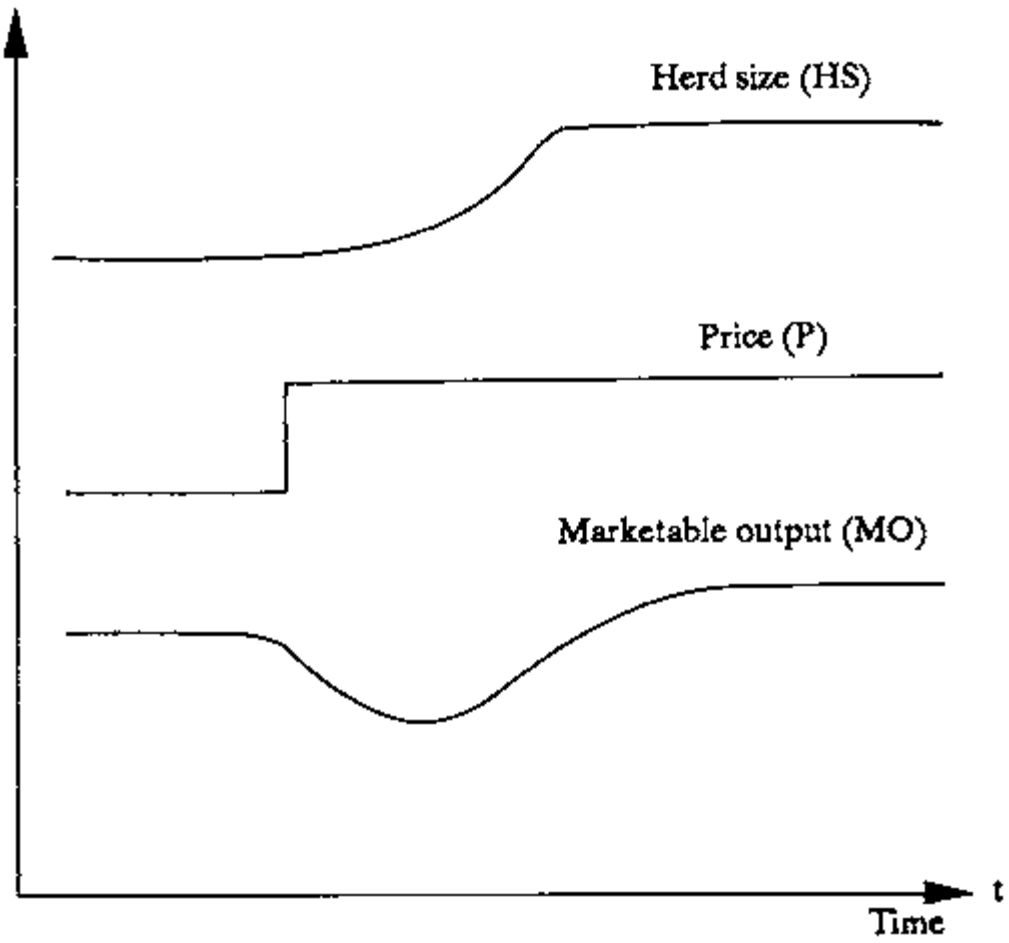
Farmers' responses to price changes are not usually instantaneous but lagged in time. For instance, a maize producer may react to a past price increase by increasing output in the next production period. However, if the price in that period falls, the apparent response in the short term will be negative. That is, production will appear to have risen in response to a price drop.

Lagged responses to price are most pronounced in cattle production, since gestation and maturation periods tend to be long. Producers may thus react to a price increase initially by reducing rather than increasing offtake, in order to increase herd numbers and hence herd value. Future offtake may increase as a result, but the time-lag before such an increase has any impact on the market may be three years or more. Thus, a serious imbalance between market prices and marketed output may occur in the short term.

This imbalance feeds on itself. As a result of the shortfall in market supply, prices may be even further stimulated in the short term, further reinforcing the short-term negative supply response and the long-term positive production response. This scenario, known as **cyclical over response,** continues until market offtake starts to reduce prices again. Price cycles have a stronger influence on market supply in the developed world than they do in Africa, where drought and other factors also intervene.

Figure 3.5 illustrates the price cycle. Herd size adjusts gradually to changes in price in such a way that movements in marketed output and herd size do not correspond. Exercise 3.4 contains a herd development model which again demonstrates this type of response.

Figure 3.5. ***Lagged response of herd size and market output to a change in producer price.***



In conclusion, cattle production systems may be characterised by the following features:

- relatively low or even negative price elasticities of supply in the short term
- higher and positive price elasticities of both production and supply in the long term.

Examples of these responses, expressed in terms of the price elasticity of supply, are shown in Table 3.9.

Activity	Minimum quantity constraint (kg)	Gross margin/ha ($)	Optimum plan		Total farm gross margin ($)
			(ha)	Quantity(kg)	
Maize	≥ 750	6.60	3.0	750	19.80
Beans	≤ 100	13.20	0.5	100	6.60
Groundnuts	≥ 75	3.00	0.5	75	1.50
Sorghum	≤ 300	8.70	1.0	300	8.70
Livestock	n.a.	n.a.	-	-	30.00
Total			5.0		66.60

n.a = not applicable.

Now, let us assume a rise in the farm-gate price of sorghum and groundnuts to 6 and 14 cents/kg, respectively, and a fall in the price of beans from 12 to 7 cents/kg. All other prices and input costs remain unchanged. The table below shows the optimum farm plan and the total gross margin in this new situation:

Activity	Minimum quantity constraint (kg)	Gross margin/ha ($)	Optimum plan		Total farm gross margin ($)
			(ha)	Quantity(kg)	
Maize	≥ 750	6.60	3.0	750	19.80
Beans	≤ 100	7.70	0.0	0.0	0.00
Groundnuts	≥ 75	8.40	1.0	150	8.40
Sorghum	≤ 300	17.40	1.0	300	17.40
Livestock	n.a.	n.a.	-	-	30.00
Total			5.0		75.60

n.a. = not applicable.

Exercise: (estimated time required: 2 hours).

Question 1. For the example above, comment on the changes which have occurred in the farm plan and the total farm gross margin. Estimate the percentage increase in total farm gross margin and total income, assuming that non-farm income and fixed costs remain constant (refer to Table 3.3, Exercise 3.2; continue to ignore manure cost and income).

Question 2. What would you expect to be the effects on farm output from an increase in meat and/or milk prices? Give a qualitative answer distinguishing between the short- and long-term effects of a price increase.

Question 3. For the small-scale dairy example (Exercises 3.1 and 3.2) assume the following:

Constraints on area cultivated:

Enterprise	ha
Maize	= 0. 5
Beans	> 0.1
Groundnuts	> 0.1
Coffee	= 0.2
Dairy	= 1.0
All enterprises	2.0

Price changes:

Maize: 3 cents/kg to 3.5 cents/kg
Groundnuts: 5 cents/kg to 14 cents/kg
Coffee: 15 cents/kg to 35 cents/kg

Using this information and the data in Exercises 3.1 and 3.2, tabulate your results to obtain the total farm gross margin for the original and new optimum farm plans. Estimate the percentage change in output resulting from the price changes for maize, beans, groundnuts and coffee. Summarise the data in a table, placing the percentage change in price for each enterprise against the corresponding percentage change in output. Discuss your results.

Question 4. List some of the factors you consider would influence the supply response to price for the commodities produced by the sample small-scale dairy unit. Explain why you think these factors would influence the response.

Question 5. Discuss qualitatively the possible effects of a significant decrease in the price of fertiliser or concentrate.

Exercise 3.4: Livestock production response: The use of cattle herd projection models.

Example: Herd projection models can be useful in understanding how producers are likely to respond to market signals over time. A pastoral model will be used to demonstrate changes in offtake rate, herd size and herd composition over 10 years. To do this, the following information on initial herd structure, expected performance parameters and offtake rates are needed:

Herd size and structure (years 1-5):

Stock category	Initial number	% total herd (after calving)
Calves:		
Males	(12)[a]	10.9
Females	(12)[a]	10.9
1- to 2-year-old males	9	8.2
1- to 2-year-old females	9	8.2
2- to 3-year-old males	8	7.3
2- to 3-year-old females	8	7.3
Males >3 years old	12	10.9
Cows	40	36.3
Total	86	100.0

[a] For simplicity, it is assumed that calves are born just after the start of the year.

Performance parameters (years 1-10):
Calving rate (%) 60.0

Mortality rates (%):

Calves	25.0
1- to 2-year-olds	10.0
2- to 3-year-olds	10.0
Cows	8.0
Bulls or oxen	8.0

Offtake rates:

The overall offtake rate (expressed as a proportion of the initial total herd number) is:

Years 1-5: 11.0%
Years 6-8: 15.0%
Years 9-10: 11.0%

Cows are culled at an annual rate of 10% and mature males at 30%. Residual sales (required to obtain the offtake rate selected) are made up entirely of 2- to 3-year-old males.

Table 3.5 presents a simple herd projection model based on the information provided above. Note how the increase in offtake rate from year 6 progressively reduces herd size until the original rate is re-established in year 9. At this rate, herd size begins to grow again, but it will take five years to regain the level of years 1-5. We may assume that the reduction in net sales from year 9 onwards reflects a desire to prevent a further decline in herd size.

Exercise: (estimated time required: 1 hour).

Question 1. Using the same production parameters as in the example above, estimate total herd size and herd structure for years 11 and 12, assuming that the overall offtake rate remains at 11% from year 9 onwards.

Question 2. Compare your result with the original herd statistics.

3.6.3 Consumption response and market demand

Basic concepts guiding consumption response

In order to understand the factors affecting household consumption responses, it is first necessary to introduce a number of concepts from economic theory. Much of the economic theory of consumption is based on three key propositions. The first proposition is that the way in which people spend their incomes and consume commodities is not haphazard but has some underlying rationale which can be understood and predicted. We will deal with only one element of this proposition here - the relationship between the amount consumed and the satisfaction afforded. According to theory, for most commodities the amount of satisfaction per unit consumed

diminishes with each additional unit. For example, one or two chocolates, mangoes or cigarettes are very enjoyable; above that number, each succeeding one gives less enjoyment.

Because the additional satisfaction a person gets with each unit tends to decline, he or she will be prepared to pay less in order to acquire the next unit, perhaps preferring to spend the money on some other commodity. For the first mango one will be prepared to pay 50 cents, for the second only 45 cents, for the third 40 cents and so on. If we aggregate all these preferences of individual consumers, we can construct a **market demand schedule** (market demand backed up by cash with which to pay). The imaginary schedule below shows how much of a commodity (say poultry) would be demanded at different prices, other things being equal:

Table 3.5. *Projected herd numbers by category of stock: Pastoral example.*

Year	Stock category[1]	Opening number	Births	Deaths	Net sales	Closing no. (year end)[2]	Opening no. (next year start)
1-5	0-1 y.o males		12	3		9	
	0-1 y.o females		12	3		9	
	1-2 y.o males	9		1		8	9
	1-2 y.o females	9		1		8	9
	2-3 y.o males	8		1	2	5	8
	2-3 y.o females	8		1		7	8
	>3 y.o males	12		1	4	7	12
	Cows	40		3	4	33	40
	Total	86	24	14	10	86	86
6	0-1 y.o males		12	3		9	
	0-1 y.o females		12	3		9	
	1-2 y.o males	9		1		8	9
	1-2 y.o females	9		1		8	9
	2-3 y.o males	8		1	5	2	8
	2-3 y.o females	8		1		7	8
	>3 y.o males	12		1	4	7	9
	Cows	40		3	4	33	40
	Total	86	24	14	13	83	83
7	0-1 y.o males		12	3		9	
	0-1 y.o females		12	3		9	
	1-2 y.o males	9		1		8	9
	1-2 y.o females	9		1		8	9

	2-3 y.o males	8		1	5	2	8
	2-3 y.o females	8		1		7	8
	>3 y.o males	9		1	3	5	7
	Cows	40		3	4	33	40
	Total	83	24	14	12	81	81
8	0-1 y.o males		12	3		9	
	0-1 y.o females		12	3		9	
	1-2 y.o males	9		1		8	9
	1-2 y.o females	9		1		8	9
	2-3 y.o males	8		1	6	1	8
	2-3 y.o females	8		1		7	8
	>3 y.o males	7		1	2	4	5
	Cows	40		3	4	33	40
	Total	81	24	14	12	79	79
9	0-1 y.o males		12	3		9	
	0-1 y.o females		12	3		9	
	1-2 y.o males	9		1		8	9
	1-2 y.o females	9		1		8	9
	2-3 y.o males	8		1	4	3	8
	2-3 y.o females	8	1		7	8	
	>3 y.o males	5		1	1	4	7
	Cows	40		3	4	33	40
	Total	79	24	13	9	81	81
10	0-1 y.o males		12	3		9	
	0-1 y.o females		12			9	
	1-2 y.o males	9		1		8	9
	1-2 y.o females	9		1		8	9
	2-3 y.o males	8		1	3	4	8
	2-3 y.o females	8		1		7	8
	>3 y.o males	7		1	2	4	8
	Cows	40		3	4	33	40
	Total	81	24	14	9	82	82

[1] Herd projection models would normally exclude this column. It has been included to demonstrate the derivation of opening herd number statistics for each production year.

[2] y.o = year old.

Retail price (cents/kg)	Quantity demanded (t/year)
100	30,000
90	39,000
80	48,000
70	57,000
60	66,000
50	75,000
40	84,000

Such a relationship can be plotted graphically, and Figure 3.7 illustrates the general shape of the resulting **demand curve.** Market demand will be discussed further under the third key proposition.

The second proposition is that consumption patterns change in response to changes in income. These responses differ according to the nature of the goods in question and the income level of the consumer. As income rises, the rate of increase in demand for staple commodities tends to decline until a point of **saturation** is reached. When the consumption of a good increases at a rate below the rate of growth in income, that good is known as a relatively **inferior good.** If consumption declines in absolute terms as income increases, the commodity is known as an **absolutely inferior good.** This good is then replaced by others in the individual's budget. An example would be the replacement of maize or sorghum by wheat or wheat flour as incomes increase in urban areas. When the consumption of a good increases faster than the rate of income growth, that good is said to be a **superior good.** Examples in African urban areas include meat, milk and fish.

Two concepts are important to this discussion on the relationship between income and consumption: **propensity to consume and income elasticity of demand.** The **average** propensity to consume a commodity is the proportion of consumers' total incomes spent on that commodity. If total income is $ 1000, of which $ 500 is spent on grain, then the average propensity to consume grain is 0.5. A more useful term is the **marginal** propensity to consume (MPC). The MPC can be defined as the proportion of an additional dollar of income that is used to consume a given commodity.

Figure 3.6 illustrates the relationship between income, the consumption of food and non-food commodities, and savings. Up to the relatively low level of income indicated by point A, all income is spent on food. Both the average and the marginal propensity to consume are equal to 1. Between income levels A and B. MPC declines rapidly and an increasing proportion of income is spent on non-food commodities. At income levels above B. the MPC for food is practically zero and some income starts to be saved. However, the average propensity to consume food at income level B and above is still about 0.5.

Figure 3.6. ***The effect of income on consumption.***

Table 3.6 presents empirical data from a rural household survey in Sierra Leone in 1977. The table shows typical shifts in the pattern of consumption associated with increases in rural income. Notice how the share of subsistence consumption declines as incomes increase. A higher proportion of income is allocated to urban-produced non-food goods within the higher income classes.

Table 3.6. *Marginal propensities to consume by income class for commodities grouped by origin, Sierra Leone, 1977.*

Origin classification	Marginal propensity to consume					
	Income class					
	Lowest decile	2nd & 3rd decile	4th & 5th deciles	6th & 7th deciles	8th & 9th deciles	Highest decile
Rural subsistence food products	0.684	0.588	0.49?	0.436	0.370	0.286
Rural purchased food products	0.153	0.178	0.201	0.218	0.235	0.257
All rural food products	0.837	0.765	0.698	0.654	0.605	0.543
Rural non-farm goods	0.013	0.012	0.011	0.011	0.010	0.009
Rural services and ceremonial	0.036	0.023	0.080	0.117	0.158	0.211
All rural products	0.814	0.801	0.789	0.782	0.773	0.763
Small urban products	0.034	0.043	0.061	0.066	0.062	0.069
Large urban products	0.019	0.019	0.020	0.020	0.021	0.021
Imported products	0.133	0.137	0.140	0.142	0.144	0.147
Total	1.000	1.000	1.000	1.000	1.000	1.000

Source: King and Byerlee (1977).

The second concept expressing the relationship between income and consumption (or demand) is the **income elasticity of demand.** This expresses the proportionate change in demand[1] in relation to a proportionate change in income, both changes expressed as percentages.

[1] Demand, defined as cash expenditure on a commodity, is easier to measure than physical consumption.

Thus:

$$\text{Income elasticity of demand} = \frac{\%\ \text{change in demand}}{\%\ \text{change in income}}$$

An income elasticity of demand of 0.25 would mean that for every 1 % rise in income, demand for a given commodity would rise by 0.25%. Table 3.7 presents empirical data on the income elasticities of demand for livestock products and cereals in different parts of the world.

Table 3.7. *Income elasticities of demand for livestock products and cereals, 1975.*

Country group/Region	Meat	Milk	Eggs	Cereals
Developed economies[1]	0.25	-0.05	0.27	-0.22
Developing economies[1]	0.63	0.57	1.00	0.16
Africa	0.79	0.68	1.05	0.21
Asia and Far East	0.97	0.52	1.07	0.22
Near East	0.72	0.53	0.83	0.13
Latin America	0.37	0.49	0.60	0.16

Source: FAO (1978).

[1] Countries are grouped according to the classification system of the Food and Agriculture Organization of the United Nations.

The third key proposition is that consumption responds to changes in the price of a commodity. This response is measured by the **price elasticity of demand,** defined as follows:

$$\text{Price elasticity of demand} = \frac{\%\text{ change in consumption}}{\%\text{ change in price}}$$

For example, if the price of a product were to increase by 10%, resulting in a 1% decline in demand for it, the price elasticity of demand would be -0.1. Note that the sign is negative, indicating the normal inverse relationship between price and demand that exists for most products.

A price change will in fact have two separate effects on consumer demand for a product. These are known as the **income effect** and the **substitution effect.** The income effect of a price increase is to reduce the purchasing power of a given level of nominal income (all other things being equal). This means that, unless it is also a producing household, a consuming household will be unable to maintain previous consumption levels without sacrificing the consumption of other goods. The effect of a commodity price change on consumer's income will depend on the share of that commodity in total expenditure. Increases in the price of staple foods in third world countries will often have a significant effect by virtue of their high share in household expenditure (often greater than 60%). A change in the price of non-staple commodities such as beef and milk will have less effect.

A substitution effect occurs when a change in the price of a product alters the demand not only for that product but also for its substitute(s). An increase in the price of maize, for example, will

tend to reduce the demand for maize and at the same time increase the demand for cassava and grain sorghum. Similar substitution effects occur in the livestock subsector, for instance between beef and other meat products. Under normal conditions, expenditures on most products accounts for only a small proportion of total income, so that substitution effects tend to outweigh income effects.

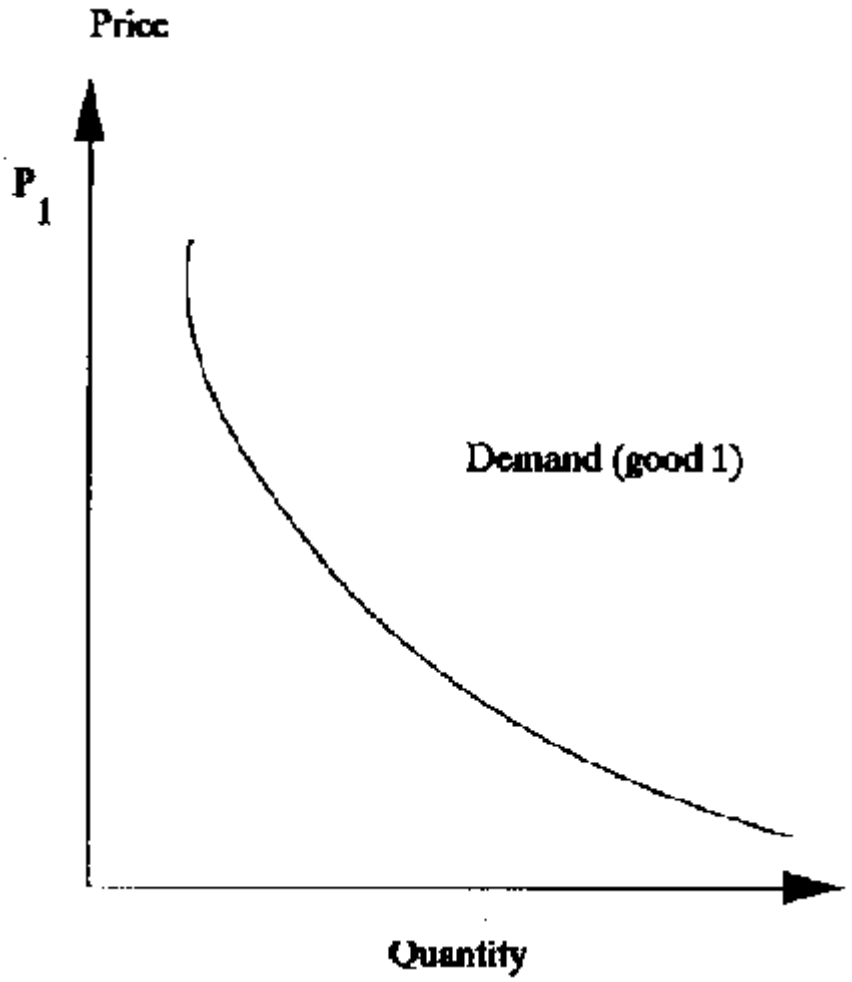
The demand response for the good in question is known as the **own price effect,** while that for its substitute(s) is called the **cross price effect.** These two effects are shown in Figure 3.7.

Consumption response of producing household

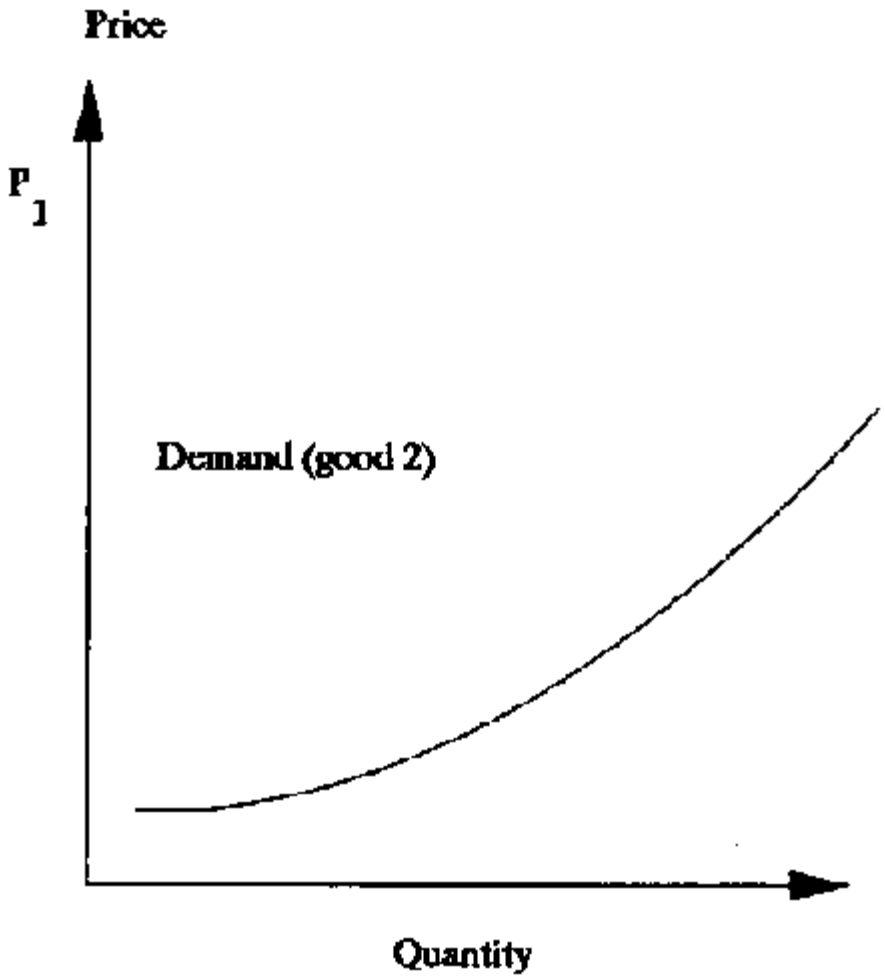
So far we have assumed that a household has a given income which is allocated between consumption and saving according to prevailing prices and individual preferences. This assumption does not apply to semi-subsistence households, where a portion of farm production is allocated to home consumption. In such cases, the producer price for a good moves with the consumer price, so that nominal total income is not predetermined (as consumption theory normally assumes). Rather, nominal income varies as producer prices vary.

Figure 3.7. *Own and cross price effects on consumption response.*

a) Own price effect



b) Cross price effect



For example, a rise in the consumer, and hence the producer, price of meat increases the value of meat output and therefore the value of total farm income. This increase may encourage the household to consume more meat, a response which could be called the **producer income effect** and which will normally be positively related to price changes. The household will also be aware that each unit of meat consumed has become more expensive - either, in the case of a surplus-producing household, because of the extra market income foregone or, in the case of a deficit household, because the costs of purchasing additional meat at market have gone up. In the latter case, the household is negatively affected by the price increase in the same way as the non-producing household.

Thus, for a subsistence commodity, the overall income effect of a price change (i.e. whether it is positive or negative) will depend on the commodity's share in the total value of farm output as well as its share in total consumption. When the share in total cash income is high, but the share in consumption is low (as is the case for beef in the typical agropastoral household), the positive effect of a price increase on producer income will often more than compensate for the negative effect on consumption.

The examples given in Exercises 3.5 and 3.6 show how to calculate income and price effects on consumption.

Consumption response of non-producing household

Two additional points need to be made with respect to the consumption response of non-producing households. Specifically:

- Increases in the price of food have a direct depressive effect on consumption in urban households because a decline in real income is not partially offset by an increase in producer income (the reverse is also true).

- In most African countries, inequalities of income are more pronounced in urban than in rural areas.

Box 3: Equity and the urban consumer.

Increases in food prices have a serious impact on the urban poor. For example, a 10% increase in the price of food led to a 9% reduction in the real income of the lowest decile urban income group in Nigeria. For the highest decile group, however, the increase resulted in only a 5.7% decline in real income. The difference reflects the proportion of income allocated to food consumption within each group. In the former group, between 60 and 80% of total income was spent on food; in the latter group, the proportion was much smaller.

The composition of commodities in the city dweller's "food basket" changes as income rises. Figure 3.8 depicts the typical pattern of change according to FAO data for a number of developing countries. The figure shows how the relative share of animal products increases rapidly as incomes increase. In other words, the income elasticity of demand for such products is high.

Figure 3.8. ***The effect of income on diet schematised: Percentage of total calories derived from fats, carbohydrates and proteins, by annual per caput GNP.***

Note: The figure is drawn in semi-logarithmic scale.
Source: Perisse et al (1969).

While the response to a price change for livestock commodities is likely to be elastic, the effect of such a change on real income will tend to be small in most African countries, because the proportion of income devoted to livestock commodities is still low. In contrast, a change in consumer prices for staples will have a pronounced effect on income, particularly for the poor. This will often be an important consideration when evaluating the equity effects of a price policy.

3.6.4 Relevant exercises

Exercise 3.5: The effect of income changes on food consumption.

Example: Refer again to the agropastoral example given in Exercises 3.1 to 3.3. Assume this time that increases in crop and/or livestock production have resulted in a 10% increase in real income.

The income elasticities of demand for the various food items consumed by this household are:

Maize + 0.1
Beans + 0.4
Groundnuts + 0.4
Sorghum + 0.1
Milk + 1.0
Meat + 1.0

Income increases also affect demand for non-food items, but these will be ignored in this example.

The effect on the demand for food can be summarised as follows:

Commodity	Income elasticity of demand	% change in consumption	Original consumption level (kg)	Extra amount consumed (kg)	New consumption level kg
Maize	0.1	+1.0	1160	+11.60	1171.6
Beans	0.4	+4.0	90	+3.60	93.6
Groundnuts	0.4	+4.0	95	+ 3.80	98.8
Sorghum	0.1	+1.0	325	+3.25	328.3
Milk	1.0	+10.0	150	+ 15.00	165.0
Meat	1.0	+10.0	20	+ 2.00	22.0

Note: Consumer and producer prices used for the agropastoral example do not correspond.

Exercise: (estimated time required: 1 hour).

Question 1. Using the small-scale dairy farm model in Exercises 3.1 to 3.3 and assuming a 15% increase in real income resulting from improved productivity, calculate consumption changes for the following commodities consumed by the household:

Commodity	Income elasticity of demand
Maize	0.12
Beans	0.45
Groundnuts	0.45
Beef	1.20

Milk	1.10

Note: Use the estimates you obtained for consumption in Exercise 3.2 as the basis for calculating consumption changes.

Question 2. Rank the following consumer commodities according to their probable income elasticities of demand for a middle-income and a high-income rural household, respectively, in an African country of your choice (commodities may be grouped together if necessary). State the reasons for your ranking.

Maize Eggs
Sorghum Fish
Millet Oils and fats
Rice Hotel drinks
Pulses Sugar
Meat Clothing

Exercise 3.6: The effect of price changes on food consumption.

Example: Table 3.8 summarises cash expenditure for an urban middle-income household.

Table 3.8. *Cash expenditure for a middle-income urban household.*

Item/commodity	Amount consumed (kg)	Value of consumption ($)
Food expenditure		
Maize	1100	55.00
Milk	400	24.00
Meat (CDW[1])	60	21.00
Sugar	50	5.00
Vegetables	200	20.00
Beverages	n.a.	30.00
Total food expenditure	n.a.	155.00
Non-food expenditure	n.a.	250.00
Total consumption expenditure	n.a.	405.00
Total savings	n.a.	45.00
Total cash income	n.a.	450 00

[1] CDW = cold dressed weight (for the relationship between dressing out percentage, CDW and price, see box, Exercise 4.1).

n.a. = not applicable.

Holding total cash income and non-food prices constant, let us examine the impact of price changes for selected food commodities on total cash expenditure and total savings. Commodity price changes have occurred as shown in the following table:

Commodity	Original price (cents/kg)	New price (cents/kg)	Price change (%)	Price elasticity of demand
Maize	5.0	6.0	+20	-0.1
Milk	6.0	5.4	-10	-1.2
Meat[1]	35.0	38.5	+10	-1.2
Sugar	10.0	10.0	0	-0.2
Vegetables	10.0	13.0	+30	-0.5

[1] CDW.

Given the above data, changes in total cash expenditure on food, in total savings and in total income will be as follows:

Item/commodity	Original consumption level (kg)	% change in consumption	New consumption level (kg)	New value of consumption($)
Food expenditure				
Maize	1100	-2	1078.0	64.60
Milk	400	+12	448.0	24.19
Meat[1]	60	-12	52.0	20.33
Sugar	50	0	50 0	5 00
Vegetables	200	-15	170.0	22.10
Beverages	n.a.	n.a.	n.a.	30.00
Total food expenditure				166.30
Non-food expenditure				250.00
Total consumption expenditure				416.30
Total savings				33.70
Total cash income				450.00

[1] CDW.

n.a. = not applicable.

Price increases for maize, meat and vegetables have resulted in a decline in their amounts consumed, accompanied by an increase in expenditure on maize and vegetables. A decline in the

price of milk has resulted in an increase in the amount consumed and a marginal increase in cash expenditure for that commodity. Savings have declined by approximately 25% because of a 7% increase in the amount spent on food.

Note that this analysis has not taken into account the substitution effect. In this exercise, we are merely concerned with own price demand responses and have assumed a zero cross elasticity of demand between the goods consumed.

Exercise: (estimated time required: 1 hour).

The following table summarises data on cash expenditure, savings and total cash income for a low-income urban household:

Item/commodity	Amount consumed (kg)	Current value ($)
Food expenditure		
Maize	1300	65.00
Milk	100	6.00
Meat[1]	70	24.50
Sugar	40	4 00
Vegetables	200	20.00
Beverages	n.a.	15.00
Total food expenditure	n.a.	134.50
Non-food expenditure	n.a.	150.00
Total consumption expenditure	n.a.	284.50
Total savings	n.a.	15.50
Total cash income	n.a.	300.00

[1] CDW.

n.a. = not applicable.

Question 1. Examine the impact on food consumption, cash expenditure and household savings (assuming that non-food expenditure and total cash income remain constant), given the following information:

Commodity	Original price (cents/kg)	New price (cents/kg)	Price elasticity of demand
Maize	5.0	7.0	-0.1
Milk	6.0	6.6	-1.4
Meat[1]	35.0	28.0	-1.3
Sugar	10.0	12.0	-0.6

Vegetables	10.0	15.0	-0.9
Beverages	no price change throughout		

[1] CDW.

Question 2. Comment briefly on the results obtained. Pay particular attention to changes in the savings level.

3.6.5 Supply response

Individual supply response

Market supply response (as opposed to production response) can be considered as the residual of other responses to price changes. The response can be computed as follows: market supply response = production response - net stock increase - home consumption response

It is not possible to draw specific conclusions about the nature of supply response to price signals without reference to empirical data. However, as a general rule, the market supply response for most products is positively related to output prices and negatively related to input prices. Figure 3.9 provides an example from semi-subsistence agriculture. (The figure ignores changes in net stock levels). Production responds positively and consumption negatively to a price increase. Above the **threshold price,** where production equals consumption, this household produces a market surplus, i.e. net supply (production minus home consumption) is positive. Below the threshold price, the residual is negative, i.e. there is a household deficit or net market demand (shown on the left hand side of the figure).

Figure 3.9. ***Net supply/net demand function as a residual of production and consumption in a semi-subsistence household.***[1]

[1] For simplicity, it is assumed that consumer and producer prices are identical.

Returning to the agropastoral example, assume a case in which a portion of annual herd offtake is consumed at home and the remainder is sold. A relative decline in the price of beef might persuade the producer to increase offtake for sale (i.e. reduce herd size), in order both to increase average herd productivity so as to maintain revenue above cost, and to transfer resources into other enterprises. Beyond a certain point, however, further sales would force a decline in home consumption of beef. The retail price at market would now become the basis for valuing beef output. This change from farm gate to retail price might dissuade the producer from further reducing herd size.

Aggregate supply response

So far we have discussed how price changes influence individual farmers, but not how to assess their influence on production and supply as a whole. From a policy perspective, it is the aggregate rather than the individual supply response which is of concern. In practice it would be impossible to obtain the aggregate response at the national level by predicting and summing all

individual responses. Instead, analysts tend to rely on sectoral statistics of market supplies to estimate supply responses. The data obtained can then be related to other time series or cross sectional data in order to establish explanatory relationships.

However, because the results of aggregate response estimates tend to be mathematically and practically unreliable, an understanding of how individual farmers are likely to respond is essential. Extrapolations from individual to aggregate responses form a useful comparison with aggregate responses derived from sectoral data.

When extrapolations of this kind are made, remember that not all producers will be able to respond as they wish to, so that aggregate response will always be less than the intended responses of all individuals summed. This is because increased competition for resources constrains individual responses, since input prices may rise and pasture, water or other resources may become scarce.

(Hint to instructors: When assessing aggregate response, be careful not to double count by attributing the same production gain to more than one stage in the production chain e.g. breeder, stock-feeder, fattener.)

The direction and intensity of an aggregate supply response is measured by the **price elasticity of supply,** calculated as follows:

$$\text{Price elasticity of supply} = \frac{\%\ \text{change in supply}}{\%\ \text{change in price}}$$

Empirical estimates of supply elasticity are rare for African livestock production systems, largely because of problems in data collection. Table 3.9 summarises data on livestock supply responses recorded in Africa and Latin America. The table demonstrates that while supply elasticities may be negative or very low in the short term, they tend to be both higher and positive in the longer run.

Table 3.9. *Livestock supply elasticities: Country examples.*

Product	Country	Price elasticity	
		Short run	**Long run**
Beef	Latin America	-0.1 to -1.2	0.4 to 1.6
Beef stock	Botswana	0.3	2.6
Beef (commercial)	Zimbabwe	-0.5 to -0.6	2.6
Beef (communal)	Zimbabwe	-0.3	n.a.
Cattle	Swaziland	-1.1	n.a.
Cattle	Sudan	1.1	n.a.

Source: Rodriguez (1985; 1986).

Market equilibrium and market price

We have now examined the concepts of a **supply curve,** which relates the quantity of a commodity supplied to price, and a **demand curve,** which relates the quantity demanded to price. Neither of these curves tell us what a price will actually be. They are much like conditional sentences: "If the price is W then the amount supplied will be X."; "If the price is Y then the amount demanded will be Z." In this section we will discuss how market prices are determined by the relationship between the two curves, assuming an open economy as the basis for discussion.

The columns below set out demand and supply schedules for a given commodity, in this case poultry meat. These columns provide the raw material for our supply and demand curves.

Supply schedule		**Demand schedule**	
Producer price (cents/kg)	**Amount supplied (t)**	**Retail price (cents/kg)**	**Amount demanded (t)**
80	75,000	100	30,000
70	69,000	90	39,000
60	63,000	80	48,000
50	57,000	70	57,000
40	51,000	60	66,000
30	45,000	50	75,000
20	39,000	40	84,000

The prices in these supply and demand schedules are recorded at different points of sale. It is the price paid to the producer at the point where he or she sells (the farm gate or primary market) that determines how much he or she will supply, and hence the supply schedule. It is the price paid by the consumer at the point where he or she buys (in the market place or the retail shop) that determines how much he or she will demand, and hence the demand schedule. Only rarely, in large modern economies, do farmers sell directly to the consumer, such that the price the consumer pays is the price the farmer receives. Normally, transport costs, taxes, traders' and butchers' costs and margins fill the gap between the producer price and the consumer (retail) price.

In order to relate the supply and demand schedules to each other, we need to use a common price. For simplicity, assume there is a uniform gap of 20 cents/kg between the producer and consumer prices in the schedules given above. We can either deduct this from consumer prices or add it to producer prices, obtaining either **derived consumer prices or derived producer prices,** respectively. Below are the poultry meat supply and demand schedules, harmonised at a common derived retail price.

Quantity supplied (t)	**Derived retail price (cents/kg)**	**Quantity demanded (t)**

75,000	100	30,000
69,000	90	39,000
63,000	80	48,000
57,000	70	57,000
51,000	60	66,000
45,000	50	75,000
39,000	40	84,000

What will the market retail price actually be? Assume that supply and demand can respond instantaneously to price. Suppose the price is 80 cents/kg. At that price, producers will be prepared to supply 63,000 t but consumers will only demand 48,000 t. The price would have to fall to about 60 cents/kg to persuade consumers to buy it all. But at 60 cents/kg, producers will be prepared to supply only 51,000 t, which will not be enough to meet demand. As a result, consumers will start competing with each other by offering a higher price. At 70 cents/kg, the amount supplied (57,000 t) will be equal to the amount demanded. That is the **equilibrium price** at which the market will settle; at all other prices, either producers or consumers will be dissatisfied and will adjust their supply or demand.

3.6.6 Relevant exercises

Exercise 3.7: Supply, demand and market equilibrium.

Example: Given below are (imaginary) supply and demand schedules for beef, unadjusted for derived prices:

Supply schedule		**Demand schedule**	
Producer price (cents/kg)	**Amount supplied (t)**	**Retail price (cents/kg)**	**Amount demanded (t)**
35	50,000	45	17,000
30	45,000	40	23,000
25	40,000	35	29,000
20	35,000	30	35,000
15	30,000	25	41,000
10	25,000	20	47,000

Exercise: (estimated time required: 1.5 hours).

Question 1. Draw up the schedules again, using a marketing margin which is fixed at 10 cents/kg.

Question 2. Draw the supply and demand curves. Do they cross one another? If so, what price will the consumer actually pay at the point of intersection?

Question 3. In the text we assumed that supply and demand respond instantaneously to price changes. Now suppose that demand adjusts instantaneously but that it takes two years before producers can adjust their supply to each price change. What effect will this have on reaching market equilibrium?

Question 4. If a government controls retail prices at a level lower than equilibrium, what will this do to the quantities demanded and supplied? What is likely to happen as a result?

Important points (3.6)

Production response

The production response to price may be neutral, negative or positive. However, with increased integration to a market economy, positive responses are more common over the long term.

• A long-term production response is, in some situations, associated with a negative short-term market supply response,

• An increase in the price of a product will affect production through one or more of the following adjustment mechanisms:

- utilising slack resources
- substituting enterprises
- intensifying production.

• The decision to substitute one enterprise for another depends on their relative profitability measured in terms of the gross margin, expressed as:

• Gross margin = gross value of output - variable costs

• The profitability of adopting intensified methods will depend on three main factors:

- The marginal physical productivity (MPP) of the inputs used, i.e. output per additional unit of input.

- The marginal revenue (MR) generated by each extra unit of output. When MPP is multiplied by MR, we get the marginal value product (MVP).

- The marginal factor cost (MFC) per unit of input used.

• To maximise profits through intensification, one can use extra inputs so long as MVP exceeds MFC.

Consumption response

• Three key propositions of the economic theory of consumption are:

- For most commodities, the amount of satisfaction per unit consumed diminishes with each additional unit.

- Consumption patterns change in response to change in income. Consumption responses will differ according to the nature of the good in question and the income level of the consumer.

- Consumption responds to changes in the price of the commodity.

• Two important concepts to express the relationship between income and consumption

- marginal propensity to consume
- elasticity of demand.

• The marginal propensity to consume is defined as the proportion of an **additional dollar** of income that is used to consume a given commodity. The income elasticity of demand expresses the proportional change in demand in relation to a proportional change in income, both changes being expressed as percentages. Thus:

$$\text{Income elasticity demand} = \frac{\%\text{ change in demand}}{\%\text{ change in income}}$$

• The consumption response to change in commodity price is measured in terms of price elasticity of demand, defined as:

$$\text{Price elasticity demand} = \frac{\%\text{ change in consumption}}{\%\text{ change in price}}$$

• A change in the price of a commodity has two separate effects on consumer demand: income effects and substitution effects.

• The income effect of a price rise is to reduce the purchasing power of a given level of income. A substitution effect occurs when a change in the price of a product alters the demand not only for that product but also for its substitute.

• The demand response for the good in question is known as the own price effect, while that for its substitute(s) is called the cross price effect.

• A rise in the price of a food commodity will have a direct depressive effect on its consumption in urban households. The effect of price rise on consumption in producing households will depend on the commodity's share in the total value of farm output as well as its share in total consumption.

• Long-term market supply response for most products is directly related to output price and negatively related to input price.

Supply response

• Market supply response is the residual of the production and consumption. It expressed as:

Market supply response = production response - net stock increase - home consumption response

• From a policy perspective, it is the aggregate rather than the individual supply response which is of concern. The aggregate response is estimated on the basis of sectoral statistics on market supplies.

• The direction and intensity of a given supply response is measured by its supply elasticity, calculated as:

$$\text{Price elasticity of supply} = \frac{\%\text{ change in supply}}{\%\text{ change in price}}$$

• The supply schedule of a product is related to producer price while the demand schedule is related to retail price. The difference between the two is called marketing margin. Common derived prices are used as the basis for relating supply with demand.

• The market equilibrium price is that price at which the supply and demand curves intersect, It occurs at that price where quantity demanded is exactly equal to quantity supplied or, put another way, at that price at which consumers are willing to buy all the producer offers for sale.

3.7 Rough approaches to forecasting production and consumption

In policy analysis, it is often necessary to forecast future production and/or consumption for a particular product based on past trends. In this section, we present two rough methods for doing so: analysis of past trends and trend extrapolation.

3.7.1 Analysis of past trends

Changes over time for any variable (including production and consumption) consist of two components:

• a systematic long-term component, known as the **trend**
• short-term deviations from the trend, known as **fluctuations**.

Reliable estimations of past trends and their use in forecasting is a highly specialised field using sophisticated econometric techniques. Here we shall not deal with these but with rough approximations.

Rough approximations of a trend from time series data can be made in three ways:

- By calculating **moving averages** in order to eliminate the effect of fluctuations. For example, the 1980 3-year moving average of production for a commodity would be the production average for the years 1979, 1980 and 1981. There is no rule concerning the number of years that should be included when calculating a moving average. The choice will depend on commodity characteristics and on the data available. In most cases, 3- or 5-year moving averages are used.

- By calculating the **average annual rate of change** for the variable over a defined period (t). This rate should always be calculated as a **compound growth rate,** defined as follows:

$$r = [(\frac{Xt}{Xo})^{1/t} - 1] \times 100$$

where:

r = the compound growth rate
Xo = the starting year value
Xt = the final year value
t = the number of years used for trend estimation.

In order to avoid bias caused by unusually high or low values at the beginning or end of the period, starting and end-year values should themselves be an average of three years.

- By graphing changes in the variable over time and subjectively estimating the trend line by hand. This method, though simple, is obviously less exact (see Exercise 3.8.)

(Hint to instructors: At this point you may wish to comment on variability and the use of means and standard deviations.)

3.7.2 Trend extrapolation

The simplest way to forecast the future of a given variable is to extrapolate its past trend. Using the graphical method described above, extrapolation would simply be done by extending the trend line to the year for which the projection is required. Using moving averages, the same method can be applied but with more reliable results.

Finally, we can extrapolate on the basis of the average rate of change observed in the past. To do this, we will need to use compound growth rates. Thus, if "r" is the percentage rate of growth for

a variable and "Yo" is its starting value, and we wish to extrapolate for a period of "t" years to obtain an end year value, "Yt", the formula used would be:

$Yt = Yo \times (1 + r)^t$

Forecasts by trend extrapolation are based on the assumption that the factors which have influenced the past will continue to have the same influence in the future. If there is reason to doubt this, extrapolations should be modified accordingly.

Sometimes the factors influencing a variable will be subject to less fluctuation about their trends and so will be more reliably predictable than the variable itself. In such cases, the best forecast of the variable is obtained by deriving it from predictions about the influencing factors rather than by extrapolating a past trend that is itself derived from sharply fluctuating values.

For example, in the case of demand, it is usually assumed that the most important factors determining the trend will be population and income. Prices may also be important, but for long-term forecasts the usual assumption is that prices will move in parallel with each other, such that specific price effects can be neglected. However, if price ratio changes are expected, they may be incorporated into the forecast.

On this basis, demand can be forecasted relatively easily, using the concept of income elasticity of demand.

For a given percentage change in real income per caput (i.e. income at constant prices[2]), the percentage change in per caput demand is equivalent to the real income change multiplied by the income elasticity. Hence, the percentage change in aggregate consumption can be calculated as follows:

[2] When projecting supply and demand, distinguish between **current prices** (the sums actually received) and **constant prices** (prices adjusted according to the cost of living index in order to offset the impact of inflation).

% change in aggregate consumption = % change in population + income elasticity x % change in real income per caput

Consumption for a given year in the future can then be forecasted by compounding the annual rate of change in consumption over the number of years required.

As we have already seen, it is extremely difficult to predict future trends in production since the number of influencing factors is much greater. If all other factors were to remain constant (which is unlikely), then price would be the determinant. The impact of changes in real producer price would be measured in terms of the price elasticity of supply. Thus:

% change in future production = % change in past production + price elasticity of supply x (% change in expected real producer price - % change in past real producer price)

Production for a given year in the future could then be forecasted by compounding the annual rate of change in production over the number of years required.

Caution should be exercised in interpreting relationships of cause and effect between variables projected in this way. Relationships for which there is no logical explanation may be apparent statistically.

The forecasting methods are rather basic, and useful only for approximating future trends. Projections based on them cannot adequately incorporate the full range of factors influencing production and consumption. However, in practical policy analysis, the opportunity to use more sophisticated methods may not exist, and these simpler techniques, properly applied, will often be useful.

3.7.3 Relevant exercises

Exercise 3.8: Supply and demand projections.

Example: Table 3.10 provides country statistics on disposable income, the consumer price index and population numbers for 1976-95. These are then related to consumption and production data for maize and to producer prices, in order to determine consumption per caput and real producer prices for each year of the period. Figure 3.10 presents the data from Table 3.10 in graphical form.

Exercise: (estimated time required: 4 hours).

Examine Figure 3.10a carefully and compare the graph with the time series data given in Table 3.10. In the graph, a trend line has been drawn by hand for deflated disposable income, forecasted estimates of which have been extrapolated for 1990 and 1995. These estimates have also been entered in the table.

Table 3.10. ***Derivation of real producer prices and per caput consumption of maize, 1976-95.***

Question 1. On Figure 3.10b, draw trend lines for maize production and consumption, and extrapolate values for 1990 and 1995. Enter these values in the table.

Question 2. On a separate sheet, derive and plot consumption per caput and extrapolate its trend to 1990 and 1995.

Question 3. On Figure 3.10c, draw the trend line for real producer price and enter your estimates in the table.

Question 4. Identify and comment on any observed and logical relationships between the variables graphed in Figures 3.10a-3.10c. Discuss the relationships between price, income and quantity trends. Indicate whether the country is moving towards being self-sufficient, a net importer or a net exporter of maize.

Question 5. Table 3.11 presents information on production, consumption and producer prices for beef and whole milk. The table is incomplete, and information from Table 3.10 on population and the consumer price index is needed to fill in the blank rows.

Figure 3.10. (a)

Figure 3.10. (b)

Figure 3.10. (c)

- For both products, complete all rows in the table.

- Graph the results, as in the previous example.

- Sketch the trend line for each variable and project this to the year 1995. Enter these estimates in Table 3.11.

- For both products, comment on any relationships which you consider logically explainable.

- For both products, determine whether the country is likely to be self-sufficient, a net exporter or a net importer by 1990.

- Why do you think the positive relationship between deflated disposable income per caput and consumption per caput is so strong for all three products? Estimate the implied income elasticity of demand for each product, assuming for this rough estimate that prices and other factors do not influence demand.

Table 3.11. ***Production. consumption and producer prices of beef and whole milk, 1976-95.***

Exercise 3.9: Group Exercise: Production systems, supply and demand. Read the relevant sections of the central case study.

Question 1. Describe the role of beef cattle in the economy of Alphabeta, giving reasons for the changing contribution of the livestock subsector to GDP earnings since independence. Cite statistical data to support your description, where possible.

Question 2. Describe quantitatively changes in beef herd growth, offtake rates, urban demand, marketed supply and exports in Alphabeta for the period since independence. Plot past trends in these variables and extrapolate these trends for five years beyond the final year of your data set. Discuss the implications of the extrapolations you have made.

Question 3. What factors have influenced the stability of the beef sector's contribution to the economy of Alphabeta?

Question 4. Describe the main features of Alphabeta's various beef production systems. If possible, indicate the degree of commercialisation in each. Also examine the evidence for changing ownership patterns and land access rights in the communal areas since independence. Comment on the results you obtain. Give quantitative evidence for the significance of each system to the Alphabeta meat industry.

Important points (3.7)

• Two rough methods of forecasting future production and/or consumption for a particular product are:

- analysis of past trends
- trend extrapolation.

• A rough analysis of a trend is made from time series data in three ways, namely,

- by calculating moving averages
- by calculating average annual rate of change
- by graphing changes in the variable over time subjectively.

• Extrapolation can be done by using the changes in the variable over time, moving averages or the average rate of change observed in the past.

• Forecast by trend extrapolation method, based on past trends, must be modified for special factors having influence for the future.

• Future population and income provide the basis for forecasting demand of a commodity instead of its price.

3.8 Feedback exercises

All answers can be found in the text.

1. Name major livestock production systems in Africa.

small-scale: _____
large-scale: _____

2. Circle T for True and F for False.

i) The degree to which a farm is integrated into the market economy greatly depends on the geographical location of the farm.

T F

ii) The proximity of a farm to urban centres does not guarantee agricultural integration into the market economy.

T F

iii) Pure subsistence production systems are virtually non-existent in Africa.

T F

iv) Semi-subsistence producers consume the bulk of their produce at home with no surplus available for sale.

T F

v) For a semi-subsistence producer, the major goal is maximising chances for survival rather than maximising production.

T F

vi) Innovation with higher production capability will be attractive to subsistence-oriented producers, despite the probability of failure.

T F

3. Below is the format of an input-output table for a mixed smallholder farming system. List the items under the heading inputs, outputs and farm activity.

Item	**Farm activity**				**Input utilisation**
	1	**2**	**3**	**4**	
Inputs					
Outputs					

4. Fill in the missing terms for the following equations:

i) Total consumption = subsistence consumption +_____ - sales.

ii) Total value of output - total variable cost - total fixed cost + non-farm income =_____

iii) Net cash income from farm sources = _____ - value of purchased variable inputs - fixed cost, excluding depreciation.

5.a. Define the terms marginal physical productivity (MPP), marginal revenue (MR) and marginal factor cost (MFC), used to determine profitability of adopting intensified production methods.

MPP_____
MR_____
MFC_____

b. Write the formula to calculate marginal value product (MVP):

MVP = _____

6.a. Name three important factors affecting household consumption responses to a commodity.

i) _____
ii) _____
iii) _____

b. Differentiate between the terms "average propensity to consume" and "marginal propensity to consume".

c. The price of milk at a farm was increased by 20%, resulting in a 4% decline in demand for it. Calculate price elasticity of demand.

7. Justify the following statement:

"Market supply response can be considered as the residual of production and consumption responses to price changes."

_____

8. Circle T for True and F for False.

i) Above the threshold price, the net market supply would be positive.

T F

ii) The production decisions at a farm are based on the price that the producer receives while consumption decisions are based on price at the retail level.

T F

iii) It is possible to convert consumer retail price to producer price term by adding the marketing margin.

T F

iv) Market equilibrium price is that price at which consumers are willing to buy all that the producers offer for sale.

T F

9. Name two rough methods of forecasting future production/consumption for a product.

i) _____
ii) _____

10.a. How will you calculate the 1990 3-year moving average of consumption of a commodity?

b. What type of values for a variable can be used to forecast its future consumption by the trend extrapolation method?

i) _____
ii) _____
iii) _____

3.9 References

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4.1 Performance objectives

Module 4 is intended to enable you to:

1. Discuss effects of policy instruments, in qualitative terms, on: prices and quantities at the producer and consumer levels; marketing margin; quantities traded; and government expenditure or income.

2. Demonstrate proficiency in solving numerical questions related to equivalent domestic and border policy instruments and the effects of state agencies.

3. Explain the rationale for using border price as a point of reference for determining the degree to which current policy instruments have been applied.

4. Explain the terms "nominal rate of protection)' and "nominal protection coefficients" and solve numerical problems on nominal protection coefficients.

5. Describe methods for determining quantitative effects of current market price and trade policies at consumer, producer and national levels and solve related numerical exercises.

6. Discuss the justification for government interference with price.

7. Describe implementation problems associated with market price and trade policies.

4.2 Introduction

Market, price and trade policies directly affect the prices and amounts of commodities produced or inputs applied. Such policies normally have both domestic and international trade effects. Module 4 provides a framework for analysing market, price and trade policy by posing questions a policy analyst might ask when reviewing policy towards a given commodity, and illustrating some of the methods available for answering them. The module discusses both the extent to which different government objectives can be met by interfering with prices and some of the problems of implementing market, price and trade policies.

In this module we focus mainly on the impact of policy on commodity output levels and prices, but much of the discussion also applies to input quantities and prices. Policy issues relevant to market structures and distribution systems are discussed in module 5.

4.3 What policy instruments are currently being used?

The first task in reviewing current policy towards a given commodity is to discover what policy instruments are already being used. This task may be complicated by the fact that a wide range of policy measures (each with its own historical origin) will often be applied simultaneously by different government and/or parastatal agencies. Below is a checklist of questions designed to ensure that no instruments are omitted from the review:

• What instruments are being used at the **international trade level?** Are there any import or export tariffs, taxes or subsidies? Are there quantitative restrictions or other non-tariff measures? Is international trade the responsibility of a state or parastatal agency with monopoly power? If so, what policy does the agency concerned pursue? Can the policy's economic effects be described in terms of tariff or non-tariff measures? Is the exchange rate in equilibrium or is it overvalued or undervalued?

• What instruments are being used at the **wholesale level?** Is marketing done by private firms or are there state or parastatal agencies with monopoly power? Are there commodity-specific taxes or subsidies? Are there any public authorities buying or selling at predetermined prices? Does the government attempt to control prices by other means? Is there a public storage policy?

• What instruments are being used at the **producer level?** Is there a programme of public procurement? Are there any commodity-specific subsidies or taxes? Are there forced deliveries or quotas on production?

• What instruments are being used at the **retail level?** Does the government attempt to control retail prices? If so, how? Are there specific taxes or subsidies? Are there "fair price" retail outlets? Is there rationing?

4.4 What effects do current policy instruments have?

After identifying the policy instruments used by the government, the second step is to ascertain how the various market, price and trade policy instruments affect:

- prices and quantities at the producer level
- prices and quantities at the consumer level
- marketing margins
- quantities traded
- government expenditure or income.

A **competitive tree market** will be assumed as the point of reference. In order to simplify the discussion, we will also assume that world prices remain unaffected by the country's trading operations (i.e. the country under consideration is a small one in terms of external trade).

As a methodical basis for discussion, the effects of the following policy instruments commonly adopted by African governments and elsewhere will be described and analysed:

- border measures
- domestic measures in an open economy
- domestic measures in a closed economy
- state agencies: inconsistent policies and informal markets.

4.4.1 Effects of border measures

An **import tariff** raises the price of imports above international levels for both the producer and the consumer. The effect is to reduce imports and increase domestic prices, and hence domestic production, while consumption declines. Domestic producers therefore benefit but consumers suffer a welfare loss. Government revenue increases. Similar effects will occur when an **import quota** is used, except that such quotas do not increase government revenue. Instead, licensed traders will be able to earn a rent on their operations over and above the profit they would have made in a free market (unless the government auctions import licenses to the highest bidder). An **import subsidy** will have the opposite effects.

An **export tax** reduces exports and hence domestic prices, leading to lower domestic production and higher consumption (Figure 4.1). Producer welfare declines but consumer welfare improves. Government revenue again increases. Similar effects result from an **export quota,** while an **export subsidy** will have the opposite effects.

The marketing policies adopted by monopoly trade agencies will often have similar effects to tariffs, subsidies or quotas. Thus, when a state or parastatal **monopoly import agency** sells on the domestic market at prices above those on the world market (even with marketing costs taken into account), the effect will be similar to an import tariff. Likewise, if a **monopoly export agency** buys on the domestic market at prices below those on the world market, the effects on production and consumption will be analogous to those of an export tax.

Figure 4.1. ***Effects of an export tax***

4.4.2 Effects of domestic measures in an open economy

When a country's international trade is unrestricted by tariffs, licenses, quotas, foreign exchange controls or any other kind of barrier (including high transport costs) it is said to have an **open economy.** The expression **open economy** is relative. An economy with a non-prohibitive level of import tariff but no quantitative or foreign exchange controls is "fairly open". Conversely, when foreign exchange controls accompany the same level of tariffs, it is considered "rather closed".

In an open economy, domestic prices generally correspond to their **border price equivalents.** The border price equivalent for a given commodity in which a country trades is its border price, adjusted for marketing, handling and transport costs (but not taxes) between the border and the domestic market. The **border price** of a commodity is its international trade price, **c.i.f.** (costs, insurance, freight) at the country's own border in the case of imports, and f.o.b. (free on board) in the case of exports.

When applied in an open economy, a **producer subsidy** increases returns to the producer, raising the incentive to produce more. Consumers remain unaffected (Figure 4.2). Either imports are reduced or exports are increased. Government expenditure increases.

A **deficiency payment scheme,** where producers are compensated for reduced revenue caused either by falling prices or by falling output (or both) over a given time period, is one example of a producer subsidy. A **floor price system,** through which the government pays the producer a guaranteed price above the border price equivalent (while it sells to consumers at the lower free market level), has essentially the same effects. A **producer tax** will work in the opposite direction.

A **consumer subsidy** reduces the price paid by the consumer, thereby increasing domestic consumption. Producers remain unaffected. Either imports are increased or exports are reduced. Consumer welfare is improved. Again, government expenditure increases. A **consumer tax** will have the opposite effects.

Figure 4.2. ***Effects of a producer subsidy in an open economy.***

The effects of tariffs/subsidies applied at the border can be expressed in terms of equivalent subsidies or taxes applied at the domestic level. For example, an export tax will have an effect equivalent to the combined effect of a producer tax and a consumer subsidy (Figure 4.1). The only major difference between border measures and equivalent domestic measures lies in their ease of administration. Whereas trade taxes and subsidies can be implemented conveniently at the border where the market channel is narrow and relatively easy to control, equivalent domestic measures require an elaborate institutional administrative framework for effective implementation. Border measures, however, will not work unless smuggling can be stopped.

4.4.3 Effects of domestic measures in a closed economy

When a country's international trade is restricted by trade barriers, high transport costs or for other reasons, it is said to have a **closed economy.** In these circumstances, domestic subsidies/taxes have different effects. For example, a producer subsidy would increase the producer price, but it would also increase total supply (instead of merely displacing imports), in which case consumer prices would fall, such that both parties would benefit (Figure 4.3). In a closed economy, a producer subsidy would be similar in its effects to a consumer subsidy. The difference would depend on the relative elasticities of supply and demand.

4.4.4 State agencies: inconsistent policies and informal markets

Policies implemented through domestic state monopolies are analogous in effect to subsidies or taxes. For example, a **monopoly marketing board,** which pays a higher price to the producer than it charges the consumer (once marketing costs have been taken into account), is effectively implementing a policy to subsidise both parties.

State monopolies and other state or parastatal agencies often operate inefficiently, resulting in serious market distortions. Associated with such distortions is the emergence and growth of informal (and often illegal) markets, which circumvent monopolies and so erode their power. Under these circumstances, a fundamental condition for an efficient system, namely market transparency, is violated. Even where state agencies do not operate as total monopolies, their margins often exceed those of the private sector. As a result, the market share of the state body often declines, adversely affecting its marketing operations still further. When state agencies operate inefficiently, private traders may face reduced competition (if their numbers are restricted), enabling them to make excessive profits.

Figure 4.3. ***Effects of a producer subsidy in a closed economy.***

Inconsistency results when a state agency is required to maintain an artificial price level (i.e. above or below equilibrium), but is unable to do so because of inadequate financial and/or policy support from government. A state monopoly with a responsibility to maintain consumer prices at levels below market equilibrium must be supported either by explicit government subsidies or by the provision of adequate financial resources to cover the losses it incurs.

Inconsistencies between the domestic operations of state agencies and the border measures taken by government are also common. For example, state monopolies are often required to purchase

commodities at prices below export parity levels. (For a definition of parity price, see the footnote to Exercise 4.1.) When such agencies receive no support (or at least no effective support) in the form of an export tax, an informal/illegal export trade will tend to emerge which will compete with the official body.

Box 4.1: The case of Alphabeta.

In Alphabeta, a range of market, price and trade policy instruments have been applied. For beef and milk, prices at the producer, wholesale and retail levels are controlled through monopolies. A tax on exports is applied and the domestic price is held below the border price equivalent. Monopolies also exist for coffee, tea and pyrethrum, but a free market system operates for sheep and goats.

The beef price policy adopted by the Meat Marketing Commission (MMC) has transferred income from producers to consumers. This has encouraged domestic beef consumption, particularly in urban areas, but production has suffered. Not surprisingly, exports have also declined.

Another aspect of Alphabeta's beef marketing policy is that a price distortion has been introduced through the beef grading system. Because price differentials between grades have been kept narrow, deliveries of superior grades have declined in relative terms while domestic demand for them has risen sharply. This has adversely affected the country's exports of prime quality beef.

Two factors have contributed to the growth of informal/illegal slaughtering and marketing of beef in Alphabeta. First, MMC's processing and marketing costs are higher than those of the private sector. The private sector has been able to pay a higher price to the producer and has commanded an increasing share of deliveries as a result. Second, MMC has attempted to keep the price of beef below the equilibrium level, but this has been done without the necessary government support. At set domestic sale prices, demand has exceeded MMC supply capacity. In order to increase supplies, MMC would have had to raise the prices offered to producers, but the necessary government financial support to do this has not been forthcoming. The intention to maintain low consumer prices has also failed since consumers have had to pay higher prices on informal markets.

The situation is similar with dairy products. The market price of milk has been kept below export parity, simultaneously stimulating consumption and discouraging production. The export of dairy products has declined as a result, with Alphabeta becoming a net importer in recent years. The price policy adopted by the National Dairy Co-operative (NDC) has effectively resulted in a transfer of income from producers to consumers.

The NDC is a commercial/co-operative agency whose prices are controlled by government. It operates as a parastatal marketing body and has been plagued by the problems and policy inconsistencies typical of such agencies. For example, seasonal and regional price structures have not reflected cost differentials since year five, resulting in serious distortions in the production and marketing of milk products. Production in remote areas has been encouraged and

seasonal gluts and shortages have become common. Informal marketing has flourished.

4.4.5 Relevant exercises

Exercise 4.1: Equivalent domestic and border policy instruments and the effects of state agencies.

Example: Let us consider the case of a wheat importing and producing country where the government has established a monopoly agency to import the commodity and to market both imported and domestic production. The following information on prices and margins is available for whole wheat:

	L$/t
Retail consumer price	60.00
Import parity price[1] retail level	50.00
Transport and marketing margin (farm gate to retail level)	8.00

[1] The **important parity price** is the cost of imports (c.i.f.) adjusted by all other costs (e.g. marketing, handling, transport and taxes) incurred in getting the imports to the point of sale (in this case, the retail level). The **export parity price** is calculated in a similar way. The main difference between the import/export parity price and the border price equivalent is that the former includes adjustments for taxes.

Under these conditions, the state agency would make a profit of L$ 10/t on its wheat imports. In the absence of such an agency, the equivalent border measure would be an import tariff of L$ 10/t, while the equivalent domestic measure would be a consumer tax of L$ 10/t combined with a domestic producer subsidy of L$ 1/t.

The domestic producer price is L$ 52/t (L$ 60 minus marketing costs of L$ 8/t). If government permitted competition by private traders and if their marketing costs were lower, (say L$ 5/t), the state agency would find it difficult to operate effectively and would tend to incur losses. Private traders could offer the domestic producer a price of L$ 55/t, and domestic wheat output would tend to be channelled through them, by-passing the government body.

Exercise: (estimated time required: 1 hour).

Read the parts of the central case study which describe the beef price policy adopted in Alphabeta. 2

Answer the questions below, given the following price/cost data[2]:

	L$/t
Farm-gate producer price	340.00

Export parity price at producer level (including MMC slaughtering costs)	358.00

[2] These data relate to fair average quality (FAQ) grade beef and are expressed in cold dressed weight (CDW) equivalents.

Box 4.2: Calculating beef prices at different market levels.

Assume a farm-gate price of L$ 0.20/kg live weight and a dressing out percentage of 50%. All prices and margins are expressed in L$/kg CDW:

	L$/kg
Farm-gate price, CDW equivalent (by-products included)	0.40
+ transport and marketing* (farm gate to wholesaler)	0.01
+ processing (slaughtering)	0.03
- value of by-products (hides, blood, bones etc)	0.06
= wholesale price, cut beef, CDW (by-products excluded)	0.38
+ transport and marketing (wholesaler to retailer)	0.01
= retail price, cut beef	0.39
Transport cost, farm gate to wholesale (slaughterhouse)	9.00
Value of by-products retrieved during processing (hides, blood, bones etc)	56.00
Transport and marketing margin, wholesale (slaughterhouse) to retail	6.00

Question 1. Assume MMC is the sole export agency for beef and that private traders are prevented from exporting it. Does the MMC make a loss or a profit on its export sales? What is the size of this loss or profit/t CDW?

Question 2. Assume that private traders are authorised to export beef. What type of border measure would be needed to maintain the producer price at its original level? What would be the level in L$/t CDW required for this measure?

Question 3. What would happen if the government did not apply the measure? What equivalent domestic measures could the government adopt instead (assuming that transport costs do not differ between MMC and private trade, but that slaughtering costs differ as in the central case study).

Question 4. Assume that the MMC and the private sector pay identical prices for beef to producers. What is the consumer price in L$/kg CDW for beef marketed through MMC and the private sector? What is the likely consequence of such a price difference? (With regard to transport and processing costs, make the same assumptions as in Question 2.)

Important points (4.3-4.4)

- In analysing the impact of market, price and trade policies oil commodity output levels and

prices, the initial task would be to find out the nature of policy instruments being employed for the given commodity at various levels including international, wholesale, producer and retail.

• Some of the important groups of market and trade policy instruments used by various governments in Africa are:

- border measures
- domestic measures with an open or closed economy
- domestic marketing monopolies.

• Among border measures, import tariffs reduce imports and domestic consumption but increase domestic prices and domestic production of the commodity, Government revenue also increases. An import subsidy will have the opposite effects.

• An export tax reduces exports, domestic prices and domestic production but increases domestic consumption. Government revenue again increases. An expert subsidy will have the opposite effects.

• A producer subsidy in all open economy increases production of the subsidised product with no effect on domestic consumption. Government expenditure is increased while imports are reduced. A tax on producers will work in the opposite direction.

• A consumer subsidy reduces the price paid by, the consumer, thereby increasing domestic consumption. Imports tend to increase. Government expenditure increases There is no effect oil domestic production. A consumer tax will have opposite effect.

• The effects from domestic subsidies/taxes ill a closed economy are different from those in all open economy. A producer subsidy would increase the producer price but it would also reduce the consumer price such that both parties would benefit.

• Border measures are easier to administer than domestic measures.

• State monopolies and other state or parastatal agencies often operate inefficiently, resulting in serious market distortions.

4.5 To what degree have current policy instruments been applied?

For a detailed empirical policy analysis, it is important to assess quantitatively the effect of various policy instruments used. First, the degree to which different policy instruments have been applied should be determined. For example, suppose a major policy objective is to increase farmers' incomes and that the chosen instruments for doing so are measures to raise milk prices. We now need to find out the extent to which these measures have succeeded in raising prices

above what they would otherwise have been. However, to do this we need something more than a simple statistic quantifying the instruments applied, such as *ad valorem* rates for tariffs, subsidies and taxes, or volumes for commodities restricted by quotas. Different policy instruments should be measured in comparable terms. To do this, a common denominator or basis for comparison should be identified. This common denominator would need to contain information which could be used to determine the impact of different policies on income transfers and quantities produced, consumed and traded within the economy.

This basis for comparison should reflect the degree of price distortion caused by each instrument. It should measure the extent to which prices under present policy circumstances differ from those which would prevail in a "no policy" environment.

4.5.1 The basis for comparison

For traceable commodities, the basis for comparison is the border price equivalents. Thus, the yardstick used to measure the degree of distortion caused by different policy instruments is the extent to which domestic prices diverge from those prevailing in international trade.

The use of border price equivalents as a reference point for policy analysis is justified by the fact that they are the prices that would prevail on domestic markets in an open economy with a competitive free market. In an open market, traceable commodities can always be imported or exported. Domestically-produced traceable commodities should therefore be valued on the basis of what they would attract in international trade.

(Hint to instructors: You may wish to discuss border and shadow prices further at this point. Refer participants to Little and Mirrlees, 1974; Gittinger, 1982; and Timmer et al, 1983).

The advantage of using this indicator as a quantitative measure of the effects of policy is that the effects of different policy instruments, such as an import quota, an import tariff, a domestic subsidy or the operations of a domestic marketing monopoly, can be analysed and expressed in comparable terms.

4.5.2 Estimating rates of protection

The case of tradeables

The difference between the domestic price and the border price equivalent (expressed as a proportion) gives the **nominal rate of protection** (NPR) for a commodity. That is:

where:

NPR = nominal protection rate

DP= the domestic price for the commodity

BP = the border price equivalent for the commodity

Another formula for expressing the same concept is the nominal protection coefficient (NPC), derived as:

NPC = DP/BP

Thus,

NPC = (NPR/100) + 1

Since NPR can be either positive or negative, NPC can be above or below 1.

When calculating NPR or NPC, policy analysts should avoid using data collected only over the short term, since these may reflect short-term fluctuations caused by exceptional circumstances which may soon be reversed.

In estimating the border price equivalent, marketing margins (including transport and handling) must be taken into account in order to ensure that international and domestic prices are compared at the same point in the marketing chain.

When a policy has different implications for producer and consumer prices, two different rates of protection may need to be estimated. Similarly, if the government has interfered with the regional price structure, different rates of protection may apply to different regions of the country. The uniform pricing for milk applied across regions in Alphabeta is a case in point. Alphabeta's dairy policy also shows how different rates of protection might be applied for different seasons of the year.

The case of non-tradeables

Estimating rates of protection will only be possible when the commodity concerned is actually traded. In the livestock subsector, most commodities are traded except liquid milk, where high transport costs are prohibitive. Ideally, the domestic equilibrium price would be used as a reference point in those circumstances (i.e. the price at which domestic supply and demand are equal to one another in the absence of government intervention). The rate of protection would be estimated by comparing actual consumer and producer prices with this equilibrium price. However, due to the difficulty in estimating domestic equilibrium price, *ad hoc* approaches are sometimes needed to estimate the reference price.

Dried skim milk, which is traded, can be used as a proxy for liquid milk, provided the quantities are adjusted for reconstitution as liquid milk (Exercise 4.2). Using dried skim milk as a proxy is not entirely satisfactory, since fresh liquid milk may give greater satisfaction to consumers than reconstituted skim milk and so command a higher price on the domestic market. In this case, a premium should be added when calculating the NPR to allow for price differences.

4.5.3 Official and shadow rates of exchange

Border price equivalents are based on international prices expressed in foreign currencies (often the US$). To express foreign currencies in the domestic currency, we use a rate of exchange. In developing countries, official rates of exchange often overvalue the local currency. For this reason, it may be preferable to use a **shadow rate of exchange** in order to reflect the real value of local currency.

Shadow rates of exchange are not necessarily the same as black market rates, since the former should represent the equilibrium rate of exchange in the absence of government intervention, while the latter represent the scarcity value of foreign exchange. If the difference between black market and official rates of exchange is small, then the black market rate can be taken as a good indicator of the shadow rate. If almost all transactions take place at the official rate but the difference between the two rates is very large, this may reflect an artificial scarcity of foreign exchange. Thus, a half-way point between the two rates should be chosen in the absence of any other indicators of what the shadow rate should be. In some countries, a standard shadow rate of exchange is applied for all national planning and policy making purposes, in which case this should be used.

Box 4.3: The case of Alphabeta.

The central case study provides examples of NPCs. The NPC for beef averages 0.95 over all grades, at the official exchange rate. Domestic producers in Alphabeta thus receive an average price 5% below the level they could expect in a free market. This could be described as an example of negative protection (or producer taxation). The NPC varies between beef grades, owing to the policy of distorted price differentials between grades. Since MMC took no measures to widen or diminish the difference between producer and consumer prices, we can assume that the NPC is the same for consumers as it is for producers.

For milk, a time series of NPCs is given. In year 11, for example, the NPC at the official exchange rate was 0.66. In that year, producers received a price 34% below the border price equivalent. A similar rate of protection for the consumer can be assumed.

4.5.4 Relevant exercises

Exercise 4.2: Estimating NPRs at official and shadow exchange rates.

Example: Assume our country has recently become a net importer of maize. The current producer price at the farm gate is L$ 30/t, while the current consumer (retail) price is L$ 50/t (sifted). The price for an equivalent quality c.i.f. at the border is US$ 150/t, and the official exchange rate is US$ 1 = L$ 0.30. It costs approximately L$ 5.00/t to store maize and transport it between the border and the wholesale market, and an additional L$ 3.00 to sift the grain, package it and transport it to retail outlets. Transport from the farm gate to the wholesaler averages L$ 4.00/t. Market processing, handling and transport facilities are competitive, with no monopoly element, but the official exchange rate is 30% overvalued. Given this information, producer border price equivalents and NPRs can be estimated as follows:

Maize import price c.i.f. (US$/t)	150.00
x official exchange rate (US$ 1.00 = L$ 0.30)	
= import price equivalent (L$/t)	45.00
+ transport/storage costs to wholesaler (L$/t)	5.00
= local wholesale border price equivalent (L$/t)	50.00
- transport costs, farm gate to wholesaler (L$/t)	4.00
= border-equivalent farm-gate price at official exchange rate (L$/t)	46.00
+ adjustment for currency overvaluation[3]	13.50
= border-equivalent farm-gate price at shadow exchange rate	59.50

[3] The adjustment for currency overvaluation is calculated as: border price in US$ x (shadow exchange rate - official exchange rate), where exchange rate is stated as amount of local currency per US$.

Thus, the NPC for producers at the official exchange rate is 0.65, while at the shadow rate it is 0.50. At the official rate, the NPR at the farm gate is -35%. That is, farmers are implicitly being taxed at a rate of *35%* for growing and selling maize. The NPR for producers at the shadow rate of exchange is even more negative at -50%.

Border price equivalents and NPRs for the consumer are calculated as follows:

Maize import price c.i.f. (US$/t)	150.00
x official exchange rate (US$ 1.00 = L$ 0.30)	
= import price equivalent (L$/t)	45.00
+ transport/storage costs to wholesaler (L$/t)	5.00
= local wholesale border price equivalent (L$/t)	50.00
+ processing/transport costs to retailer (L$/t)	3.00
= border-equivalent consumer price at official exchange rate (L$/t)	53.00
+ adjustment for currency overvaluation	13.50
= border-equivalent consumer price at shadow exchange rate	66.50

Thus, the NPC for consumers at the official exchange rate is 0.94; at the shadow rate it is 0.75. At the official rate, consumers are paying 6% less than the border price equivalent; at the shadow rate they are paying 25% less.

Exercise: (estimated time required: 3 hours).

Question 1. Refer to Question 2 of Exercise 3.8, Table 3.11 and the graphs derived for beef production and consumption. The country is a net exporter of beef, as shown by the net traceable surplus calculations. Calculate the border-equivalent consumer and producer prices and NPRs for beef, given the following information:

- The 1986 farm gate price CDW for FAQ beef is L$ 340/t.

- The 1986 retail price for cut beef CDW is L$ 350/t.

- The f.o.b. border price for CDW cut beef is US$ 1500/t and handling costs to the border from the wholesaler are L$ 6.30/t.

- It costs L$ 6.00/t to transport and market beef from the wholesaler to the retailer in cut form. Transport from the farm gate to the wholesaler costs L$ 9.00/t and processing to cut beef costs L$ 32.00/t. The value of by-products retrieved during processing (hides, blood, bone etc) is L$ 56.00/t.

- Exchange rates are the same as in the example given above, and marketing and transport activities are competitive, with no monopoly elements.

Enter your calculations into Tables 4.1 and 4.2 and comment on the results.

Question 2. Refer to Question 2 of Exercise 3.8, Table 3.11 and the graphs derived in the exercise for whole milk. The country is a net importer of whole milk, as indicated by the net traceable surplus figures. Calculate the border-equivalent consumer and producer prices and NPRs for milk, given the following information:

- The 1986 international price c.i.f. at port of entry for powdered whole milk is US$ 800/t (13.5 kg of whole milk powder with added water is reconstituted to form 100 litres of liquid whole milk).

- The 1986 farm-gate price of whole milk is L$ 50.00/t and the consumer price (processed, in carton or bottled form) is L$ 60.00/t.

- It costs L$ 4.00/t of liquid milk equivalent to transport powder from the border to the wholesale point, and another L$ 8.00/t of liquid milk equivalent to reconstitute powder to liquid form.

- It costs L$ 7.00/t to transport whole milk from the farm gate to the wholesale point.

- Processing of whole milk to bottled or carton form plus wholesale to retail marketing costs are L$ 2.00/t.

Given the same exchange rates, and assuming that marketing functions are competitive, complete Tables 4.1 and 4.2 for whole milk and comment on the results.

Table 4.1. *Border equivalent producer prices and NPRs for beef and whole milk.*

Situation	Net exporter (Beef)	Net importer (Milk)

Operator (+, -, x)		
Export situation (beef)		
Export price f.o.b. (US$/t CDW)		n.a
Official exchange rate (US$ 1 = L$ 0.30)		n.a
Export price f.o.b. (L$ equivalent/t CDW)		n.a
Handling costs, border to wholesale (L$/t)		n.a
Processing and transport, farm gate to wholesale (L$/t)		n.a
By-products from processing (L$/t)		n.a
Border equivalent farm-gate price/t CDW equivalent (official exchange rate)		n.a
Effect of currency overvaluation		n.a
Border equivalent farm-gate price/t CDW equivalent (shadow exchange rate)		n.a
i) Nominal protection coefficient (official exchange rate)		n.a
ii) Nominal protection coefficient (shadow exchange rate)		n.a
Import situation (whole milk)		
Import price c.i.f (US$/t whole milk equivalent)	n.a.	
Official exchange rate (US$ 1 = L$ 0.30)	n.a.	
Import price (L$/t whole milk equivalent)	n.a.	
Transport costs, border to wholesale (L$/t)	n.a	
Costs of reconstitution (L$/t)	n.a.	
Transport costs farm gate to wholesale (L$/t)	n.a.	
Border equivalent farm-gate price/t (official exchange rate)	n.a	
Effect of currency overvaluation	n.a	
Border equivalent farm-gate price/t (shadow exchange rate)	n.a	
i) Nominal protection coefficient (official exchange rate)	n.a.	
ii) Nominal protection coefficient (shadow exchange rate)	n.a.	

n.a. = not applicable

Table 4.2. *Border-equivalent consumer prices and NPRs for beef and whole milk*

Operator - Situation	**Net exporter**	**Net importer**
Exporter	**(Beef)**	**(Milk)**
Export situation (beef)		
Export price f.o.b (US$/t CDW, cut form		n.a.

Official exchange rate (US$ 1 = L$ 0.30)		n.a.
Export price f.o.b (L$ equivalents CDW)		n.a.
Handling costs, border to wholesale (L$/t)		n.a.
Transport and marketing cost, wholesale to retail, (L$/t)		n.a.
Border equivalent consumer price/t CDW equivalent (official exchange rate)		n.a.
Effect of currency overvaluation		n.a.
Border equivalent consumer price/t CDW (shadow exchange rate)		n.a.
i) Nominal protection coefficient (official exchange rate)		n.a.
ii) Nominal protection coefficient (shadow exchange rate)		n.a.
Import situation (whole milk)		
Import price c.i.f. (US$/t whole milk equivalent	n.a.	
Official exchange rate (US$ 1 = L$ 0.30)	n.a.	
Import price c.i.f (LS$/t whole milk equivalent)	n.a.	
Transport and storage costs to wholesale (LS$/t)	n.a.	
Cost of reconstitution (L$/t)	n.a.	
Transport and processing costs to retail (L$/t)	n.a.	
Border equivalent consumer retail price/t (official exchange rate)	n.a.	
Effect of currency overvaluation	n.a.	
Border equivalent consumer retail price/t (shadow exchange rate)	n.a.	
i) Nominal protection coefficient (official exchange rate)	n.a.	
ii) Nominal protection coefficient (shadow exchange rate)	n.a.	

n.a. = not applicable.

Important points (4.5)

- For detailed policy analysis, it is essential to assess quantitatively the effect of various policy instruments. To compare various policy instruments, a common denominator is required.

- For any tradeable commodity, the border price equivalent is used as a common denominator.

- The difference between border price equivalent and the domestic price is taken as the yardstick to measure the effects of different policy instruments in terms of price distortions.

- The divergence of domestic prices from the border price equivalent is generally expressed in terms of nominal rate of protection (NPR) for a commodity or normal protection coefficient (NPC). Their values are calculated as:

NPR = {(DP - BP)/BP} X 100

NPC = DP/BP = (NPR/100) + 1

where

DP = the domestic price for the commodity

BP = the border price equivalent for the commodity

• Since policies may have different implications for producer and consumer prices; two different rates of protection may need to be estimated.

• For non-tradeable commodities, the domestic equilibrium price is used as a reference, point. Sometimes *ad hoc* approaches are more appropriate.

• Shadow rates of exchange express the real value of a local currency.

4.6 What is the effect of current policies?

To complete our analysis of current market price and trade policies, we need to measure their effects on consumer and producer welfare as well as on the amounts of a commodity produced, consumed and traded. To do this, information on **price elasticity** must be incorporated.

4.6.1 Estimating price elasticity

The concept of price elasticity expresses the responsiveness of demand and supply to price changes. In this section, we discuss the problem of how to estimate elasticity, outlining a few of the factors known to influence it.

Elasticity must be estimated empirically, and there is often controversy about the estimates used. In addition, econometric analysis tends to be cumbersome and time consuming. As a result, policy analysts often have to rely on their best guesses, based on whatever estimates are available for other similar commodities or countries. In Africa, elasticity estimates are rarely available, and there is a dearth of reliable data from which to calculate them.

Price elasticities of demand and supply vary significantly between commodities. As a rule, they tend to increase as the degree of substitutability between commodities increases. For example, elasticities of demand and supply for individual grades of beef will tend to be higher than for beef as a whole. This is because consumers are more likely to switch between different grades of beef than to switch from beef to some other meat. Likewise, producers will find it easier to adjust the kind of beef they produce than to move out of beef altogether. The availability of the inputs or technology required to increase production is an important determinant of the price elasticity

of supply. For example, livestock production based on the use of purchased feed is likely to be more flexible than production based on rangeland feed resources.

In terms of supply, an important consideration is the time horizon used to estimate probable response. The short-term elasticity of supply tends to be considerably less than the long-term. This is particularly true for livestock production, where short-term market supply responses may even be negative (Table 3.9).

4.6.2 Effects on quantity

The quantity effects of policies can be calculated by multiplying the NPR for a commodity by its elasticity:

% change in quantity = elasticity x NPR (%)

where NPR is also the percentage change in price caused by the current policy measure. This formula holds for both supply and demand.

Having estimated the effects of a policy instrument on domestic supply and demand, it is relatively simple to calculate its probable **international net trade effect.** This is simply the difference in the surplus available for export (or deficit requiring to be imported) resulting from the change in domestic production and consumption. The effect on the balance of payments can easily be calculated by multiplying the net trade effect by the border price. Exercise 4.3 gives examples of how these effects are calculated.

4.6.3 Effects on producer income and consumer surplus

The aggregate effect of a price change on the income of producers can also be estimated. It will be brought about by a combination of changes in price and changes in the amount produced. This can best be understood by looking at the area between the two price lines (P1 and P2) and the supply curve shown in Figure 4.4.

Conceptually, the overall income change can be broken down to small incremental changes. Each small change in income consists of a separate price multiplied by its respective volume of production.

If the calculation of these income effects were limited to the effects on producers' income, then rises in commodity prices would usually seem desirable because they would lead to rises in producers' income. Similarly, price falls would usually seem undesirable because they lead to falls in producers' income.

In reality, the effects of commodity price changes on consumers need to be taken into account to offset them against the effects on producers. Effective policies often depend on striking a fair balance between the interests of the consumer and those of the producer.

The concept of **consumer surplus** enables us to quantify the effects of price changes on consumer welfare. Consumer surplus is defined in terms of the amount consumers would have been prepared to pay for a commodity in excess of what they actually paid. Suppose you would have been prepared to pay $ 0.75 for an egg but only had to pay $ 0.50 for it. Your consumer surplus is $ 0.25. Figure 4.5 helps us understand the concept of consumer surplus. The change in consumer surplus is represented by the area between the two price lines and the demand curve. Again, this can be calculated in terms of the effect of incremental price changes on the quantity consumed. Each small change multiplied by its respective consumption level gives the resulting change in consumer surplus.

Figure 4.4. ***Change in producers' income resulting from a price change.***

Figure 4.5. ***Change in consumer surplus resulting from a price change.***

In algebraic terms, changes in producer income and consumer welfare can be roughly estimated by multiplying the absolute difference between any two prices (P_1 and P_2) by the average of the quantities produced (S_1 and S_2) or consumed (D_1 and D_2) at these prices. That is:

Effect on producers' income = $(P_2 - P_1) \times (S_1 + S_2)/2$

Effect on consumers' surplus = $(P_2 - P_1) \times (D_1 + D_2)/2$

where the symbols have the same meaning as in Figures 4.4 and 4.5.

4.6.4 Effects on budget and net welfare

We are also interested in the impact of policy on a government's budget and on net economic welfare. The budget effect, assuming that all differences between domestic and border equivalent price arise from taxes, subsidies or the profits and losses of government corporations, is best calculated as follows:

Budget effect = (DPP-BPP) x S - (DCP-BCP) x D

where

DPP = domestic producer price
BPP = border producer price
DCP = domestic consumer price
BCP = border consumer price
S and D = supply and demand.

If the resulting number is positive, the policy instrument results in net government expenditure. If it is negative, there is a net income to the government. In cases where quantitative restrictions (in contrast to tariffs) allow those with import licenses to capture all or part of the difference

between border equivalent and domestic prices as excess profits which do not accrue to the government (section 4.4.1), the calculation must be adjusted accordingly.

The **net welfare effect** of a policy is the sum of the effects on producers, consumers and the government budget. Figure 4.6 demonstrates how the net welfare effect of an export tax can be derived.

Before the imposition of an export tax, the domestic price is equal to the border price equivalent at P_1. At that price, domestic consumer demand Q_1 and the balance of production (Q_4 - Q_1) is exported.

The government now imposes an export tax (P_1 - P_2). After the tax, the producer receives only P_2, which becomes also the domestic price. At that price, producers decrease their supply to Q_3 and consumers increase their demand to Q_2. The balance (Q_3 - Q_2) is still exported.

The welfare effects are as follows. The fall in the after-tax price reduces producers' incomes by the area AEFH. This income loss is partially offset by gains made by consumers and by government. Consumers gain a surplus represented by ABGH. The government gains revenue represented by CDFG. The net welfare effect is an uncompensated loss represented by the two triangles BCG and DEF. This is the cost of the government's intervention.

Because they distort domestic resource use away from the economic optimum, interventions of this kind usually have a negative effect on net economic welfare. The price decrease resulting from the tax has reduced domestic production below what could have been competitively produced at the international price. At the same time, consumers benefitting from lower prices have been led to believe that the commodity is less scarce than it actually is. In other words, when policies disrupt market forces, prices no longer convey the appropriate signals to producers and consumers.

Figure 4.6. ***Net welfare effect of an export tax.***

Sometimes, there may be sound reasons for government interference with free market forces, and some of these reasons are discussed in the next section. In such cases, the benefits of intervention should always be set against the overall welfare losses which result. These would be measured in the way just described. Moreover, we need to remember that net economic welfare may not be a complete indicator of all the welfare aspects of change within society. This is because our definition weighs all incomes in the economy equally (i.e. regardless of income distribution). If, however, consumers in the export tax example given above are poorer than producers, the government may want to give their gains more weight (per nominal $) than the producers' losses.

4.6.5 Limitations of the analysis

The analysis of policy effects, as presented, has a number of limitations. For example, the analysis is partial in the sense that it is applied to individual commodities, without taking into account the linkages which might exist between different commodities. In reality, however, such

linkages may be very important to both production and consumption. While these limitations can be overcome, the methods adopted will not be discussed here.

4.6.6 Relevant exercises

Exercise 4.3: The effect of price and exchange rate policies at consumer, producer and national levels.

Example 1. National effects of price policy. The effects of price and exchange rate policies on maize production and consumption, foreign exchange and foreign trade are summarised in Table 4.3. Relevant data from Exercise 4.2 are given and the price elasticities of demand and supply, and 1986 national consumption and production levels are also stated. From these data, the following policy effects can be calculated for maize priced at the shadow rate of exchange:

• Production: At the official exchange rate, the NPC for the farm-gate price is 0.65, showing that producers are paid *35%* below the border price equivalent. Given a supply, elasticity of 0.3, this means that the existing price policy lowers production by 10.5% (i.e. 0.3 x 35.0). Aggregate maize production is thus reduced by 115,500 t (1.10 million t x 0.105).

• Consumption: Consumers, on the other hand, pay 6% lesthan the border price equivalent at the official exchange rate. At a price elasticity of demand of -0.1, this price depression has increased maize consumption by 7500 t.

• Foreign trade: The net foreign trade effect of this price policy is simply the increase in consumption and the decrease in production, i.e. 7500 + 115,500 = 123,000 t of maize which, in the absence of current policies, would not have had to be imported.

• Foreign exchange: These additional imports, valued at the current US$ price/t c.i.f (i.e. US$ 150), result in an extra foreign exchange expenditure of US$ 150 x 123,000 t = US$ 18.45 million.

Table 4.3. *The effects of government policy on consumption, production, foreign trade and foreign exchange earnings of maize, beef and milk.*

	Item	Unit	Maize (1986)	Beef (1986)	Whole milk (1986)
i) Data:	Producer price	L$/t	30.00		
	Retail price	L$/t	50.00		
	Import price	L$/t	45.00		
	Export price	L$/t	-		
	Protection coeff. Production	(Official exch. rate)	0.65		

	Protection coeff. Consumption	(Official exch. rate)	0.94		
	Level of national production	'000 t	1100.00	152	580
	Level of national consumption	'000 t	1250.00	115	680
ii) Assumptions:	Price elasticity of supply	(%)	+0.30	+0.50	+0.60
	Price elasticity of demand	(%)	-0.10	-1.20	-1.20
iii) Calculated results:	Policy effects on:				
	- production	'000 t	- 115.5		
		(%)	(-10.5)		
	- consumption	'000 t	+7.50		
		(%)	(+0.60)		
	- foreign trade		123.00		
		(%)			
	-foreign exchange[1]	US$ million	+18.45		

[1] Refers to savings or losses in foreign exchange as a result of policies adopted, i.e. foreign trade effect multiplied by border price policies.

Example 2. Farm-level effects of price policy. Table 4.4 presents data on changes in the maize gross margin per ha and per person-day for maize produced by the agropastoral farm used in module 3. The border price equivalent for maize at the official rate of exchange is taken from the example in Exercise 4.2. At the official exchange rate, the border price equivalent farm-gate price is L$ 0.046/kg, compared with the current producer price of L$ 0.03/kg. At the shadow exchange rate, it is L$ 0.060. Gross margins per ha and per person-day are, thus, considerably higher at the shadow foreign exchange rate.

Exercise: (estimated time required: 3 hours).

Question 1. Using data from Exercise 4.2, complete Table 4.3 for beef and whole milk, using the border price equivalent at the official exchange rate.

Question 2. Using data from Exercises 3.1-3.2 and 4.2, complete Tables 4.4 and 4.5. Note that for hybrid maize seed, the price per unit used should remain unchanged. Ignore the cost of manure in Table 3.3.

Question 3. For both sets of tables, comment briefly on the results.

Question 4. Discuss in qualitative terms how the results change when the border price equivalent at the shadow exchange rate is applied. If time is available, compute the pure effect of currency overvaluation for beef.

Table 4.4. ***Impact of different producer price levels of the gross margins of maize and beef enterprises on farms in an agropastoral production system.***

Table 4.5. ***Impact of different producer price levels on the gross margins of maize and dairy enterprises on farms in a small-scale dairy production system.***

Important points (4.6)

- The concept of elasticity expresses the responsiveness of supply and demand to changes in commodity prices.

- Price elasticities of demand and supply vary significantly between commodities. Elasticity increases with substitutability of commodities,

- The effect of a policy on the quantity of a commodity is calculated by multiplying nominal protection, rate by its elasticity.

- The net trade effect of a policy is expressed in terms of gross exports minus gross imports.

- The effect of price changes on producer income is computed by multiplying the change in price by the change in quantity produced.

- The concept of consumers' surplus shows how price changes affect consumers.

- The effect of policies on the government budget is best calculated as:

Budget effect = {(domestic producer price - border producer price) x supply}-{(domestic consumer price - border consumer price) x demand}

- The net welfare effect of a policy is the sum of effects on producers, consumers and the government budget.

- Government interference in prices usually results in a net welfare loss.

4.7 How does interfering with price help to meet different government objectives?

Thus far we have examined some of the instruments of market, price and trade policies and shown how to quantify their effects. We will now discuss the extent to which government interference with prices helps meet different national objectives. The module will end with a brief discussion of practical issues concerning the implementation of trade, price and market policies.

In module 2, government objectives were classified under five major categories. Our discussion will focus on three of these categories: the stability objective; the equity objective and the efficiency objective.

4.7.1 Stability objective

Instability in the price and/or availability of major commodities and inputs may result from fluctuations in supply and demand on either the international or the domestic market. In both cases, there are sound arguments for stabilising domestic prices, since abrupt changes often have undesirable effects on income distribution and/or resource use. In addition, they play havoc with both national and individual planning.

However, a stabilisation policy which attempts to freeze prices at a certain level, when long- or medium-term trends in international supply and demand are moving them away from that level, will usually have undesirable effects on farmers' incomes, consumers' surplus and the government budget. A stabilisation policy which evens out extreme inter-year fluctuations but keeps the domestic price moving in the same direction as medium-term border price equivalents is probably the most sensible one.

If domestic production can only be increased at costs which exceed world market prices, price interventions geared to the promotion of self-sufficiency may be unwise. The pursuit of self-reliance (in the sense of fostering economic prosperity) will be a more cost-effective route to stable food availability.

Similarly, market, price and trade policies often aim to stimulate domestic production and/or discourage consumption in an attempt to save/earn foreign exchange and prevent foreign exchange crises. Such a strategy, however, cannot be easily defended. Balance of payment problems should be tackled through appropriate macro-economic policies, in particular exchange rate adjustment. Policies which distort individual markets decrease the international competitiveness of the economy and are therefore likely to lead to deterioration of the balance of payments in the long term.

Box 4.4: The case of Alphabeta.

Alphabeta has experienced a decline in price for several of its export commodities and a resulting deterioration in its balance of payments. One conceivable policy reaction would be to provide support for producers of those commodities in an attempt to raise the volume of exports to its previous level. To the extent that such producer support would eliminate existing negative protection, this would be a desirable policy response. However, expanding exports beyond the competitiveness of domestic producers on international markets would be inadvisable.

Heavy dependence on a few commodities for the generation of foreign exchange incurs a higher risk of economic instability (a sudden change in the economic fortunes of the country). Countries often attempt to overcome this problem by diversifying their export trade. This strategy may require a degree of protection for the production of new export commodities. Justification for

this will depend on whether the direct welfare costs involved are less than the macro-economic benefits associated with greater foreign exchange stability.

4.7.2 Equity objective

Arguments in favour of interference are often based on equity criteria. Price distortion is justified on the grounds of income redistribution between and within the various groups of consumers and producers. Interventions will often be effective in achieving redistribution objectives of this nature, particularly when the proportion of producer or consumer income affected is large.

However, the problem is that market, price and trade interventions do not only affect the distribution of income. They also affect the structure of production and consumption. This, in turn, may have international trade and welfare implications. The desired effects of income redistribution must therefore be balanced against any negative welfare effects resulting from structural changes.

Moreover, income transfers resulting from market policies tend to be non-specific in terms of who benefits and who pays. For example, a general low-price policy for food benefits not only poor urban consumers (who may be the policy target group), but also consumers in other income classes who could afford to pay unsubsidised prices.

Sometimes it may be possible to avoid this non-specific policy effect by concentrating on commodities of particular importance for the target group (i.e. by implementing **self-targeting policies).** For example, if cassava is consumed largely by the poor, subsidising its consumer price is likely to have the desired effect. However, self-targeting policies are not always feasible

Regardless, it is always worth asking whether more cost-effective ways of achieving the same end are not open to government. In economic terms, alternative ways of affecting income distribution, without distorting the structure of production and consumption, may well be superior to interventions in the market place.

If direct transfers (in cash or kind) to the target group are feasible, they should be given preference over price policies. For example, food stamp or similar schemes for poor consumers are preferable to low-price food policies. A policy which works directly towards eradication of the cause(s) of poverty should be given priority over one which merely attacks the symptoms.

Direct income redistribution policies are not always easy to implement. Among other things, they may require substantial government expenditure, which may be difficult to finance.

Similarly, market policies are often implemented to increase government revenue (for example, through export taxes or low producer prices). Again, it must be emphasised that such measures often have negative side-effects, and these must be taken into account in any policy evaluation exercise.

Box 4.5: The case of Alphabeta.

Taxation through low producer prices often has negative effects on producer income distribution. Alphabeta's low-price policy for beef demonstrates this. Although herd size and sales levels are highly skewed, the policy affects both large and small producers. Direct taxation could instead be targeted towards larger producers, with more effective impact on income redistribution.

4.7.3 Efficiency objective

As far as economic efficiency is concerned, few arguments favour market intervention and price distortion. Where producers need incentives to embark on new enterprises, adopt new technology or enter the market, there may be a case for stimulating responses by offering price incentives. This is known as the **infant industry** argument for producer protection.

However, since policies of this nature tend to become entrenched, it is often difficult to abandon protection after achieving the initial purpose. The possible negative long-term consequences of such a policy must therefore be weighed against its short-term benefits.

Production may occasionally have pronounced positive or negative **external effects** which justify price intervention. For example, if there is overwhelming evidence that overgrazing is endangering the long-term sustainability of production in a particular area, there may be a case for lowering producer prices for animals raised there in order to reduce the incentive to keep so many.

In many cases, however, external effects do not result from production as such, but from a specific method of production or input use (this appears to apply to the problem of overgrazing). The appropriate policy response in such cases is to attack the root causes of the problem rather than some superficial or symptomatic aspect of the production system. For example, low market supplies of cattle may reflect the circumstances of a particular production system at a given point in time (e.g. the post-drought rebuilding of herds), rather than a deficiency in marketing infrastructure or in the price policy adopted.

A different issue, and indeed a difficult one, is the **balance of protection** offered to different sectors of the economy. In many African countries, the manufacturing sector is protected at the expense of the agricultural sector.

Box 4.6: The case of Alphabeta.

In Alphabeta, the protection of certain manufacturing industries penalises the agricultural sector. Resources have been attracted into the manufacturing sector, wages have increased and the terms of trade have moved against agriculture.

In such circumstances, the appropriate strategy would be to reduce distortion by decreasing protection for the manufacturing industry. Where this is not feasible, there may be a case for protecting agriculture in order to counter the effects of protecting industry. In this way,

distortions in resource allocation can be balanced or redressed, but the number of policy measures multiplies, complicating the analysis.

Such a policy, known in economics as a **second best** policy, may well be justified, for the case against disadvantaging agriculture in developing countries is very strong. In the long run, however, an accumulation-of second best policies may make a return to best policy options increasingly difficult.

In considering alternatives to existing policies, the costs of using any additional administrative resources should be included in the analysis. Countries attempting to implement self-targeting policies may find themselves unable to do so because they lack the necessary institutional resources. Effective implementation of market, price and trade policies also depends on the existence of efficient institutions.

4.8 Implementation problems associated with market, price and trade policies

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4.8.1 Relevant exercises

Although governments may have clearly defined objectives when market, price and trade policies are initially implemented, the overall policy framework may lack coherence. Different measures may be introduced at different times, some (or even most) of which may no longer be justified. For political reasons, it is often difficult, if not impossible, to modify or abandon an existing policy. Again, different government institutions may be responsible for different measures, with the result that the overall policy package is inconsistent. Two general principles should be observed:

- The number of policy measures should be kept as small as possible. The larger the number of measures, the greater the likelihood of inconsistency. Thus, before a new measure is introduced, it is important to determine whether existing measures can be adapted to achieve the same objectives. Ironically, new measures are often introduced to counter the negative effects of existing policies. Instead, it may be better to abandon an existing measure than to introduce a new one.

Box 4.7: The case of Alphabeta.

In Alphabeta, beef is illegally slaughtered and traded. This problem could possibly be solved by imposing fines or by exercising greater control over marketing. However, instead of introducing these new measures, it would seem more sensible to tackle the cause of the problem by changing the operations of the MMC, thereby removing the incentive to trade illegally.

Measures which have a direct bearing on quantities and prices should be controlled by the smallest possible number of institutions. In addition, there must be close co-operation among the different institutions involved. Particular care should be taken to reconcile domestic with border measures and to ensure that consumer policies are in harmony with those applied to producers.

Box 4.8: The case of Alphabeta.

In Alphabeta, the number of institutions involved in marketing is too large: five ministries and eighteen statutory boards. Moreover? border measures for beef appear inconsistent with domestic marketing interventions.

- Policy instruments should be continually under review. Long-term objectives and effects must always be carefully considered during such reviews, for the danger is that they will be eclipsed by short-term exigencies, such that the original intentions of the policy are lost. To avoid this, the direction of a domestic price policy might, for example, be monitored by regular comparison of the administered price with the equivalent border price (using a 3-year moving average).

Changes in commodity price relationships should also be monitored. Marginal price changes which move the prices of closely-related commodities in opposite directions can have more serious consequences than a distortion resulting from broad-based price protection for the whole sector. Again, it should be emphasised that price ratios in international trade will normally provide the most reliable basis for domestic pricing decisions.

4.8.1 Relevant exercises

Exercise 4.4: Group exercise: Market, price and trade policies. Read the relevant sections of the central case study.

Question 1. Calculate the NPC at the producer level for any one year of your data set.

Question 2. Estimate how this protection may have affected production, government budget and foreign exchange earnings. If estimates of supply elasticity are not available, make reasonable assumptions. Justify your assumption for supply elasticity in qualitative terms.

Question 3. What government policies may have caused this protection? Were these policies appropriate, given the country's overall objectives for the livestock subsector? What better market, price and trade policies could have been applied? Why would they have been better?

Important points (4.7-4.8)

- Government interference with market, price and trade policies is generally motivated by certain national objectives such as stability, equity and efficiency.

- Two major concerns of a government, in terms of stability, are to avoid abrupt changes in prices and/or quantities offered on the domestic market, and to maintain equilibrium in balance

of payments.

• Price stabilisation policies should ensure that domestic prices move In the same direction as international prices.

• Equity concern,; may lead a government to formulate price policies aimed at income redistribution between producers and consumers. Such interventions affect the distribution of income within the community and the structure of production and consumption.

• Alternative ways of affecting income distribution should *be* sought in place of price *policies* with negative side effects,

• Price policies or market interventions intended to reinforce economic efficiencies may be justified in order to introduce new production technology, transfer resources into alternative activities, stimulate market entry and the like. However, protection offered in the farm-price policies to encourage such incentives becomes difficult to abandon even after achieving its initial purposes.

• Effective implementation of market, price and trade policies depends on the existence of efficient institutions. The major problem in implementation of these policies is the lack of' coherence in the overall policy framework, Two important principles to remember are:

- The number of policy measures and institutions administering them should be kept as low as possible and effective communication should be maintained within existing institutions.

- Policy instruments should be frequently reviewed.

4.9 Feedback exercises

All answers can be found in the text.

1.a. Name two main areas that market and price policies focus upon:

i) _____
ii) _____

b. What type of information would you collect to analyse the nature of the current policy instruments being used by a government?

i) _____
ii) _____
iii) _____

2. List some important parameters used for the quantitative assessment of the effects of policy instruments.

i) _____
ii) _____
iii) _____
iv) _____

3.a. Explain the terms "open economy", "closed economy" and "border price equivalent".

_____

b. How does the effect of producer subsidy differ in an open economy from that of a closed economy?

_____

4.a. Name the common denominator used to compare policy instruments for traceable and non-traceable commodities.

traceable commodities_____
non-traceable commodities _____

b. Define nominal rate of protection (NPR) and nominal protection coefficient for a commodity (NDC).

(NPR) =
(NPC) =

5.a. What are the two concepts used to calculate the effects of policies on the quantity (supply/demand) of a commodity? Tick (√) the correct answers.

i) border price equivalent
ii) price elasticities
iii) shadow price
iv) nominal rate of protection
v) domestic equilibrium price

b. Which of the following are included in determining the net welfare effect of a policy? Tick (√) the correct answer(s).

i) effects on producers
ii) effects on consumers
iii) effects on the government budget
iv) none of the above
v) all of the above

6. Circle T for True and F for False.

i) Government interference with prices is always for justifiable objectives.

T F

ii) Self-reliance, rather than self sufficiency, should be the goal of a government's stability objective.

T F

iii) A high degree of export concentration on a few commodities for foreign exchange earning is preferred to diversifying export trade.

T F

iv) Price policies associated with the equity objective of a government focus on income redistribution between producers and consumers.

T F

v) The appropriate policy responses to national objectives should attack the root causes of the problem rather than the symptoms.

T F

vi) In order to avoid policy implementation problems, the number of policy measures should be kept as large as possible.

4.10 References

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5.1 Performance objectives

Module 5 is intended to enable you to:

1. Define marketing and explain the role of marketing in economic development.

2. Discuss the theory of markets.

3. Describe the main characteristics of marketing systems for their basic elements, functions, agents, enterprises and channels.

4. Explain specific features of livestock marketing as compared with crop marketing.

5. Discuss some important methods of evaluating marketing systems.

6. Differentiate between direct and facilitating roles of governments in improving markets.

7. Describe three types of indirect government interventions for market improvements.

8. Describe how an effective marketing system contributes to the national objectives of a country.

5.2 Marketing and its role in economic development

5.2.1 What is marketing?

Markets are the context, both physical and conceptual, where exchange takes place. Marketing includes all activities from the producer to the final including processing and distribution systems. The term **producer** includes farmers or pastoralists and the manufacturers of production inputs when they produce the commodity being marketed. The term **consumer** is used for anyone who is the final consumer of a product or the final user of a production input (e.g. pastoralists may consume butter and veterinary inputs). The **retailer** is the final link in the

chain from producer to consumer. Hence, an urban butcher is a retailer and so is a vaccinator in the government veterinary services who delivers a vaccination. The **wholesaler** delivers the product to the retailer. The term **farm gate** is the location of a sale where a farmer keeps his or her animals or produces his or her crop (i.e. on a farm in the case of settled cultivators or at an encampment in the case of pastoralists). The terms **market actors** and **market agents** are used interchangeably to represent any persons participating at any level of the market.

The objectives of marketing vary. For the individual producer or consumer, the objectives may be to maximise benefits from the resources available and to expand marketing operations in order to increase wealth. From a societal viewpoint, the objectives may be to encourage efficient allocation of resources, to create wealth and promote economic growth in order to improve the general welfare of society. Important considerations may also be to improve distribution of income between sectors of the economy and to maintain some stability of supply and demand for marketed goods. The concurrence of marketing objectives with national policy objectives identified in module 2 will be discussed later in this module.

5.2.2 Characteristics of agricultural and livestock marketing

Agricultural marketing in Africa normally begins at the level of the individual smallholder. Producers usually carry out some or all of the marketing steps. Often, because producers are also consumers, little of what is produced is marketed. Livestock owners may be only marginally market-oriented. Because of traditional attitudes towards wealth in cattle, owners may choose to hold cattle rather than market them.

Producers are likely to be some distance away from consumers. They may also be highly dispersed. Both conditions affect the nature of the marketing and distribution process. Also affecting the process is the nature of agricultural and livestock commodities, which are rarely in consumable form when first entering the marketing system, and suffer from perishability or are otherwise susceptible to losses during storage/handling. Agricultural, and particularly livestock products, are generally seasonal in supply and are more susceptible to natural shocks. In Africa, the marketing of agricultural products typically suffers from limited institutional support.

5.2.3 The role of marketing and trade in development

Marketing and trade play vital roles in the economic growth and overall development of a nation. The major roles of marketing and trade in the national economy can be thought of in terms of:

- specialisation in activities of comparative advantage
- enhanced resource-use efficiency and trade
- advances in marketing with economic growth.

Specialisation in activities of comparative advantage

Without market facilities, areas must maintain diversified activities to produce their own food, shelter, tools and other needed goods. In the presence of a market, however, an individual can

specialise in one activity and sell the surplus in order to purchase other needed goods. The individual is likely to specialise on the basis of a **comparative advantage** in that activity for which he or she has some special resource or ability. A comparative advantage exists when an individual or region can produce a good, relative to the price of other goods, more cheaply than another individual or region. In livestock production, comparative advantage is often the result of agro-ecological conditions particular to a region making it suited to certain specialised activities. The agro-ecological basis for production results in regional comparative advantage, whereby all of an area with that common agro-ecological base shares the ability to produce the good relatively more cheaply than another area.

Box 5.1: Comparative advantage.

Table 5.1. *Production possibilities of beef and mutton for Countries A and B.*

Proportion (%) of land devoted to		Production ('000 t)			
Beef	Mutton	Country A		Country B	
		Beef	Mutton	Beef	Mutt
100	0	90	0	25	0
50	50	45	30	12	25
0	100	0	60	0	50

In this very simplistic example, countries A and B produce both beef and mutton. The two countries have an equ amount of productive land. Country A, however, has more favourable agro-ecological conditions than B for both and beef. Table 5. 1 shows the relative production potential of both countries for different proportions of land de each product.

The **trade-off ratio** between beef and mutton for Country A is 3/2 (i.e. 90/60 under complete specialisation; 100 land devoted to each) while for Country B it is 1/2 (i.e. 25/50). The trade-offs for the two countries can be expres

Beef	Mutton
Country A, 1 t	= 2/3 t
Country B. 1/2 t	= 1 t

Note that country A can produce more of either beef or mutton than country B. Thus, country A has an **absolute** advantage for both beef and mutton over country B. However, when we consider the trade-off ratios between bee mutton for individual countries, we find that to produce one tonne of mutton, country A has to give up the produ 3/2 t of beef and Country B only 1/2 t of beef. Therefore, Country B has a comparative advantage in the producti mutton and Country A has a comparative advantage in the production of beef.

The important point is that both countries would benefit if they could trade with each other in the item for which has a comparative advantage.

Figure 5.1. ***Production possibilities with and without specialisation of trade for Countries A and B.***

Figure 5.1 further explains the concept of specialisation and trade for beef and mutton for Countries A and B. If at the total production of beef and mutton in the two countries, we find four possible situations:

	Total produc ('000 t)
a. Countries A and B devote half of their land to each product 45 + 30 + 12 + 25	= 112
b. Both countries specialise in beef 90 + 25	= 115
c. Both countries specialise in mutton 60 + 50	= 110
d. Country A specialises in beef and Country B in mutton 90 + 50	= 140
The largest amount of production results from each country specialising in the product for which it has a compar advantage. Both countries will, however, end up with more of one good than they need and none of the other. So benefits from comparative advantage to be realised, trade must occur. Figure 1 illustrates that the largest product results at point C, where both countries specialise and trade for one product only.	

Specialised activities lead to trade. **The gains from trade** will be the value of additional production made possible through specialisation and trade. The exact gains from trade will depend on the market prices of the goods with and without trade. This concept applies equally to individuals, who use their comparative advantage to specialise in one task, selling their products to trade for the other goods they need.

Exercise 5.1: Comparative advantage (estimated time required: 3/4 hour).

The table below provides production alternatives for countries C and D in milk and beef production.

Proportion (%) of land devoted to:		Production ('000 t)			
		Country C		Country D	
Milk	Beef	Milk	Beef	Milk	Beef
100	0	7000	0	9000	0
50	50	3500	10	4500	30
0	100	0 20	0	60	

Question 1. What are the trade-off ratios between milk and beef for countries C and D? (Hint: create two trade-off tables, one expressed in terms of 1 kg milk, the other 1 kg beef.)

Question 2. Where do absolute and comparative advantages exist for milk and beef? Use your results to discuss the type of trading scenario which would be to the advantage of both countries.

Question 3. Draw a graph, as in Figure 5.1, showing the point of greatest benefit to both countries.

Enhanced resource use efficiency and trade

Through specialisation and trade, a community is better able to utilise its limited resources. Specialisation and the resulting efficiency of resource-use is the basis for economic growth and development. As markets and economies develop, surpluses occur more frequently in profitable

activities, creating new wealth, while products are moved greater distances than before. Thus, trade is a necessary ingredient for economic growth. Marketing is simply the means by which trade occurs.

Advances in marketing with economic growth

As economic growth proceeds, several changes in marketing take place. With economic development, the activities and tasks of marketing increase. Activities such as storage and processing, packaging and retail distribution become more important. Greater activity moves away from the site of production and towards marketing. This, in turn, creates employment opportunities and further specialisation (diversification of the community). Since livestock products typically have positive income elasticities of demand, economic growth can lead directly to new opportunities for production. Thus, the livestock subsector increases in importance.

With development, more economic agents may enter trade, helping to improve marketing services and, in some cases, allowing the market to capture **external economies of scale.** This refers to a situation where the presence of many agents allows each one to operate at a lower cost. An example is the case where increased trade in some commodity (e.g. livestock allows for the establishment of large storage facilities (e.g. pre-slaughter holding areas), which lowers per unit storage costs. The physical infrastructure can also be affected in a positive way by large markets, in the form of better roads and communication, offering the potential for external economies of scale.

(Hint to instructors: Discuss the differences between external and internal economies of scale. For example, discuss external economies with respect to milk production density.)

5.2.4 Requirements for market development

For market development to occur, rural areas must be effectively linked, in terms of information and infrastructure, through the middlemen in the marketing system with urban centres of consumption. With the shift in resources away from production to marketing services, small-scale processing can expand markets by increasing demand through diversification of the end products. Perhaps most important, and crucial to the reform of African marketing systems, is the requirement that the institutional and policy environments do not discourage or unnecessarily impede the actions of marketers. As well, property rights and contracts should be protected.

Another important factor in the development of markets is the disequilibrium between demand and supply. Producers and consumers then must exert greater efforts to cope with each others' requirements. Increased efficiency resulting from trade is not in itself sufficient to create wealth. A stable but static equilibrium, where supply meets demand, may no longer produce new wealth. Disequilibrium, along with technical and institutional changes, may be the conditions needed to move to even greater comparative advantage and efficiency levels.

Further, initial scarcity of resources **(poverty trap)** can cause subsistence activities to dominate, denying the surplus labour or resources necessary to invest in new knowledge or technology

required to create comparative advantage. The institutional and organisational requirements necessary to expand markets may also be enormous. The role of property rights will play an important role, as marketing inherently involves transferring property rights. The nature of the society may restrict the scale on which such transfers can take place.

5.3 The theory of markets: six basic considerations

Module 3 showed how market supply and demand curves were derived from aggregated individual supply and demand. The intersection of the two curves gave us equilibrium market prices and quantities. We also saw how supply and demand elasticities could be used to make market price forecasts. We will now look a little more closely at how the marketing system and its structure can influence the determination of price. In this context, six main characteristics of the marketing system which influence price will be discussed:

- perfect competition
- imperfect competition: monopolies and oligopolies
- horizontal and vertical integration
- separation of markets
- product differentiation
- seasonal and cyclic variations.

5.3.1 Perfect competition

For supply and demand to determine price, a competitive situation must exist in the market. **Competition** is an ingredient in most markets which are not centrally-planned. Competition, by definition, exists when no single economic agent, whether buyer or seller, can control the price in the market. This will occur when each agent's activities in the market make up only a small part of total market activity; because many other agents are carrying out the same roles. New agents can enter the market at will if they feel there are profits to be made. Price is thus determined by the market as a whole. In theory, each agent must simply accept that price. Ideally, the market would also be large enough to absorb whatever quantity of goods is traded by any single agent at the ruling price. Since, in perfect competition, it is up to the agent to decide the quantity traded, sellers and buyers are all **quantity-fixers** and **price-takers.** Each agent chooses to trade that quantity which will maximise his or her profits and which he or she has the resources to handle.

In such a market, no agent is earning more than a normal profit level, comparable to the profits of all others in the market. Any occurrence of unusually high profits will cause new agents to enter that activity, driving down the price until profits return to normal. Market prices thus act as a signal to participants, informing them where best to expand their efforts and resources in order to achieve the greatest returns. High prices to sellers in one market sector will result in greater efforts to supply that sector. Similarly, low prices to buyers will cause greater demand for those goods, again shifting resources appropriately. Traders will move their resources to those goods

where the margin, or difference between the price they pay and the price they receive, is the greatest.

The movement of resources in response to price signals occurring in a competitive market results in one of the most important and desirable aspects of such a marketing system: the **optimal allocation of resources.** The producer is able to respond, through market signals, to the changing needs of the consumer. A well-operating market provides for the most efficient use of resources, thus providing the potential for greater wealth creation and economic development.

The ingredients for such a competitive system are thus:

- A large number of economic agents in every market activity, with unhindered entry and exit.

- A rapid and extensive flow of information, especially relating to prices, quality and quantity, between consumers, traders and producers.

- Institutional and physical infrastructures which support the movement of goods and which enable the above two requirements to be met.

5.3.2 Imperfect competition: monopolies and oligopolies

A system of perfect competition is often difficult to find. Many marketing systems are characterised by some degree of **imperfect competition,** where some agents have the ability to influence directly or indirectly, if not control, market prices. Imperfect competition occurs when one of the above requirements is not met and is usually seen in two general forms: **monopoly and oligopoly.** A monopoly exists when a single large supplier can dictate the market price because buyers have no alternative suppliers. **(Monopsony** is the case of a single buyer). An oligopoly occurs when there are only a few large actors in the market. This reduces competition and allows these actors (whether deliberately in concert or not), to influence market prices to their benefit. Both of these situations result in increased costs for other market actors and inefficient use of market resources as a whole. Inefficient resource use results when monopolists receive greater returns than they "deserve" (i.e. greater than "normal" profits). Those resources cannot then be used elsewhere. Figure 2 illustrates the concepts of complete and partial monopolies and oligopoly.

Figure 5.2. ***Levels of competition between buyers and/or sellers.***

Source: Abbot (1979: p. 213.

5.3.3 Horizontal and vertical integration

Market integration refers to the expansion of some firms to the point that they begin to occupy larger portions of the market, in terms of either activities or market share. **Horizontal integration** occurs when some firms grow so large within one trade that they are able to dominate that trade. **Vertical integration** is the expansion of activities of a firm until it controls

its raw materials at one end and its markets at the other. Contract farming is a form of **quasi-integration** where the **buyer assumes** some of the risks and also has some control over production decisions.

5.3.4 Separation of markets

Agents with some degree of monopoly power may be able to **separate markets.** If agents can control the movement between markets, they can control not only the total quantity sold but the price in each market. Under this form of discriminatory pricing, sellers take advantage of differences in demand in each market. This is done by charging a higher price in a high-income or inelastic demand market and a lower price in a low-income, elastic demand market. A micro-level example is the pricing arrived at by individual bargaining. If each buyer is unaware of what the other buyers paid, the seller can charge what the buyer can, and is willing, to pay. In a traditional livestock market, buyers are, however, aware of existing prices. A tourist buying souvenirs, on the other hand, may not be, and thus may be subject to price discrimination. On a larger scale, separation of markets might take place regionally. Separation of markets can also result from official restrictions on product movement.

5.3.5 Product differentiation

Product differentiation, which can also lead to market separation, occurs when otherwise similar products are differentiated by quality or presentation (i.e. packaging, brand name etc). An example is the urban red meat market, where prices in the elite market, sold by licensed butchers and supermarkets catering largely to higher-income consumers, may be much higher than those in shops selling to the larger community.

5.3.6 Price movement due to seasonal and cyclic variations

As with all agricultural markets, livestock markets are susceptible to **seasonal variation.** Fresh milk prices fluctuate in the same way as food crop prices - moving inversely with supply on the market as supply diminishes in the dry season. Meat prices move in a slightly different manner with natural shocks. While food prices are likely to rise during bad years when crop production falls, meat prices will fall during the same years as producers attempt to sell livestock they can no longer maintain for lack of feed or water. The bad year price rise in food causes demand to fall and sellers to hoard supplies, contributing to reduced consumption. This lengthens the period during which food supplies will last. The consequences of a bad year on the livestock market, however, are the opposite. The perishability of livestock during such a year causes supplies to be consumed more quickly than normal. The effects may be felt for years as producers attempt to rebuild their herds.

Cyclical price variation is not due to natural shocks, but is based on the reactions of supply to changing market conditions. Because sustained increases in livestock production, in response to some increase in demand, may take some years to bring about, during the lag prices may be sustained at a high level, and fall later.

5.4 Marketing systems: Functions, agents, enterprises and channels

All marketing systems have evolved within the constraints and conditions placed upon them by the production sector and by the nature of the goods being marketed. The type of product, the number, size and density of producers, the infrastructure and the policy and institutional environments all determine the type of marketing system and the effectiveness with which it operates.

Important points (5.2-5.3)

• Marketing includes all business activities involved in the flow of goods and services from producers to consumers.

• For a consumer or producer, the objectives of marketing are to maximise benefits from the available resources and to expand marketing operations to increase wealth.

• From a societal viewpoint, the major objectives of marketing are to:

- assist in the efficient allocation of resources
- create wealth and promote economic growth
- improve income distribution among different sectors of the economy
- maintain stability of supply and demand for marketed goods.

• The main characteristics of agricultural and livestock marketing in Africa are:

- Marketing begins at the level of individual farmers.
- Producers are widely dispersed.
- Agricultural and livestock commodities are perishable and seasonal in supply.
- Institutional supports are limited.

• Marketing and trade allow specialisation of activities. This leads to enhanced resource-use efficiency and economic growth. With economic development, the tasks and activities of marketing further increase, creating employment and other avenues for development.

• Some important prerequisites to market development are:

- proper linkages between rural areas and urban centres of consumption

- a conducive policy institutional environment for marketers to operate effectively and for markets to expand beyond the basic need levels of consumers and producers

- a dynamic relationship between supply and demand.

• The marketing system and its structure influence the determination of a commodity's market price.

• The six main elements of price theory used to explain market prices are:

- perfect competition
- imperfect competition
- horizontal and vertical integrations of markets
- separation of markets
- product differentiation
- seasonal and cyclic variations.

A marketing system is comprised of a number of elements: the particular products (e.g. butter only, or butter and raw milk) and their characteristics being transferred from producer to consumer; the characteristics of participants (e.g. the producer, the trader, the consumer); the functions or roles that each participant performs in the market; and the locations, stages, timetable and physical infrastructures involved.

When we talk of describing, quantifying or analysing a particular marketing system, there is an implicit assumption that we can distinguish the elements of that system from other economic activities. Analyses of marketing systems usually include a quantification of the flows and of the value added, costs and profit margins at each stage in the system.

5.4.1 Marketing functions

Marketing is sometimes thought of as simply the process of buying and selling. Its tasks are much more extensive than this simple description. For a marketing system to be operative and effective, there are three general types of functions which it must provide.

• Exchange functions:

- buying
- selling
- pricing.

• Physical functions:

- assembling
- transport and handling
- storage
- processing and packaging
- grading and standardisation.

• Facilitating functions:

- financing and risk-bearing
- market information
- demand and supply creation
- market research.

Exchange functions are what is commonly thought of as marketing. They involve finding a buyer or a seller, negotiating price and transferring ownership (but not necessarily physical transfer). These functions take place at the "market" - that is, the physical meeting point for buyers and sellers at the point of production or *via* some other means of communication. At this point, formal or informal property rights are important to ensure the reliable transfer of ownership and to guarantee legality (e.g. that animals on sale were not stolen and will not be reclaimed).

Physical functions enable the actual flow of commodities through space and time from producer to consumer and their transformation to a form desirable to the consumer. Assemblying or concentrating the product at convenient points allows its economical transport (i.e. getting enough animals together to transport cheaply). This is a valuable function which is often overlooked in the public perception of traders. Storage allows the commodity to be held until peak season demand, thereby stabilising supply. Processing transforms the commodity into the products desired by the consumers. Grading and standardisation allow the consumer to be more confident of the characteristics of the good being purchased.

Financing and risk-bearing are two important facilitating functions. The owner of goods at any marketing stage must sacrifice the opportunity to use the working capital needed to buy those goods elsewhere. Or the owner must borrow that capital. In either case, capital must be provided by the trader or by some lending source. Regardless, cost is involved. Further, there is an implicit cost in the risk of losing all or part of that capital through theft, spoilage, mortality or changing market conditions. Without the willingness to provide the capital and to bear these costs, no stage of the market chain could function. Other facilitating functions enable producers to respond to consumer needs and thus provide goods in the locations, quantity and form desired.

These functions create the **marketing environment,** whose elements are:

• Market and facilities - including all of the physical infrastructure that a market may depend on.

• Market information and intelligence - including informal and formal communication systems, and standard weights and grades on which market information depends.

• Institutional environment - including the government policy environment, regulations and supporting legislation.

5.4.2 Marketing agents

Market actors are defined the roles they play, by the nature of their financing activities and their responsibility to ownership (whether to a centralised public office, to a private purchaser of the marketing: service or self-responsibility as in the case of independent private enterprises). Actors in the market can choose between specialising in one activity or integrating a number of activities into one enterprise in a vertical or horizontal manner. A specialised enterprise can offer its customers more individual attention and provide the exact quality and form of goods desired (e.g. local butcher). Thus, the roles of actors are often difficult to separate. The roles of vertically-integrated actors are likely to overlap with those of more specialised agents in the market. Figure 5.3 illustrates how the roles of market agents can vary.

Figure 5.3. ***The varying roles of market agents.***

Adapted from Timmer et al (1983: p.167).
S = storage; P = processing; and T = transport.

Country buyers often carry out the initial task of assembling goods from dispersed farms or local rural markets. These buyers may be farmers, shopkeepers, itinerant traders or some co-operative or government-buying agency.

The role of wholesalers is to transfer goods from producers or country buyers to retailers or other wholesalers. Thus, their role may overlap with that of country buyers, in that they may deal directly with producers. They often finance the movement of goods themselves and consequently bear the cost of marketing risks. In the African livestock trade, there is a tendency for there to be a number of stages in the wholesale trade, as animals are assembled into larger and larger herds for subsequent trekking to urban centres. To operate profitably, wholesalers must be especially well-informed about current market prices and conditions, since the costs of market risks increase with the number of stock being handled.

Commission agents may sometimes operate on behalf of wholesalers for a percentage of the price paid. Although they act in the same way as wholesalers, the risk remains with the owner of the goods. Brokers offering an intimate knowledge of the market act to bring buyers and sellers together. In West Africa, livestock brokers also serve to enforce informal market rules by monitoring transactions, assuring the integrity of each party in the transaction and guaranteeing the negotiated price will be paid. Thus, they contribute in several ways to the exchange functions by facilitating buying and selling, and reinforcing the informal system which enforces contracts.

Processors transform the good either partially or completely into the form to be consumed. In the African livestock trade, processing is often carried out on a large scale by government agencies who also operate as wholesalers. They may also sell their processing services to smaller traders.

Retailers present the good to the consumer in the manner, location and form desired. In the case of livestock, they may also carry out processing activities (e.g. butchering).

5.4.3 Marketing enterprises and channels

Enterprises of four types normally fulfill the roles of middlemen described above. These are:

- independent, locally-based private enterprises
- co-operatives
- marketing boards and other state enterprises
- transnational companies.

Independent, locally-based private enterprises operate with capital owned directly by the operators and their partners, or in some cases by shareholders. Although not always large in scale of operation, these make up the greatest number of agriculture and livestock enterprises. Great variety exists in their level and degree of sophistication. Sometimes foreign-owned operations may' occupy important roles in this niche, particularly in foreign trade of livestock products.

Co-operatives have the potential to improve marketing efficiency. They can reduce marketing costs. For example, a village livestock marketing co-operative could co-ordinate the production schedules of small farmers, so that sufficient animals would reach market age at the same time, allowing truck transport to markets and lowering per unit transport costs. Co-operatives can also be used to counteract imperfect competition (monopsony/oligopoly power) among buyers, by creating greater bargaining power among producers. Typically they are used to distribute credit or subsidised inputs. In Africa they have been more successful when they have confined themselves at first to one' simple function which is important to all members, attempting only later to expand their role. In order to be successful in the long run, a co-operative must be able to carry out marketing functions with lower cost or effort than available alternatives. If this ability is not perceived by members, co-operatives are likely to break down. Since the ownership of co-operatives, by definition, lies in the hands of those who use its services (and who are thus entitled to any profits), a distinction must be made between farmer-owned and -controlled co-operatives and **parastatals.** Parastatals are co-operatives in name only, since they are government controlled. They may serve as taxation mechanisms or to promote government support. Private co-operatives are likely to be more efficient than parastatals, because of ownership incentives. Some co-operatives are difficult to classify, such as the Kenya Co-operatives Creamery (KCC). Although nominally a private cooperative, the KCC acts as a parastatal because of government-sanctioned monopoly and regulatory powers.

Marketing boards and other state enterprises, although popular with many African governments, have been much criticised. They are set up by government direction with government capital. Major operating decisions are subject to approval by the responsible minister. Parastatals are slightly more independent. Although government financed, they are autonomous in terms of handling funds, recruiting staff and making operational decisions.

The objectives of establishing such public intermediaries are: to raise the bargaining power of agricultural producers via an imposed monopoly on sales; 'to set up needed market and processing facilities; to raise the scale of operation and thus to capture economies of scale; and to stabilise market supply and prices. They often fail to achieve these objectives because of

inappropriate policies, poor management and lack of knowledge. Attempts to replace private markets usually fail because the detailed information necessary to operate may be too dispersed to gather. Managers succumb to patronage and corruption, and incentives for efficient operation are usually lacking. The Kenya Meat Commission (KMC) was, until recently, a parastatal set up to buy and process cattle and to market the products. Although potential economies of scale existed, these were not achieved because capacity was under-utilised and per unit costs were higher. Slaughterhouses built to handle peak seasonal supply are usually under-utilised during other seasons. Parastatals with a mandate to buy at fixed prices from all producers also suffer from high costs of cattle purchases in pastoral areas, where such sales are widely dispersed.

Transnational companies often succeed because of their access to processing technology and external markets. By definition, they operate in countries other than that of their headquarters. They can assist market development by facilitating the movement of skills and capital to areas where they are in short supply, potentially contributing to the levelling of commercial expertise.

When considering the relative advantages of each of these enterprises, attention must be given to the particular environment of livestock marketing in Africa. Its marketing structures are more complicated and differentiated than those in a developed country where production is much more specialised. Further, issues of equity and income distribution between producers are more acute and must be considered in the policy decision to promote certain types of enterprise.

All of the goods in a particular market are unlikely to pass through the same set of agents. Usually goods pass through a variety of market channels as a result of varying degrees of vertical integration existing in the same market. Figure 5.4 illustrates a marketing system showing multiple marketing channels. At times, some intermediaries are bypassed, while in others, goods pass through a large number of hands. Mote that at any one level of the market, such as at level A, the sum of the percentage flows in the diagram is always 100. This type of diagram can be helpful in basic planning for new investment in marketing, by identifying both the channels where volume is highest and other channels which could be further developed.

Figure 5.4. ***Marketing chain for milk and dairy products.***

Adapted from Ansell (1971: p. 7).

Exercise 5.2: Livestock marketing channels (estimated time required: 1 hour).

Using personal knowledge of a livestock marketing system in one's home country, draw a market channel diagram similar to Figure 5.4. Identify all stages, actors, enterprise types and flows in the system and identify the percentage flows through each channel. Discuss the reasons, in terms of price policy, institutional environment and infrastructure, for the existing pattern of market channels.

5.5 Structure and specifics of livestock trade and their implications

While livestock and agricultural marketing systems share some characteristics, a number of features unique to livestock products determine how their marketing will be carried out. Tables 5.2 and 5.3 illustrate some of these similarities and differences. In our discussion of livestock marketing characteristics, we will deal mainly with the marketing of meat, although dairy marketing will also be addressed.

Table 5.2. *Comparison of animal and crop characteristics.*

Factors	Animals	Crops
Evaluation of product	Difficult	Relatively easy
Grading system	Less standardised	More standardised
Market organisation	Less organised	Organised

Source: Amir and Knipscheer (1989: p. 147).

Table 5.3. *Common marketing problems in the livestock sector.*

	A problem about:		
	Production inputs	**Meat**	**Milk**
Problems for livestock producers			
No market outlet	X		X
Differential prices by location	X		X
Place of sale too far from farm			X
Difficulty of storing			X
Low prices		X	X
Purchaser exploiting seller		X	X
Retailer exploiting producer	X		
Overproduction and surpluses		X	X
Problems for consumers			
High prices	X	X	X
Unreliable supply	X		X
Suspect quality end hygiene	X	X	X
Poor consumers lack access to supply	X		X
Problems for producers and consumers			
Seasonal fluctuation, price and quantity		X	X
Large margins between prices	X	X	X
Market failure when drought		X	X

Marketing system not responsive to changes in supply and demand	X	X	X

The characteristics of livestock producers hamper buying at the producer level - a level which is typified by many small producers. They are widely dispersed under traditional land tenure regimes using traditional management systems. Communication and infrastructure are limited and bargaining power is poor. A lack of market orientation often exists among producers, especially in pastoral areas, where cattle are not necessarily held for profit, thus changing the nature and timing of sales. These characteristics affect the number and type of traders, the types of services offered, the cost and type of transport system adopted, the location of market sale points and processing facilities, and the efficiency of information dissemination. One result of such conditions is the large role of the informal sector in livestock marketing, because of the costs incurred by large integrated efforts to market cattle. Facilities for assembling livestock are important, but often lacking, leading to informal trading.

Some marketing differences are brought about by the nature of the good itself. There is less processing involved in the marketing of livestock than with grains. Indeed sometimes no processing may occur until just before the products are to be sold at retail. Therefore, a larger share of the amount the consumer spends on meat is expended for the live animal. Thus, a greater proportion of the retail price goes to the producer. Livestock processing usually involves not only slaughter, but butchering and refrigeration as well. Because of the lack of refrigeration facilities, meat is stored for only a short period of time. Therefore, storage after processing is minimal. Meat marketing begins with the live animal which is transported or trekked to slaughtering facilities for processing to, at least, the carcass level. If transport opportunities are limited, slaughtering may only operate to sell fresh meat to the local market. The limited role of processing in livestock marketing is made up by the importance of transportation and its associated costs. In Africa, the limitations of road transport and the unreliability of refrigerated transport (either by road or rail), lead to most livestock being trekked to slaughter points. This has been shown to be relatively efficient, as will be discussed in more detail in the section on market evaluation.

At slaughter points, and at the carcass level, livestock are graded according to consumer preferences. Important characteristics for grading are fat levels, tenderness, age, and weight. Carcasses can be processed into either wholesale or retail cuts, in the former case serving yet another level of market intermediaries. If not processed into retail cuts, carcasses can be chilled and shipped to centralised butchering and distribution centres, where they are further processed into wholesale cuts, which at retail outlets are processed into retail cuts. More valuable cuts are distributed to higher-income retail areas, leading to product differentiation in the retail market. Slaughter and packing houses must comply with government sanitation regulations and be subject to inspection, which forms another part of the grading and standardisation process. Although export markets exist, disease regulations inhibit the movement of stock for export. Thus, such trade is usually limited and is handled by parastatals.

As the livestock market develops, the use of specialised skills and technologies increases, as does market integration. Market integration can reduce the risks that occur from price instability. The

larger firms that result from integration can raise capital for improved plant and equipment and its more specialised management.

Box 5.2: Example of a livestock marketing system: West African markets for cattle and meat.

There are three main sources of meat supply for the southern cities along the West African coast:

- cattle and small ruminants from dry savannah areas (pastoral areas)
- livestock from mixed farming areas
- chilled, frozen and canned imported meat.

Because tsetse occurs along the coast, producers are far to the north. As a result, the marketing structure has to be complex in order to move livestock over long distances to the consuming areas with minimum loss.

Supply varies with the willingness of producers to sell, the quantity and quality of grazing at different seasons, and disruptions to the infrastructure such as broken bridges or restrictions on movement imposed by veterinary officials. The price for meat in Abidjan or other coastal cities may be twice as high as equivalent prices for cattle in the supply regions. Thus, prices which dominate the trade are the wholesale prices in the consuming towns on the coast - where the greatest aggregation of supply and demand are reflected.

Marketing begins with local traders (country buyers) in the north who buy surplus cattle from migratory herders. Cattle are driven to village markets where some are bought by other traders to transport (in droves of 100-150 head) to the south by rail, truck or foot. The animals may be bought and sold several times before reaching their destination, with each trader specialising in a single stage of the market. This, using the best local knowledge and permitting rapid turnover of capital, thereby reduces risk. Along the journey, the cattle are fed and watered, weak animals are sold and all are inspected, dipped or vaccinated by veterinary officials. If travelling *via* official corridors, they are taxed at the frontiers.

In the coastal towns, brokers or "landlords" put buyers in touch with sellers and provide some of the finance required to handle the cattle between arrival and the retail sale of the cuts. These landlords provide accommodation to the livestock sellers, arrange introductions and provide guarantees for payment at agreed prices. Most buyers are wholesalers, although some resell to subsidiary markets. Wholesalers sell carcasses to retail butchers, and sell hides and offal. The retail market is differentiated into low quality meat at low prices, marketed in low-income areas and high quality meat, sold in select shops in high-income areas. (Whetham, 1972).

Important points (5.4-5.5)

- The four major elements of a marketing are:

- product type
- participants

- physical infrastructure
- policy institutional environment.

• Marketing system functions are broadly categorised as: exchange functions, physical functions and facilitating functions

• Actors in the market are defined by the roles they play. Major market agents/actors are. farmers, country buyers, wholesalers, commission agents and brokers.

• Functions of the middlemen in the market are carried by four types of enterprises, namely,

- locally-based private enterprises
- co-operatives
- marketing boards and other state enterprises
- transnational companies.

• Goods in a market pass from producer to consumer through a variety of channels.

• Livestock marketing systems differ from agricultural marketing systems in terms of product procurement, processing, grading and transportation. Markets for livestock products are less organised than crop markets.

5.6 Marketing systems evaluation

In Africa in the 1960s, and in some cases prior to that, governments, development agencies and commercial farmers tended to think that existing indigenous and private sector marketing systems were inefficient little potential for internally-generated improvement. Common assumptions were that: traders were exploitative; their operations were inefficient because of an excess number of intermediaries; and traders were unable to respond to new market opportunities and changes in consumer demand (resulting in consumer demand not being relayed properly to producers). Traders were seen as adding costs to trade without providing a service. As a consequence, government intervention increased and many livestock marketing projects and schemes for the distribution of veterinary supplies and other inputs were initiated, which either did away completely with private-sector participation in these activities, or placed them under intense government regulation. Examples of such regulatory interventions were compulsory use of stock routes, frequent veterinary inspection, mandatory weighing of animals, auction markets and detailed specifications of the qualifications or endowments a trader must have before being licensed.

While some of these projects were successful, many were not. Studies have suggested that many of these indigenous systems were much less inefficient than had earlier been believed. As a consequence, it is now more generally accepted that before intervening to change the existing marketing or distribution system, its current performance should be evaluated. This section discusses some commonly used methods of market evaluation including:

- degree of market efficiency in terms of marketing margin
- price analysis
- evaluation of services
- structure, conduct and performance analysis
- market information and intelligence.

5.6.1. Degree of market efficiency in terms of marketing margin

Technical versus economic efficiency

The degree of efficiency is often the measure by which marketing systems are evaluated. However, a distinction exists between technical and economic efficiency.. A new machine may allow for greater **technical efficiency** by using fewer inputs for the same level of output; it may not result in **economic efficiency** if the cost of the machine is not compensated by the savings in inputs. Economic efficiency is more desirable because it considers the value of resources, not just their quantity. Economic efficiency occurs in marketing when market operations are carried out at the least cost, subject to the techniques and knowledge available, provided that the good is supplied at a desired quality.

Economic efficiency is likely to occur in a competitive environment where traders are forced to provide good quality products and services at low prices, or be undercut by others more willing to do so. The obstacles to economic efficiency in marketing are lack of information, resistance of established institutions and monopoly or oligopoly power on the part of some market agents.

To evaluate markets on the basis of efficiency, the ingredients of an efficient market must be identified. Four of these are:

- Consumer demand is accurately and quickly relayed to the producer and the resulting information on producer supply is relayed back to the consumer.

- Marketing and distribution services are provided at the minimum cost per unit, compatible with the kinds and qualities of service required. Normally, the cost of marketing services will be reflected in the marketing margin.

- Innovation and flexibility exist so that market intermediaries are able to respond to new opportunities in terms of location or product quality.

- The national objectives of marketing are assisted.

Marketing margin, a measure of market efficiency

A common means of measuring market efficiency is to examine **marketing margins.** This is an attempt to evaluate economic or **price efficiency.** The overall marketing margin is simply the difference between the farm-gate price and the price received on retail sale. That difference can then be considered to be the cost of marketing and all that is entailed in getting the product from

the producer to the consumer in the desired form. The question to be evaluated is whether the marketing services being provided are "worth" the cost of this margin.

Marketing margins can be calculated for different levels of the market, so that:

Marketing margin = $P_1 - P_2$

where

P_1 = the price at one level or stage in the market
P_2 = the price at another level

A marketing margin is the difference between the **primary and derived demand curves.** Primary demand is based on consumer preferences and their response to retail prices. Derived demand is based on the relationship between price and quantity at the farm gate or intermediate points. Derived demand can thus be thought of as consumer demand as experienced by producers or other intermediaries. Primary and derived supply curves are analogous. The retail price is established where the primary demand curve and the derived supply curve intersect. The farm-gate price, on the other hand, occurs at the point where derived demand and primary supply curves intersect. The difference between the two prices is the marketing margin, which is illustrated in Figure 5.5.

Figure 5.5. ***The marketing margin: (Pr - Pf).***

Source: Amir and Knipscheer (1989: p. 160).

There are several types of marketing margins, based on the market level being considered. The **wholesale margin** is the difference between the price paid by the wholesale trader (or the processor) and the farm-gate or producer price. The **retail margin** is the difference between the price the retail trader pays and the retail price he charges to consumers. When the margin is expressed in monetary terms, it is called the price spread. Expressed as a percentage, it is known as the **percentage margin.** The **mark-up** is the price spread between two levels in the market divided by the selling price, expressed as a per cent.

Exercise 5.3: Calculation of marketing margins.

Example: A rural dairy producer sells one kg of locally-processed butter to a trader for 20 Ethiopian Birr (EB)/kg. The trader sells the butter to a retailer in an urban area for EB 24/kg. The retailer in turn sells the butter to his consumers for EB 26/kg.

wholesale margin	= trader price - producer price
	= EB 24 - EB 20 = EB 4
retail margin	= retail price - trader price
	= EB 26 - EB 24 = EB 2 total
price spread	= wholesale margin + retail margin

= EB 4 + EB 2= EB 6

percentage margin = wholesale margin/wholesale buying price X 100

= (EB 4/EB 20) x 100 = 25%

retail mark-up = retail margin/retail selling price x 100

= (EB 2/EB 26) X 100 = 7.69%

Exercise: (estimated time required: 1/2 hour).

A pastoral herder in West Africa can sell his cattle to a trader for about CFA 700/kg (based on the buyer's estimate of the weight). The trader treks the animals to an urban area, where he sells them to a butcher for 1200 CFA/kg. The butcher then sells the meat to consumers. Half of the meat sells for 2100 CFA/kg; the rest sells at 900 CFA/kg.

Question 1. What is the wholesale margin? What is the retail margin, based on an average retail price for meat? What is the total price spread?

Question 2. What is the wholesale percentage margin? What per cent is the retail mark-up?

In an efficiently operating market, the competitive environment should keep the marketing margin to a minimum. Market prices should then reflect two elements: the actual costs of marketing plus **normal profit** margin. A normal profit is one which provides returns to investment comparable to available rates of interest plus some compensation for the risk borne by the marketer.

At different stages in the marketing system the "product" (e.g. animal or meat) is sold and bought. Normally, at each successive stage, the price per unit bought/sold is higher and we say that **value has been added.** This refers to the fact that some marketing service has been provided, whether transport, processing or one of the other marketing functions, and the value of that service is now included in the product price (and presumably the desirability of the product has been likewise increased). Again, at each successive stage the value added at that stage can be split into two categories: the part which is reflected in the real additional costs of adding value and the part which reflects the extra "profit" made.

Some of the additional costs incurred at each marketing stage are obvious, for example: taxes and market fees, transport costs (e.g. hiring a truck or paying trekkers accompanying the cattle), food purchases for the animals, any interest paid on a loan taken to finance the purchase, and animal upkeep.

Table 5.4 gives an example, based on data from Abidjan in 1977, of the growth in value added at different point in a marketing system and the apportionment of this growth in value added to costs and profits.

Table 5.4. *Evolution of the cost and value added of beef and offal sold retail in Abidjan in 1977.*

Item	% of final sale price	
Purchase of animal in Ouagadougou	46.8	46.8
Labour		
Shipping cattle	0.5	47 3
Slaughter	0.6	47.9
Total labour	1.1	
Intermediaries' commissions and margins	1.9	49.8
Taxes and licenses		
Burkina Faso		58.2
Côte d'Ivoire	8.4	62.5
Total taxes	4.3	
Transport of cattle	12.7	
Transport fees	6.1	68.6
Shrinkage	7.0	75.6
Losses and forced sales	1.5	77.1
Total transport	14.6	
Selling costs of meat		
Transport, stall rental and labour	4.4	81.5
Wastage (bone)	1.0	82.5
Losses due to condemnations, credit default	0.8	83.3
Total selling costs	6.2	
Profits		
Cattle trader	5.0	88.3
Wholesale-retail butcher	7.5	95.8
Vendor of fifth quarter	4.1	99.9
Total profits	16.6	

Source: Delgado and Staatz (1980: p.62).

In value-added costs, some costs are less obvious. If a trader buys 20 cattle at $ 100 each and one of these dies before he can resell it, the average additional "cost of losses" incurred can be estimated at $ 5.26 for each of the remaining 19 animals that he does sell ($ 100 loss divided by 19 remaining). Similarly, if a trader buys a 300 kg animal at $ 600 and, before he sells it, the animal loses 30 kg, then to his original cost per kg (live weight) of $ 2.00 has to be added a further $ 0.22/kg for the loss of live weight before sale (cost per kg is then $ 600/270 kg = $ 2.22). Such costs and transport costs are particularly important in livestock trade (Box 5.4).

Box 5.3: The case of Alphabeta: Beef marketing efficiency.

An evaluation of the efficiency of the beef market in Alphabeta was carried out by examining processing costs. The focus was on the Meat Marketing Commission (MMC), a state agency which controls slaughter for export and urban markets. The analysis showed that between years one and six, MMC's costs rose faster than inflation. MMC total costs rose by 31%, while consumer costs rose by 13% and manufacturing costs in general rose by 22%. This trend continued in years 7 and 11. The comparison suggests that increased costs to MMC are not caused by increased costs in general in the economy, but by inefficiency in MMC's operation.

Further, MMC's margins were compared with those of private slaughtering operations and again the analysis suggested inefficiency. Private margins were 5 cents/kg, while MMC operated at a margin of 7.5 cents/kg. Private processors can offer a higher price to producers and a lower price to consumers.

Some further costs tend to be more controversial. Suppose a trader keeps an animal which he has bought for $ 600 for three months before he sells it. The interest rate payable on deposit accounts at the local bank is 10%/year, calculable 3-monthly. By investing $ 600 in the animal and not selling for three months, the trader "lost" $ 15 which otherwise he could have earned by putting the money on deposit account ($ 600 x 10% x 3/12 = $ 15). Many economists would want to count that $ 15 as a "cost" of trading, even though the trader did not actually pay anyone interest for using this money. The $ 15 is the **opportunity cost** of the capital he has invested in the animal during the period he is holding it. Another controversial cost is that of the trader's own time. Suppose he spent three weeks trekking the animals from the place he bought them to the place where he sold them. If he had not been doing that, the trader could have been employed by someone else at $ 5/day. Again, many economists would argue that an extra $ 105 (i.e. $ 5 x 21 days) of any "value added" between purchase and sale should be counted as "cost of trading" rather than as "trader's profit".

Information on value-added costs and profits is very difficult to obtain, since the people who have the information (usually traders) are reluctant to reveal it for fear that, as a consequence, they will be taxed or regulated or the information might be used by a competitor.

Value-added costs and profits will tend to vary widely over time, i.e. a trader will make a big profit on one buying expedition, a small one on the next and possibly, a big loss on the third. For this reason, policy makers must carefully consider the variation that is possible not only over time, but between enterprises (i.e. some may be making profits while others fail, even though the market as a whole exhibits normal margins).

Some approaches to estimating market margins

Three commonly used approaches to determine marketing margins are:

- To sample prices of uniform products at each market stage **cross-sectionally** at one point in time across a variety of market agents.

• To sample prices of uniform products at each market stage through time **(time-series),** relying on data from a smaller number of sources.

• To examine gross receipts and expenses of marketers at each stage, and divide by number of units traded.

The method selected may depend on the availability of reliable means of collecting data.

Margin analysis in African agricultural markets shows that there are not many cases of excess profits. In most cases, traders' profit margins amount to less than 10% of the selling price. Table 5.5 shows the distribution of costs in some free-market livestock systems. Returns of 10% or more may be required in many markets to compensate for risk factors. Further, such returns may be similar to those in other professions. The analysis of livestock margins is often made particularly difficult by the large role of the informal market, and thus a lack of data on prices and/or the level and structure of costs of those involved in the marketing process.

Table 5.5. ***A comparison of free-marketing sheep and cattle systems in selected African countries.***

Source: Sandford (1983: p. 204).
n.a. = not available.

Box 5.4: Transport systems and costs in Africa.

A number of studies have addressed the conditions and costs of transport systems and their effects on trade (Ariza-Nino et al, 1980). Examination of the economics of transport requires a comparison of the merits and disadvantages of different modes of livestock transport (trekking, trucking and railing), a comparison which is usually made on the basis of cost. Such costs are both direct and indirect. While the direct costs may be obvious, indirect costs include weight loss or death in transit (sometimes resulting in early sale en route), forced sale or loss of grade at sale, crop damage or pasture use during transit, causing conflict or the need for cash compensation and the costs of government services to help avoid these costs.

In many parts of Africa, trekking is the primary means of moving livestock to consumer markets. Ansell (1971) looked at one indirect cost, animal weight loss resulting from lack of adequate feed and water during trekking, and found that the cost was not as large as expected. Without facilities for food and water, weight losses can be expected to range from 8-13%. These could be reduced to about 5% by providing both adequate water points along the trek routes and rest, food and water at pre-slaughter holding grounds. During bad years, losses from trekking can be expected to be much higher but not necessarily higher than when other modes of transportation are used. Although trekking results in high indirect costs, trucking can produce high direct costs (fuel, depreciation, capital etc). Rail and trucking can also lead to high mortality and weight loss. An exception is Nigeria where an improved road network and low fuel costs have led to a large-scale replacement of trekking by trucking. The level of trucking costs are also affected by return loads and alternative uses for vehicles. Large specialist vehicles could produce economies of scale, but only if used frequently (to avoid the cost of "dead time"). Small multi-purpose private

vehicle transport is usually more cost-efficient because of alternative vehicle uses. Improved roads would lower trucking costs and reduce the risk to animals from transportation breakdowns and accidents. Transporting live animals is usually more cost effective than transporting slaughtered animals because of refrigeration costs.

Reference values of marketing margins for evaluating market efficiency

Reference standards can be used to set up a point at or beyond which performance is judged to be "satisfactory" or "unsatisfactory". Market margins of more than 15%, for example, could be considered unacceptable. These are best used, however, as an indicator that more examination, using other measures of evaluation, is needed.

Because economic conditions generally, and marketing systems in particular, tend to change rapidly of their own accord even when governments do not deliberately intervene, infrequent one-time evaluations may be inadequate. Thus, permanent monitoring systems may be required. However, these can be expensive, and careful planning is required to ensure that a monitoring system will be viable over the longer term, with data not only being collected with satisfactory accuracy, but also analysed and utilised. A permanent monitoring system needs to collect some data without reference to specific criteria for evaluation. Data of this kind include export and import flows, price trends and information on functions, flows, participants and stages (Figure 5.4).

Great care must be used in making conclusions based on comparisons of marketing margins, especially between different countries. Policy decisions based solely on simple margin analyses are likely to be based on erroneous conclusions. Efficiency in performance of marketing functions is not in all cases equated with small marketing margins. Similarly, large margins are not necessarily a firm indication of inefficiency or excess profit by traders. Marketing margins and costs can only be meaningfully discussed in relation to the services and functions which are provided. We return to the question whether marketing services provided are "worth" the cost.

Widening margins over time may reflect an increased demand by consumers for additional services. In that case, consumers may begin to prefer more processing or better presentation or handling, increasing the value added and the margin between producer and consumer prices. Consumers may demand meat which is refrigerated and packaged, and be willing to pay for the additional value added because they perceive the worth of such product handling. This change in demand points toward one reason why it is difficult to measure market efficiency. Markets must encourage new production and consumption by introducing new products. Thus, equilibrium and stable margins may not always exist.

In cross-country comparisons, a higher margin may only mean lower production costs per unit or more value added in the form of services. In developed country markets for beef, the proportion of retail price which goes to the producer is likely to be small, reflecting the large value added of handling and packaging. Such comparisons are really valid only when production systems, marketing systems and consumer preferences are similar. Thus comparisons between marketing channels within an economy can be useful. The existence of large differences in margins between marketing channels would justify further examination of services, costs and market

conditions. Because there are no absolute indicators of efficiency, evaluation depends on comparisons between enterprises and between marketing sectors within an economy.

5.6.2 Price analysis

Price analysis is a widely-used evaluation method which looks at the spatial correlation of markets through time. The assumption is that if market prices in different regions move together, then the overall market is operating effectively, in that supply is being distributed regionally in a way which meets local demand. It also assumes information and transport are operating effectively. However, there is some criticism of this method because markets with no strong trade links may show correlated price simply due to similar demand and supply conditions. Further, a monopoly firm could control prices in several regional markets. If price correlation occurs, other evidence needs to be used to discover how prices are being determined.

5.6.3 Services

Marketing services may be difficult to evaluate directly, although cost comparisons can provide some indication of availability. Evidence of excessive mortality and weight loss may indicate that feed, water points or other services during transport are lacking. The functioning of services can also be seen in the structure of the market. Large numbers of intermediaries in the market indicate a lack of capital and risk-avoidance services such as banking and insurance. Without capital, traders are forced to deal in small quantities at a time. This leads to a preponderance of small traders in the market. Lack of livestock insurance can have the same result. The presence of numerous traders can thus be seen as an effective adaptation of the market to a situation where services from external and public source are lacking.

Box 5.5: Pooling transport costs.

Differences in transport costs will affect the pattern of production and marketing. Farm-gate prices can be expected to be lower at greater distances from the market, until, at some point, the price traders are willing to pay to producers is lower than production costs. This point is the effective limit, under a free market system, to the area supplying the market. Governments in Africa, however, have often intervened to create **cost pooling** where a single producer price is paid and profitable support unprofitable routes. This allows the inclusion of otherwise non-viable production areas into the market supply zone (an example is the KCC in Kenya).

This is a difficult policy to implement because of the possibility of overall losses, particularly if some external shock occurs which changes the cost structure. Thus, the producer price must be carefully chosen. Also, a price remaining constant over the year does not acknowledge seasonal changes in supply and demand. Even if overall losses occur, cost pooling is often justified on the basis of equity considerations which are seen to outweigh the efficiency criteria.

Encouraging production in remote areas may be desirable for equity reasons. Indeed this is true of any policy which equalises charges for government services, such as veterinary or artificial insemination services delivered to dispersed pastoral producers at great cost. Choosing to pursue

such a policy depends on which of the objectives, efficiency or equity, is considered more important.

Exercise 5.4: Transportation costs.

Example. Table 5.6 compares the costs of transporting cattle to market by truck and mixed trek-rail. The largest trucking cost is from truck rental. A trek-rail system requires higher costs in terms of salary, (note the greater number of days in transit), as well as additional costs for damaged fields etc. The overall costs of trek-rail, however, are significantly less than those of trucking and animal mortality rates are lower (1.5% compared to 2%), but the table does not reflect the costs of animal weight loss while in transit. Instead, it assumes that the animals are sold for the same price (40,000 CFA) even though those trekked may have lost significant weight.

Exercise: (estimated time: 2 hours).

Question 1. Group the costs from Table 5.6 into direct and indirect costs. Convert them into percentage total costs. How do the two transportation methods compare in terms of proportion of direct and indirect costs?

Table 5.6. ***Comparative costs of transporting 50 head of cattle from Koutiala, Mali, to Abidjan by a) truck and b) mixed trek-rail transport, 1976-77 (all costs in CFA).***

Expense	Truck		Trek and rail	
	Total	**Per animal**	**Total**	**per animal**
Salary, food, return trip for drovers	24,000	480	75,000	1,500
Round trip and food for owner	14,400	288	14,400	288
Health certificate	4,000	80	4,000	80
Indemnity for damaged fields			250	5
Salt for animals			500	10
Loss of animals	2% of 50 animals @ 40,000 each = 40,000	800	1.5% of 50 animals @ 40,000 each = 30,000	600
Forced sales	2% of 50 animals @ 20,000 loss each = 20,000	400	2% of 50 animals @ 20,000 loss each = 20,000	400
Cattle market tax	25,000	500	25,000	500
Merchant license,	220,000	4,400	220,000	4,400

vaccination, export tax				
Transport charges				
Truck rental/rail car	2 trucks =700,000	2 rail cars =14,000	125,116	2,502
Straw			1,000	20
Loading/unloading	2,500	50	2,500	50
Other			2,500	50
Unofficial charges	105,000	2,100	5,000	100
Total costs (excluding weight loss)	1,154,000	23,098	517,266	10,445
Days in transit	3		31	

Source: Delgado and Staatz (1980: p. 68).

Question 2. Suppose that, under the trek-rail method, animal mortality increased to 4% and forced the sale of animals to 8%. How do the two transportation methods compare?

Question 3. Suppose that weight loss under either method amounted to 0.5% each day and that this was directly reflected in a lower sale price for each animal (i.e. a 10% weight loss during transit resulted in a sale price 10% less than 40,000 CFA). How do the two transportation methods compare when weight losses are taken into account?

Question 4. At what daily rate of weight loss do both methods result in the same costs? Is such a rate plausible?

Exercise 5.5. Market area determination on basis of transport costs.

Since transport costs increase with distance, there is a certain distance from a market at which it is no longer profitable to transport goods. The area around a consumer market in which transportation is profitable is called the **market area.** The radius, or limit of the area, is calculated by the following equation:

Radius (kms) = P/T

where:

P = profit per head of livestock

T = transport cost per head per km.

The further producers are from the consumer market, the greater the transport costs and the lower the producers' profits (all costs of transportation are passed from the trader to the producer). A change in price at the market centre affects mainly those producers who are on the edge of the market area, since the relative price change differs.

Example: Figure 5.6 illustrates a hypothetical African country and the system of roads connecting the capital with main points in the interior. In the interior traders purchase livestock which they truck to an abattoir in the capital. Producers close to the capital receive $ 360/head at the abattoir and pay an average of $ 300/head in production costs.

Figure 5.6. ***Hypothetical country and transport routes.***

Exercise: (estimated time required: 1.5 hours).

Question 1. What is the average producer profit?

Question 2. If transport costs an average of $ 0.40/head per km, what is the radius of the market area?

Question 3. If producers require a $ 10 minimum profit on each head of cattle, what is the radius of the market area?

Question 4. What would transportation costs have to be for the market area to reach point D?

Question 5. What would be the maximum price a trader would be willing to offer at point A?

Exercise 5.6: Cost pooling in transport.

Use the information given in Figure 5.6. The government is considering establishing a livestock marketing system which would purchase cattle from all willing buyers, no matter how distant they are from slaughter facilities (pooling costs). The government proposes to offer a uniform price of $ 310/head. The selling price at the abattoir is; proposed at $ 360/head. An examination of transport costs shows that for points A and B. in mountainous and sparsely populated areas, transport costs are $ 0.70/head per km. Transport costs from point C are only $ 0.35/head per km. Costs from other points remain at $ 0.40/head per km. The expected annual livestock purchases are:

Point	**No. of head**
A	10,000
B	15,000
C	65,000
D	32,000
E	25,000
F	1 8,000

Exercise: (estimated time required: 1 hour).

Question 1. What will be the annual costs and revenues of the government marketing system from the total purchase?

Question 2. Will the government be obliged to provide a subsidy at the price, and if so, of how much?

Question 3. At what farm-gate price will revenues in the system cover costs?

5.6.4 Structure, conduct and performance analysis

Because marginal analysis alone may be limited in value, it can be included in a wider analysis. A measure of market evaluation which can complement the market margin analysis is a classic approach called **structure, conduct and performance analysis.** The three elements of **the** analysis, as the name implies, are conduct, structure and performance

The approach, based on ideal competitive market conditions, holds that if the market is "structured" in a particular way, it will tend to make participants conduct their business in particular and rather predictable ways with, again, particular and partially predictable consequences for market performance. This approach focuses on the continuous monitoring of the market on structural issues, (which are easier/cheaper to monitor), leaving a full investigation of performance (e.g. price-margin analysis) only to those cases where monitoring of structure suggests that some undesirable conduct and performance are likely to arise.

Structure is determined by the number and size of firms in the market, the degree of product differentiation and the conditions for entry of new firms into the market. The number of participants operating in a particular market or related markets can be indicative of the extent to which buying and selling power is concentrated amongst them. A few large firms can dominate a market and control prices. The **concentration ratio,** which measures the proportion of total sales in a market by a given firm, can be used to indicate the level of concentration of market share. Monopoly elements in the performance of market functions will not necessarily disadvantage consumers or producers. Economy of scale, which may lower market costs, has been the basis for government interventions.

Entry, or the ease with which individuals can join and leave business, is important to a competitive environment and to market structure. This may refer to the process of getting a license or professional qualification or skill, or to the need for having a minimum amount of capital or other resources in order to operate successfully. Lack of available capital could effectively restrict entry of new firms if a large initial outlay is required. Structure can also include the nature of information transfer in the market, which might require an examination of the institutional and other facilities available for acquiring and transmitting market information. This could include weigh scales, an auction system, trader registration and accessible information on prices at which deals are concluded.

Conduct refers to the strategies that firms pursue with regard to price, product and promotions, and the linkages/relationships between and among firms. The market behaviour of firms will determine whether or not they compete and whether they are acting innovatively to improve market efficiency. Informal association between even a small number of firms **(collusion) can** cause price distortions, and seemingly independent firms can have joint ownership **(subsidiaries).** These conditions can sometimes be seen in African markets where one ethnic

group, often from another country, can dominate a particular market and, through cohesive behaviour, affect market conditions. Thus, a point of examination might be the social composition and distinctiveness (e.g. in terms of ethnic group, income class, membership of associations) of one kind of market participant (e.g. traders) and the practical social opportunities that this gives to collude in operating against the interests of other market participants (e.g. farmers or consumers).

Performance is the focus of the margin analysis discussed in section 5.6. It is exhibited by trends and stability of prices, margins and profits. A monitoring scheme which focuses on the relatively easy-to-monitor issues of structure will not itself provide the raw material needed to evaluate the efficiency of a marketing system. It may, however, provide information at relatively low costs on changes indicating the opportunity for monopolistic tendencies to prevail.

Tables 5.7 and 5.8 provide an example based on Ethiopia of the monitoring of one of the elements of market structure, i.e. the number of traders and the number of sheep they offer for sale. Data for only one year are presented. Monitoring over several years would indicate trends.

Table 5.7. ***Average number of sheep offered for sale by individual trader by market and period.***

Market	High transaction on (festivals etc)		Normal transaction		Mean no. of sheep offered
	No. of traders	Average no. of sheep offered	No. of traders	Average no. of sheep offered	
Shola	67	24.6	90	25.1	24.9
Addisu Shola	25	56.1	6	52.8	*55.5*
Deneba	16	15.7	7	10	14.0
Degollo	10	17.7	12	20.6	19.3
Ginchi	12	11.4	9	12.2	11.8
Debre Zeit	5	9.6	6	11	10.3
Dejen	8	5.4	3	5.3	5.4
	143	25.9	133	23.2	24.6

Source: Kebede Andargachew (1990: p. 86).

Table 5.8. ***Distribution of traders by number of sheep offered for sale.***

Flock size	No. of traders	% of all traders	Cumulative %	Percentage of all sheep offered	Cumulative %
1-10	87	31.5	9.1	9.1	9.1
11-20	80	29.0	60.5	18.3	27.4

21-30	45	16.3	76.8	17.6	45.0
31-40	25	9.0	85.8	13.3	58.3
41-50	17	6.1	91.9	10.9	69.2
51-75	15	5.4	97.3	14.2	83.4
76-100	4	1.4	98.7	5.1	88.5
100+	3	1.1	99.8	11.3	99.8

Source: Kebede Andargachew (1990: p. 87).

5.6.5 Market information and intelligence

Market information is crucial to producers, wholesalers and consumers to help them make decisions on what and whether to buy and sell. In general, information is required on prices, traded or available quantities, forecasts of future supplies and demand, and general market conditions. Information must be relevant, accurate and timely and reflect all sectors of the market, especially consumer demand. Such information can be used by traders to shift to those goods with high consumer demand. An effective market information system reduces risks to traders, eventually reducing market margins. When reliable information is not available, traders increase their margins to protect themselves from risk (e.g. if information on distant cattle markets is not reliable, traders face the risk of finding low prices at the end of a long trek).

In most African livestock markets, evidence suggests that information flows relatively freely through traditional information systems, although this may not be the case for markets that are not trading regularly throughout the year. Even external consumer preferences are conveyed well, as evidenced by a quick shift in the suggested export patterns when international demand changes.

Researchers in West Africa found it easy to obtain price information for livestock transactions. Further, prices reported by buyers and sellers showed close correlation. Information about prices and market conditions is spread rapidly by returning merchants and word of mouth (the price of live cattle in Ouagadougou reaches Abidjan in about the time it takes trains to travel the distance).

An efficient market information system needs to address information flows in both directions between consumers and producers. Information should be evaluated in terms of its accuracy, how promptly it reaches those who need it and its degree of detail. These can be determined by comparing the results of surveys of traders and agents with known information about the market.

Methods of collecting market information vary from country to country. Central agencies may be poorly trained and the same market figures may be reported in successive years. Price information, perhaps the easiest to gather, is usually collected by reporters who go into the market and randomly sample. The systematic collection of reliable market data is a tedious and difficult task and is often avoided because of large recurring costs. In cattle markets, collecting systematic data may not be feasible because of the large volume of informal trading that takes

place. Whether information about the number of animals presented at market or slaughtered can be transmitted rapidly depends on the effectiveness of the market information collection and dissemination system. The cost effectiveness of weekly and monthly statistics on this type of information is uncertain, because such information is likely to be more readily and efficiently disseminated through informal communication channels. Whatever system is used, it should be simple. Data should be generated quickly and disseminated promptly.

Attempts to disseminate price information on cattle have suffered from a lack of uniform standards (e.g. animal weights, grades etc). Grading systems are particularly important to market information systems. The need for grading is based on the idea that buyers recognize differences in quality. Thus, some buyers are willing to pay more for the quality they want and may buy other qualities only at lower prices or in smaller quantities. Sellers can benefit from grading because negotiating contracts becomes easier.

Exercise 5.7: Market information systems.

Choose from your country some livestock commodity market with whose market information system you are familiar. (If the participant is not familiar with such a system, a description of the system in the literature can be used.)

Exercise: (estimated time required: 2 hours).

Question 1. Describe in detail the level of development of the market information system, both formal and informal.

Question 2. Describe how market information is collected. Evaluate the market information collection system in terms of accuracy, regularity and relevance.

Question 3. Evaluate market reports and forecasts in terms of timeliness and accuracy. How well are they prepared, how are they disseminated and how well do they meet the needs of users?

Question 4. Suggest what improvements could be made to the market information system and discuss how this could be done.

5.7 The role of government interventions in markets

Despite recent free market trends in the world and in Africa, markets in general remain a subordinate instrument of national political systems and their policies. Government interventions must work to facilitate market competition and to help the market achieve national policy objectives.

Government policies and interventions must address more than the objective of "rationalising" trade, which often results in efforts to make marketing practices conform mechanically to a

modern model. Marketing interventions should take into account the proven capability of the marketing network. Policies should be aimed at working with the existing system, not at replacing it. Government attempts to replace free market systems have often raised the costs of marketing, thereby hurting consumers, distorting resource allocations and damaging the economy. It is important that policy makers view trading as a necessary and socially desirable activity carried out in an environment of risk.

The questions to be asked in considering any intervention are: is it really necessary or is it simply for the sake of government control? What would happen if the intervention wag removed? Studies of cattle marketing systems in Africa have, in fact, shown that markets often perform well when left to private entrepreneurs.

It is generally recommended that governments play a facilitating rather than a direct role in markets. Regulatory interventions should be limited. Appropriate interventions are thus **indirect** in nature and have three general aims:

- to improve market infrastructure
- to improve information
- to improve institutional infrastructure.

5.7.1 Improve market infrastructure

Interventions to improve market infrastructure would target roads, rail, market facilities, water points and health-control infrastructures (i.e. quarantine facilities). Projects for market-sale points, such as auction yards, need to be better designed and located. In Abidjan, for example, a new concrete livestock market remained unused next to the traditional open-air market (Ariza-Nino et al, 1980). In this case, the informal market was already serving an existing need. If market facilities are provided, they need to be built on existing traditional sites and should not be so heavily regulated that agents avoid them.

Investment in water points along trekking systems may prove wasteful. Water points can cause crop damage to neighbouring fields. Often, traders are taxed at these points, which makes them use traditional routes. Market trails could be created if well located in terms of supply and demand areas and grazing areas, along the route and water points. Providing grazing reserves near major livestock markets helps to stabilise the flow of cattle, but fees for such use must be reasonable if traders are to use them. Such reserves could reduce price fluctuations, reduce risk and animal weight loss.

5.7.2 Improve information

Information is important for facilitating effective marketing. While traditional information systems seem relatively effective for livestock markets, one unfortunate consequence of regulated prices is a lack of information on real market prices.

5.7.3 Improve institutional infrastructure

Improving the institutional infrastructure may be the most important government role in marketing. Government interventions should promote an open and stable institutional framework. This may take the form of improving security (i.e. protecting property rights and contracts) and controlling corruption and violence.

A major difference between "traditional" and "modern" markets lies in the degree of personal involvement of marketing agents. In a "modern" market system, personal involvement is minimum; traders operate through institutions which guarantee legality and value. While in traditional livestock markets transactions are guaranteed by a broker who is known to the traders, transactions in modern markets are guaranteed through regulations and supporting legislations. Unfortunately, attempts to provide these regulations have often been badly handled. As a result, traders have shifted back to operating within the informal sector.

Box 5.6: Government intervention in livestock.

In Africa, government interventions in the market have primarily been in terms of providing abattoirs, meat packing facilities and milk processing plants. These interventions set prices, grades and standards for livestock products. Such interventions are usually implemented in order to control consumer and producer prices through a monopoly framework. Control would be over grades and quality for standardisation, health or export. The view held is that private trading is exploitative and inefficient. Thus, government monopolies would produce economies of scale.

These interventions may, in fact, result in inappropriately-located processing facilities, such as abattoirs in pastoral, low-density areas which cannot supply to plant capacity. In practice, it is difficult to exploit the potential economies of scale because of chronically under-utilised capacity.

Capacity under-utilisation is also caused by price policies which pay low prices to producers, uniform across regions and seasons. The result is an unwillingness by producers to supply at the controlled price level. Instead, goods are diverted to the informal economy, because private agents may be able to offer higher farm-gate prices. The result is less use of existing processing capacity, higher average processing costs and a general decline in the economic viability of the system.

Institutional attempts to "organise" trade through restrictive licensing or limiting the number of intermediaries have forced traders to move into the informal sector. In some Sahelian countries, authorities have tried to limit or reduce the number of traders and organise them along artificial functional lines. The result has been less competition, less new entry into the market and the creation of informal markets. Attempts at regulation should promote rather than discourage competitive marketing to reduce costs. Finally, any new interventions should be made gradually, since new policies often cause severe market disruptions.

Most governments have not been able to resist the temptation to intervene directly in markets, particularly by setting prices to create low prices for urban consumers. In general, price-control efforts reduce the efficiency marketing systems.

Direct government intervention in the form of marketing boards is now also recognised as generally undesirable. The result has often been to incur additional costs and wastage which might not occur in a competitive marketing situation. Problems of marketing boards tend to be:

- Government management styles and procedures can be too cumbersome for efficient marketing.
- Few incentives exist for efficiency.
- Low salaries can produce corruption.
- Marketing boards are too often a convenient means for taxing producers and traders.
- Since, for marketing boards to operate efficiently, marketing channels need to be few and concentrated, livestock markets are generally not suited to them.

Box 5.7: The case of Alphabeta: Price intervention.

In Alphabeta, the government adopted a system of uniform producer prices for milk delivered to the National Dairy Co-operative (NDC). The government gave no consideration to seasonal and regional variations in milk supply and production. Because informal milk market prices could not be effectively controlled by the government, they varied seasonally. During the dry season, when milk was in short supply, producers sold their milk to the informal market which offered higher prices. The effect of the uniform price policy was, thus, to divert milk to the informal market during the dry season. During the flush season when informal milk prices were low, milk was delivered to the NDC. The result was under-supply to the NDC during the dry season and over-supply in the flush season. The consequent need for additional manufacturing capacity to cope with the flush supply led to capacity under-utilisation during the dry season and higher overall processing costs. Further, uniform producer prices in all locations, no matter how remote, led to higher transportation costs. The higher processing and transportation costs were passed on to consumers in the form of higher dairy product prices.

5.8 Marketing and national policy objectives

An effective marketing system can contribute to national policy objectives. This section relates the features of marketing to the five main broad groups of policy objectives as identified in module 2.

The **independence objective** aims at obtaining and preserving a satisfactory degree of political and economic autonomy. Although in general increased trade could be seen as acting contrary to

this objective, an effective domestic marketing system reinforces independence by enabling a nation to supply its own needs more easily. For example, improvements in the West African livestock marketing system could enable regional supply of high-quality beef which in some cases is now imported. Regional marketing systems which replace supplies from world market sources work towards regional independence.

The self-sufficiency ratio, discussed in module 2, reflects the performance of the production and marketing systems combined. If the marketing system is defined broadly to include the external trade factors, then changes in the NPC (module 4) are a measure of changes in the incentives given by the marketing system to domestic producers in comparison with imports. But when NPC is calculated, the least reliable data are typically the costs of internal marketing for both domestic products and imports. They are the key issues in any discussion of the performance of a marketing system in respect to independence objectives.

The **economic efficiency objective** focuses on increasing the level of real national income and its growth rate over time (maximising real income). The attainment of this objective is the most important contribution of an effective marketing system. In a country where livestock production is important, improvements in livestock marketing can make a significant contribution to national economic efficiency and thus growth. The contribution of marketing to this objective is a result of the optimal allocation of resources which can occur with the meaningful price signals that a well-working market can deliver. Producers and traders will move in response to price and other market signals to activities which return the greatest value to the economy. Over time and on a large scale, the increased wealth made possible from an effective marketing system can add significantly to national income growth. Livestock, because of its positive income elasticity of demand, offers opportunities for creating wealth not only for rural smallholders but for the economy as a whole, due to the development of many new marketing services.

The **resource conservation objective** concentrates on preserving the natural resource base to ensure the above two objectives. An improved marketing system may or may not contribute to this objective. Indeed, market activity in general is often criticised for working against the goal of resource conservation. It is sometimes argued that, especially in dry areas in Africa, resource degradation has increased due to integration of these areas into world commodity markets. In South America, forests have been cut in order to raise livestock for export. If some economic actors are given the opportunity to exploit natural resources without being responsible for the long-term damages and costs, resource degradation could indeed occur. Large firms exploiting natural resources for the market must be monitored by appropriate government agencies.

On the smallholder level in Africa, there have been some cases where increased market integration has caused environmental degradation. One such example is making charcoal from trees in rural areas to supply urban demand in Addis Ababa, an activity which accelerated with the change of government in 1991. But here the factor which led to the problem was uncertainty of land ownership and use rights. The effect of market integration on natural resources is closely tied to property rights and land tenure issues (module 7).

There is no conclusive evidence either way concerning the impact of African livestock markets on the environment. Traditional land tenure systems may moderate the effects. Improved

marketing which causes producers to offer more cattle for sale, rather than hold them for wealth, may increase offtake rates and eventually reduce the stock using natural grazing resources.

The **stability objective** attempts to avoid abrupt and large changes in income, in the price and availability of domestically-produced basic commodities and inputs. One of the main forms of instability in the livestock sectors of countries with unreliable rainfall is a huge increase in the flow of livestock into markets when drought strikes, as farmers sell their stock when they are threatened by starvation. The huge increase in livestock flows, at a time when many potential consumers are also suffering from drought-induced declines in income, quickly leads to a total collapse in livestock prices. An improved livestock marketing system is unlikely to avoid this problem. Better marketing of inputs such as feed and operating capital may allow some farmers to withstand a drought situation until prices return to normal. In general, effective marketing systems create stability in supply and prices by allowing surplus regions to supply areas with net demand, smoothing price and availability differences. Whether this will be effective at the national or even regional level is uncertain, as the 1992 Southern African drought has shown.

The **equity objective** promotes the fair distribution of income and wealth within society, among different types of farms, among regions and between producers. Again, the impact of greater market integration on this objective is not necessarily positive or negative. If some economic agents are able to control large market shares, they may increase wealth at the expense of others. This is unlikely to occur in African livestock markets which are typified by a large number of small producers and traders. Indeed, a shift from monopoly marketing boards to free market trade carried out by numerous private enterprises is almost certain to improve the distribution of income and thus aid the equity objective.

Important points (5.6-5.8)

- Marketing interventions should be preceded by an evaluation of existing marketing systems.

- Some commonly used methods of market evaluation are:

- assessing the degree of market efficiency in terms of marketing margins
- price analysis
- evaluation of marketing services
- structure, conduct and performance analysis market information and intelligence.

- Marketing margin is the difference between the farm-gate price and the retail sale price received. However, there arc, several basic types of marketing margins, based on market levels or stages being considered.

- A value is added to the cost of a product at each successive stage of the marketing system.

- Marketing margins of more that 15% indicate unacceptable market performance. However, great care. must be used in making conclusions based on marketing margin values alone as many

other factors influence the performance of a marketing system.

• Price analysis, as a method of marketing evaluation, examines the price correlation between markets separated by space and through time

• Marketing services, as an indicator of the effectiveness of marketing systems, are difficult to evaluate. However, the cost of a commodity and marketing structure give an idea of the effectiveness of marketing -services.

• Structure, conduct and performance analysis is used with margin analysis to evaluate marketing systems. This approach holds that the structure of a market controls the conduct of the participants and consequently the performance of the marketing system. Accordingly, continuous monitoring of structural issues should form the basis of market evaluation.

• Market information is crucial for producers, wholesalers and consumers taking decisions on what to buy and sell. Information on prices, traded or available quantities, forecasts of future supplies and demand and general market conditions are needed for such decisions.

• Government policies and resulting interventions should play a facilitating rather than a direct role in markets.

• Three appropriate types of government intervention in marketing systems are:

- improving market infrastructure
- improving information
- improving institutional infrastructure,

• An effective marketing system contributes to national objectives by:

- Enabling a nation to supply its own needs of goods and services.
- Facilitating optimal allocation of resources.
- Creating stability in supply and prices by integrating surplus and deficit.
- Improving the distribution of income under competitive marketing.

6.1 Performance objectives

Module 6 is intended to enable you to:

1. List seven steps in budget and manpower planning.

2. Explain some basic principles and issues involved in budget and manpower planning.

3. Prepare capital and recurrent cost budget requests for livestock development projects and programmes.

4. Demonstrate, by examples, the linkage between budget and manpower planning, and operational efficiency of animal health services in sub-Saharan Africa.

5. List and discuss three important indicators used in assessing the effectiveness of government services provided to the livestock subsector in Africa.

6. Describe three options in improving the effectiveness of African animal health services.

6.2 Introduction

Livestock policy analysts may propose new projects or programmes as instruments of policy implementation. Or, they may be asked to investigate the operational problems of existing livestock services with a view to increasing their efficiency.. In either case, an understanding of the principles of budget and manpower planning is essential to the task. Those responsible for formulating and/or monitoring the budget and manpower plan for livestock services frequently lack both the training and the skills for doing so. One purpose of this module is to introduce some of the principles and issues involved in planning and to provide an opportunity to carry out some planning exercises.

Budget and manpower planning could be made more reliable and less time-and-paper consuming if more were known about past experiences. Policy scientists at ILCA and elsewhere have analysed experiences in African animal health services. Some useful rules-of-thumb regarding ratios between broad categories of expenditure and resources have emerged from this analysis. These are presented in the second section of the module, which also discusses some approaches to improving the effectiveness of the services provided.

6.3 Steps in budget and manpower planning

Seven major phases involved in planning and managing any rural development policy, project or programme can be roughly sketched as follows:

1. Identification

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2. Formulation and control

↓

3. Appraisal and selection

↓

4. Negotiations

↓

5. Implementation

↓

6. Monitoring

↓

7. Evaluation

Policy, programme or project monitoring and evaluation activities feed information into new designs, generating potentials for improvement in formulation, implementation and impact. In practice, however, courses of action identified often proceed little further than the formulation stage. If implemented, they are rarely monitored or evaluated. Feedback relevant to the design of new projects, programmes or policies is therefore either scant or non-existent and reports on causes of "success" or "failure" tend to be vague.

It is at the formulation stage and during monitoring that an understanding of the principles of budget and manpower planning becomes critical. Poor formulation and/or monitoring of budget and manpower needs can, for example, result in the following problems:

- The rejection of projects, programmes or policies because of over-stated budget and/or manpower requirements at the formulation stage.

- Non- or incomplete implementation of projects due to understated costs and manpower needs, leading to chronic shortages of human and physical resources.

- A tendency for personnel costs to rise with time, "squeezing out" other important project cost items and preventing effective implementation.

The need for careful budget and manpower planning is, therefore, crucial to the success of any project, programme or policy.

6.4 Some principles of budget and manpower planning for livestock development

Budget and manpower planning in Africa is complicated by the fact that information on the availability of resources is often completely lacking, not only when projects are being formulated, but also during their implementation. As a result, planning is fraught with

uncertainty and implementation must be continually adjusted as circumstances change. The central problem of budget and manpower planning is how to deal with this uncertainty. Careful formulation and monitoring are thus important in minimising this uncertainty - which also arises from the absolute and relative limitations in the availability of financial and manpower resources.

A number of principles are important in this respect:

- Understand the relationship between capital and recurrent costs.

- Understand the relationship between staff and non-staff recurrent costs.

- Clearly identify those resources critical for success and seek consensus to ensure that they will be made available.

- If resources will not be made available, modify the project accordingly.

- Understand the relationships between inputs.

- Include contingency allowances in budget projections.

6.4.1 Capital and recurrent costs

Capital expenditure breeds future recurrent costs. When capital development is proceeding apace, planners and policy makers tend to forget that heavy recurrent costs will be incurred several years down the line. Capital funds are often (though not always) easier to acquire, for instance from donors, than are recurrent funds, which traditionally come from the Ministry of Finance. Typically, there is little analysis of the relationship between capital and recurrent costs, and recurrent funds tend to be committed more or less automatically in order to secure capital funding. As Chambers (1974) notes, "In planning activities, recurrent resources...have been relatively neglected, and there is a strong case for subjecting recurrent allocations and their use to more stringent appraisal, evaluation and management".

(Hint to instructors: Not all countries use their resources equally efficiently.. Another use of the ratio between capital and recurrent costs is to ask whether one's own country has the same ratio as others with similar conditions, and if not, why not. Get the participants to form pairs in order to look into this question, comparing their own country with a neighbour's.)

6.4.2 Staff and non-staff recurrent costs

The same principles which apply to the ratio between capital and recurrent costs also apply to the ratio between staff and non-staff costs within the recurrent cost category. Staff costs breed non-staff

Box 6.1: Recurrent costs and the planner.

Let C be the capital cost of 1 unit (a dip) enabling a certain activity (dipping) and R the annual recurrent costs of operating that unit. Then, C/R is the ratio between them. Let I be the amount of investment funds available for building dips and O be the amount of funds available for operating them. The limit on the number of dips which can be successfully built and operated will be set by whichever is smaller, I/C or O/R. Project planners habitually ignore R and O and concentrate on C and I, assuming that O will increase to meet the needs generated by I. But the future size of O is limited by the following factors:

- The rate of growth in the economy as a whole.

- The relationship between the rate of economic growth and the rate of growth in the government's budget.

- The priority government gives to the agricultural sector, as expressed by its share of the government's budget.

- The priority given to the livestock subsector, as expressed by its share of the agricultural budget.

Planners in the livestock subsector have to learn to live with these factors, which are not going to change simply because they spend too much I. However, the planner responsible for budgeting the dipping programme should think about, and perhaps seek to influence, the following:

- The desirable proportion that dipping should represent of the ministry's total activities in the livestock subsector.

- The C/R ratio of dips and dipping.

Clearly, the planner must know what the C/R ratio is in order to allocate sufficient recurrent funds, thereby avoiding building dips that cannot subsequently be operated. But he or she may be able to do more than this. First, the project may need to be modified if the C/R ratio looks unrealistic. This might be done either by reducing the number of dips, by changing their design (e.g. making them sturdier), by delaying their construction or by replacing them with some other input. Second, the planner can investigate the feasibility of introducing users' charges, with the aim of reducing the amount of R needed from the government budget. For equity reasons, planners are often reluctant to charge for services. But if O is finite, then the issue is whether users (or some of them, at least) will be better off not paying for a service which is in very short supply, or paying for one which is plentiful. The planner can use the C/R, I/C and O/R ratios to check whether users should pay a capital subscription (because I is the limiting factor) or a users' fee. costs and the planner must know what the ratio between them is if resources are not to be wasted. Rising staff costs, coupled with a relative (and real) decline in funds available to meet other recurrent costs, has been a major cause of failure in animal health services of many countries in sub-Saharan Africa. As this trend continues, staff are unable to perform their functions effectively, as operational funds are steadily depleted.

6.4.3 Critical resources

Resources critical to success need to be established at the outset of the planning process. They may consist either of staff or of physical inputs (or of both). In either case, given the competition for scarce resources in most developing countries, it is likely that those considered necessary for one project will also be in demand for several others. Under these circumstances, rather than plan in a vacuum, it is vital to seek consensus on which project(s) should take priority. This may require consultation with other ministries and institutes besides one's own. Critical inputs should not only be identified but, where necessary, their continued availability in the future should be ensured. This is particularly true of manpower needs in livestock services, requiring some highly specialised skills which take a long time to develop (e.g. veterinarians). Hence, there is the need to monitor changing staff ratios and to relate these to future manpower and training needs. The following steps are normally followed:

- Project/programme objectives are determined and critical manpower needs are established by category.

- These needs are then related to the output of existing educational institutions for each category and for each period; transfers of staff from other sources are considered and negotiated.

- Allowances are made for wastage, caused by factors such as retirement, resignation, emigration, dismissal or death. (Wastage rates are frequently neglected in manpower planning, leading to the inefficient use of resources arising from unexpected manpower shortages.)

This procedure yields information on expected staff surpluses or deficits by category. A plan can then be devised to compensate for any anticipated shortages, giving careful consideration to the capacity of existing institutions to meet demands, the funds available for expanding them where necessary and the time that will elapse before additional manpower will come on to the market (e.g. trained veterinarians).

6.4.4 Project modification

The approach taken to project design will determine the size, scope and nature of resource needs. If critical resources cannot be obtained for the project as currently designed, it will have to be modified. Modification will involve one or several of the following options:

- Reducing the size of the project, thereby scaling down the demand for scarce resources.

- Redesigning the project by substituting scarce resources with others which are cheaper and/or more plentiful.

- Rescheduling project operations to allow more time for resources to become available.

There may be considerable scope for resource modification without altering basic project/programme objectives.

6.4.5 Relationships between inputs

The relationships between inputs should be understood and specified. All, not just some, inputs may need to be available before a given new technology can work. For instance, a new printing press cannot function unless paper, plates and ink are also provided. Alternatively, certain inputs may be vital over one period but not needed over another. For instance, seed is required during the planting season but not thereafter; peak labour requirements will occur during planting, weeding and harvesting, but not during the dry season.

Techniques such as critical path analysis and bar chart planning have been used to establish resource-to-resource and resource-to-activity relationships more precisely and to improve the scheduling of operations. The former relies on a precision of control rarely achievable in livestock projects/programmes in Africa. However, the latter can be of use in:

- identifying and establishing resource linkages
- examining the assumptions regarding the availability of critical components
- examining potential conflicts in the scheduling of project activities
- monitoring capital and recurrent expenditures.

Figure 6.1 relates project activities to labour availability. Activities are first scheduled according to specified time periods, then the labour needed for each period is calculated. The labour requirement is then compared with the amount of labour available to determine the surplus or deficit for each period. Any necessary rescheduling or redefinition of activities can then be carried out.

Figure 6.1. ***Labour resource and activity relationships for a hypothetical project plan.***

6.4.6 Contingency allowance

Provision should be made for unforeseen delays or shortages by including **contingency allowances** for all inputs in budget projections. Contingencies are of two kinds:

- Physical contingencies, which compensate for the under-estimation of infrastructural needs in the capital budget. It is normal to allow between 10 and 15% for such items. Where capital expenditures are tied to specific components (e.g. housing to staff) or where there is no uncertainty with respect to physical needs (e.g. construction of standard buildings to design specifications), physical contingencies should not be applied.

- Price contingencies, which compensate for inflation of both capital and recurrent cost items. If necessary, variable inflation rates may be applied to different items in the budget.

Contingency allowances should not be so large as to cover all conceivable cost over-runs, since this will reduce the incentive for careful cost estimating, relax the pressure for tight control

during implementation and lead to misleadingly low estimates of rates of return on the proposed project (Gittinger, 1973).

Contingency allowances are best shown separately in cost tables, with appropriate footnoted explanations on how they were arrived at.

6.4.7 Relevant exercises

Exercise 6.1: Budget and manpower planning.

Example. The exercise which follows is based on data from a rural development project document in an imaginary country. Eight areas, designated as Rural Development Zones, have been identified as suitable for intensive development. The project is intended to improve crop and livestock production through the provision of extension and marketing services, the construction of roads, input supply depots and stock water supplies, the development of small irrigation schemes and the rationalization of land use practices through resettlement. Rangeland areas are to be fenced and improved pastures will be introduced on a trial basis in selected areas. Veterinary services are to be increased and breed improvement schemes will be implemented.

The proposed capital development programme will be phased as follows:

Rural Development Zone	Year of commencement	Year of completion
A to E	1	5
F to H	2	5

Capital development and recurrent cost budgets are given for area A in Tables 6.1 and 6.2. Note that:

• Major recurrent and capital cost categories are broken down by item in sufficient detail to ensure that all important cost components are included. Where detailed itemisation is not needed, costs may be aggregated (as in the case of office running costs).

• Financial budget projections have little meaning beyond a three- to five-year time horizon. The time period chosen will normally depend on the budgetary planning period adopted by the government and/or donor agency involved (e.g. triennial review period or a five-year national plan period).

• While the tables presented here only summarise the project's capital and recurrent costs, government and donor commitments will normally need to be clearly specified and separated out for negotiation purposes.

Table 6.1. ***Capital cost budget for Rural Development Zone A (years 1-5) (A$).***

Table 6.2. *Recurrent cost budget for Rural Development Zone A (years 1-5) (A$).*

Exercise: (estimated time required: 4 hours).

Question 1. Tables 6.1 and 6.2 make no provision for physical or price contingencies. All costs are expressed in terms of constant prices. Complete the summary cost tables (Tables 6.3-6.5), given the following contingency allowances:

- a physical contingency allowance of 10% for capital expenditures on land, livestock and irrigation development

- A price contingency allowance of 10% per annum on all capital and recurrent cost items (compound interest tables may be used).

What proportion of the total 5-year budget is made up of contingency allowances? Note the impact of a 10% inflation rate on annual and total budgetary needs. Note as well the changing relationship between capital and recurrent costs in the budget, as portrayed in Figure 6.2. Assuming inflation continues at 10% a year until year 10, plot recurrent cost commitments to that date in Figure 6.2.

Question 2. Table 6.6 gives some illustrative examples of recurrent expenditure as a proportion of investment expenditure, also known as "r" coefficients, for some agricultural development projects.;

- Assuming that no capital costs are incurred from year five onwards and that recurrent costs continue to year 10 at year 5 levels, calculate the "r" coefficient for Rural Development Zone A using the total financial costs you calculated in Tables 6.3 and 6.4.

- Suppose now that you did not take account of price contingencies in your calculations of capital and recurrent costs. Recalculate the "r" coefficient for Rural Development Zone A on this basis.
Compare this coefficient to the one you obtained previously and comment on the results.

- The preceding calculations use total recurrent costs and include costs which do not necessarily recur in every year of the project. Identify and list some of these cost items from Table 6.2.

Question 3. Table 6.7 summarises programme needs for junior level extension agents. Staff for these categories can be obtained from the 2-year National Agricultural Certificate Course. Twenty junior level staff currently in the field are also available for immediate transfer to the new programme.

Table 6.3. *Summary capital costs for Rural Development Zone A (years 1-5) (A$).*

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Grand total
a) Construction	46,200	33,500	12,000	12,000		103,700

b) Vehicles	18,000		14,500	14,500		47,000
c) Land development	58,155	55,655	53,155	43,155	41,280	251,400
d) Livestock development	41,965	40,915	33,915			116,795
e) Irrigation development	59,350	30,850				90,200
+ Physical contingency @ 10% on c) d) and e)						
Total capital cost (constant prices)						
+ Price contingency on items (a-e)						
Total financial cost						

Table 6.4. ***Summary recurrent costs for Rural Development Zone A (years 1-5) (A$).***

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Grand total
a) Salaries	77,570	78,770	78,770	77,570	63,850	376,530
b) Vehicle costs	26,800	26,800	26,800	26,800	26,800	134,000
c) Tractor pool costs	8,710	8,710	8,710	8,710	8,710	43,550
d) Other recurrent costs	22,890	31,690	34,255	35,895	36,890	161,620
Total recurrent costs (constant prices)						
+ Price contingency @ 10% on items (a-d)						
Total financial cost						

Table 6.5. Summary capital and recurrent costs for Rural Development Zone A (years 1-5) (A$).

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Grand total
Capital costs						
Recurrent costs						
Total financial costs						

Figure 6.2. ***Capital and recurrent costs (Rural Development Zone A).***

Complete the table, calculating the surpluses or deficits of junior staff available for the programme. Discuss what courses of action may be considered to ensure that adequate numbers are available during and after the implementation phase. Retirements, transfers and dismissals are expected to be 10% per year.

Assume now that 20% of certificate graduates are absorbed by the private sector and are not available for government employment. Recalculate the table. Comment on the sensitivity of the

programme to changes in the availability of certificate graduates. Discuss possible courses of action open to the programme planning staff.

Table 6.6. *Recurrent expenditure implications of projects (some examples).*

	"r" coefficient[1]
Agricultural sector	
Forestry	0.04
Veterinary services	0.07
Fisheries	0.08
General agriculture	0.10
Livestock	0.14
Other examples	
Agricultural colleges	0.17
Rural health centres	0.27-0.71
Feeder roads	0.06-0.14

[1] If a livestock development programme including water supply system, fencing, internal roads etc costs $ 1 million, we can estimate that it would cost an average of $ 140,000 in each subsequent year to meet salary, operating and maintenance costs.

Table 6.7. *Junior staff requirements and availability in all zones.*

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Transferred junior officers at start of year	20	18	16	14	13
Retirements, transfers and retrenchments	2	2	2	1	1
New junior staff required by programme:	25	30	28	14	0
Agricultural credit officer (ACO)	2	1	1	-	-
Agricultural extension officer (AEO)	10	25	25	14	-
Agricultural livestock extension officer (ALEO)	5	2	-	-	-
Mechanisation assistant (MA)	4	1	1	-	-
Grain storage officer (GSO)	4	1	1	-	-
Total junior staff required	45	48	44	28	13
Total available certificate graduates	20	20	20	20	20
Balance available for programme (+,-)					

Important points (6.2-6.4)

• Seven major steps in budget and manpower planning for a project, programme or policy are:

- identification
- formulation and control
- appraisal and selection
- negotiation
- implementation
- monitoring evaluation

• Knowledge of the principles of budget and manpower planning is critical at the formulation and monitoring stages.

• Budget and manpower planning in Africa is characterised by uncertainties because of the lack of information on the availability of resources.

• Four important considerations in budget and manpower planning are:

- Understand relationships between recurrent and capital costs, and personnel costs and non-personnel costs.

- Identify resources critical to project success and find out the possibility of project modification in case of non-availability of these resources.

- Understand the relationship between inputs.

- Include contingency measures for all project inputs.

• Capital expenditure incurs future recurrent costs. Likewise, staff costs breed non-staff costs.

• During formulation, it is important to identify which inputs are crucial for the success of the project and to negotiate to secure them.

• When assessing the future availability of manpower, allow for wastage and for the time required to train replacements and additions.

• If crucial resources will not be available, modify the project.

• Think about phasing inputs. Bar charts can be a useful tool for scheduling operations.

• As a safety measure, include contingency allowances in budget projections. Contingency measures are of two types:

- physical contingencies
- price contingencies.

6.5 Staff and non-staff costs: The crisis of animal health services

6.5.1 Decline in performance of animal health services

Healthy animals are a prerequisite if the livestock subsector is to perform productively. Yet, animal health services in sub-Saharan Africa have deteriorated alarmingly during the past decade, with the control of economically important diseases increasingly jeopardised. Some indicators of the magnitude of the problem in sub-Saharan Africa are:

- Direct and indirect losses from animal disease and health-related causes amount to billions of US dollars per year.

- Many of these losses are directly caused by mortality in cattle, sheep and goats and in other species, mainly pigs and poultry.

- Rinderpest, foot-and-mouth disease and tick-borne diseases are major causes of animal loss and/or lowered animal productivity. Corresponding losses in terms of trade and foreign exchange earnings also result.

- Internal parasites are a major cause of death in pre-weaned calves and lambs.

The declining performance of animal health services highlights the need for careful budget and manpower planning. There is a clear link between inadequate planning and operational inefficiency. After briefly examining the evidence for this link, some possible solutions to the problem will be discussed.

6.5.2 Budget trends

Post-independence relative levels and trends in budget and manpower allocations, and ratios in the animal health services of West/Central and East/Southern Africa have been studied and analysed by Addis Anteneh (1983; 1985a; 1985b; 1991) and de Haan and Solomon Bekure (1991). These studies compared the relative shares of recurrent expenditures on livestock services with recurrent expenditures on all agricultural services. By 1979, the share of livestock services in total agricultural services was, in most cases, proportionately lower than the share of livestock output (livestock GDP) in total agricultural output (agricultural GDP). This indicated that in most of the countries studied, livestock services did not receive an allocation proportionate to the contribution of the livestock subsector to GDP (Table 8).

In both regions studied, real recurrent expenditure allocated to livestock services increased over time. The most important factor contributing to the poor performance of livestock services was the disproportionately high amount of resources spent on staff, relative to non-staff costs.

Within the West and Central Africa region, growth in total recurrent budgets and staff expenditure allocated to livestock services continued into the mid 1980s for most countries studied. Overall, staff costs tended to rise faster than the total recurrent cost budgets, further "squeezing" non-staff costs in the process.

Table 6.8. ***Share of livestock in agricultural GDP and livestock service in agricultural budgets, 1978/1979.***

Region/Country	Share of livestock GDP in agricultural GDP (%)	Budgetary share of livestock services in agricultural services (%)
West & Central Africa		
Burkina Faso	29	16
Cameroon	10	14
Gambia	21	4
Niger	29	8
Sierra Leone	7	5
East & Southern Africa		
Botswana	(75-80)[1]	44
Ethiopia	33	11
Kenya	40	34
Lesotho	58	28
Malawi	6	21
Swaziland	16	48

Source: Addis Anteneh (1991).

[1] Estimates from various sources.

In East and southern Africa, recurrent expenditure per TLU[1] not only declined in real terms, but the share of staff expenditure in total recurrent expenditure also rose. This probably reduced the effectiveness of livestock services even more than in West and Central Africa[2].

[1] TLU = one tropical livestock unit of 250 kg live weight. The TLU is the equivalent of 1 camel, 1.25 horses, 1.43 bovine, 2 donkeys, 5 pigs, 10 sheep or goats or 100 poultry.

[2] The ratio between staff and non-staff costs is likely to be affected by the environment. A large country in the arid/semi-arid zones with relatively low disease incidence will have a different ratio to another country in an environment with higher disease incidence (Anteneh, 1985a).

6.5.3. Manpower ratios

IEMVT expresses the ratio between staff and non-staff recurrent costs as the **coefficient of efficacy** (CE), such that:

CE = non-staff expenditure/staff expenditure

Table 6.9 summarises trends in the coefficient of efficacy over the period 1969-79 for 14 West African countries. In all but two cases, the coefficient declined over the period. Similar patterns were observed in East Africa and in Zambia. This decline represents both a failure on the part of governments to provide the necessary operational funds to support staff activities and a failure on the part of animal health services to limit staff numbers and salaries.

As a result, staff have been underemployed and unable to provide an effective service-even when the will to do so existed. The production and distribution of vaccines to control serious diseases has been seriously affected, as has support for public health control measures. Solutions to this problem must be found if further deterioration in the provision of basic animal health services is to be prevented.

Table 6.9. ***Changes in the efficiency coefficient in African animal health service budgets (1969-79).***

Source: Bremaud et al (1976a; 1976b; 1976c; 1976d; 1976e; 1976f; 1977) and IEMVT (1980)
... = data not available.

Box 6.2: Performance indicators for animal health services.

Besides the ratio of staff:non-staff costs, two further ratios affect the delivery of national animal health services and are therefore important indicators of their efficiency. These ratios are:

- the ratio of senior (highly qualified) junior (auxiliary) staff.
- the ratio of staff to TLUs.

The optimum levels for both these ratios depend on the range of services being offered, the location of staff, the species of livestock receiving attention, the size of individual herds and their dispersion, and the ease with which subordinate staff can be supervised. The following broad guidelines have been suggested (Sandford, 1983; de Haan and Nissen, 1985).

When the functions of the veterinarian are primarily confined to visual diagnosis in the field, supervision of mass vaccination and enforcement of quarantine, ratios of 1 veterinarian to 20-30 auxiliary staff and up to 200,000 TLUs are feasible, the implied auxiliary staff: TLU ratio in these circumstance being 1:6667-10,000. When the veterinarian's functions extend to more sophisticated diagnosis and preventative care on a herd/flock basis, rather than on a mass vaccination basis, ratios of 1 veterinarian to 10 auxiliaries and 1:10-30 000 TLUs are feasible,

the implied auxiliary staff: TLU ratio in these circumstance being 1:1000-3000.

When the functions entail a full range of animal health services (including artificial insemination and individual animal care), ratios of 1 veterinarian to 1-5 auxiliaries and 1:5000 TLUs are feasible, the implied auxiliary staff:TLU ratio in these circumstances being 1: 1000-5000.

Because staff numbers have been allowed to increase, most sub-Saharan African countries appear, in the light of these ratios, to be endowed with enough senior and junior staff to provide basic preventative animal health care (Sandford, 1983; Cheneau, 1986; de Haan and Nissen, 1985). However, the appearance is deceptive, since in most countries there has been a corresponding shortfall in funds available to meet the costs of veterinary inputs and other supplies.

6.6 Approaches to improve the effectiveness of African animal health services

It is impossible to define an optimal staff:non-staff expenditure ratio, since the conditions determining it vary from one country to the next. However, the evidence suggests that a ratio of 1:1 is generally desirable. In order to achieve such a ratio without reducing staff, a budget with a current ratio of 3:1 would have to be increased by 50% and additional investments might also be required. The chances of such a budgetary increase are remote in most sub-Saharan African countries. Measures must therefore be taken within the financial constraints imposed. Such measures are difficult to take wherever entrenched organisational conventions, rigid training philosophies or pressure from professional interest groups inhibit change. Nevertheless, the following approaches are possible:

- cost recovery and the removal of subsidies
- privatisation
- organisational reform.

6.6.1 Cost recovery and the removal of subsidies

In the majority of West African countries, animal health services are provided free of charge. In at least nine countries, all vaccines and drugs are provided at no cost to the producer. In at least four others, vaccines are provided free but charges are levied for drugs and for curative treatments. Only two countries pursue a policy of cost recovery for most materials and services.

In East and Southern Africa, the majority of countries provide free vaccinations but charge the producer for drugs. Several countries have introduced a fee for individual treatments and services. However, the revenue recovered represents only a small fraction of total operating costs (between 5 and 20%; see de Haan and Nissen, 1985).

There is the potential for greater cost recovery in West Africa, and some scope for cost recovery in East and Southern Africa. However, in nearly all cases, the impact on operational budgets is likely to be limited at first, since at present, veterinary inputs account for a low proportion of overall operating costs.

The following arguments have been used in support of zero to low cost-recovery:

- Animal health services benefit all members of society, so the costs should not be borne only by those who own or raise livestock.

- Livestock producers will make less use of animal health services if full payment is required.

- Leakages in the system would not permit full cost recovery.

- The livestock subsector is already taxed in various ways (e.g. head tax, slaughter fees, internal trade tariffs etc) and the revenue from these taxes should be used to finance animal health services. (In fact, most revenue from the livestock sector tends to be absorbed by the central government and is not directly recycled to livestock services.)

The extent to which animal health services should be subsidised is debatable. There are sound arguments for continuing to subsidise some services, particularly mass vaccination against diseases such as Rinderpest and CBPP (contagious bovine pleuropneumonia). Subsidisation has been shown to increase the response to vaccination programmes in Kenya, whereas the imposition of fees for dipping in Tanzania has had the reverse effect (Sandford, 1983).

However, de Haan and Nissen (1985) argue that at least partial cost recovery is justified, and that all non-salary costs should be recouped to ensure that services can be maintained. When the service provided is more of an individual (or curative) nature, governments should give serious consideration to the recovery of all costs, since producers receiving individual attention are normally quite willing to pay for it.

The best approach to use in recovering costs is also open to question. Attempts to establish **revolving funds** to finance drugs and services have been generally unsuccessful (Sandford, 1983; de Haan and Nissen, 1985) and have done little to alleviate the chronic shortage of operating funds. It has been suggested that cost recovery could be improved if veterinary field staff were allowed to sell drugs to farmers at a profit to themselves, increasing the incentive to provide effective services (CTA, 1987).

6.6.2 Privatisation

Greater involvement of the private sector in the provision of veterinary services and supplies might improve the overall efficiency of health services. The funds and/or personnel released could be used to provide services deemed to be more specifically the responsibility of government.

The decision whether or not to privatise will often depend on the nature of the service provided, i.e. whether it promotes a **public good** or **a private good. A public good** (strictly defined) is one which if supplied to one person can be made available to others at no extra cost, and from which others cannot be excluded. National defence is an example. By a looser definition, public goods are ones in whose production or consumption there are **externalities,** i.e. they confer costs and benefits to others which are not reflected in the costs or prices paid by the immediate producers or consumers.

According to de Haan and Nissen (1985), animal health services which fall into the **public good** category include:

- veterinary inspection to ensure that public health standards are adhered to
- veterinary reporting and the collection of relevant statistics
- the detection of notifiable diseases and vaccination against diseases of national economic importance
- quality control of vaccines produced within the country.

These are services for which, because of this "public" nature, it is difficult to charge a full cost user fee.

The supervision, enforcement and funding of mass vaccination campaigns falls rightly within the responsibilities of government. Including the private sector in the implementation of a campaign may nonetheless be justified, and subcontracting activities under government supervision may reduce costs significantly.

When the benefits of treatment accrue predominantly to the individual and when those who refuse to pay for a service can be denied access to it (the exclusion principle); disease control can, in theory, often be more efficiently handled by the private sector, with the government retaining responsibility only for quality control of the services provided. The problem is that the private sector is often not sufficiently developed to take on a curative role on the scale required. In these circumstances, governments may need to concentrate first on encouraging private enterprise.

(Hint to instructors: Ask the participants to think of ways of encouraging private enterprise. For example, could middle-order veterinary staff, often in over-supply in government services, form the basis for a viable private sector? Is there scope for relaxing the rules on out-of-hours private practice by government-employed veterinary surgeons or for creating professional veterinary associations to work alongside state services?)

In the pastoral zones, it may be difficult to attract private operators, and mobile personnel attached to specific communities may be better at providing low-cost services in more remote areas. Livestock owner associations might be formed for this purpose (CTA, 1987). Such a service needs to be carefully planned, with the definition of government/community

responsibilities in terms of salary payment, supervision and staff selection being clearly defined at the outset.

6.6.3 Organisational reform

Restoring the balance between staff and non-staff costs implies careful exam nation of the organisation and management of animal health services. For example, the automatic recruitment of veterinary graduates and/or the continued recruitment of new junior staff will be inappropriate when existing staff are already underemployed. There may be a case for introducing early retirement (with incentives) or even for dismissing staff - a measure rarely used at present.

Again, for specific campaigns or seasonal programmes, hiring temporary staff or using staff from other departments may obviate the need to recruit permanent staff who will be under-utilised at other times of the year. When the private sector is relatively underdeveloped, the two latter options are likely to prove more effective in the short term than attempting to privatise. In any reorganisation, the following variables should be carefully considered:

- Staff densities, as exemplified by the ratio of senior to subordinate staff (Box 6.2).

- The allocation of functions among different organisations actually or potentially involved in the provision of services.

- The location and mobility of services relative to the livestock populations they serve, i.e. whether they should be centralised, dispersed, stationary or mobile.

- The level of skills required by staff in the field, hence the type of support training needed.

- The degree of integration possible among the various services, e.g. whether to provide a single, multi-purpose service or a range of specialist services. In the choice between specialist and multi-purpose services and/or their integration at different levels, technical considerations, availability of skilled staff and finances play important roles. By far the dominant influence on such a choice is technology, i.e. the types of improvements developed by research, the need for technical skills and facilities to handle inputs, and the frequency with which these inputs have to be delivered.

The important point is that options for adjustment do exist in most countries. The pros and cons of all relevant options for increasing operational efficiency should be carefully considered.

6.6.4 Relevant exercises

Exercise 6.2: Budgeting for animal health services.

Data. Refer to Exercise 3.4 for an understanding of herd projection models. Now study the following production parameters for a regional or national cattle herd raised in a communal area:

Number of cattle by age and sex category ('000 head) in 1989

Calves:
0 to 1 year-old males: 312
females: 3 12
Other stock:
1 to 2 year-old males: 150
females: 150
2 to 3 year-old males: 140
females: 140
Cows: 700
Bulls/oxen: 1250

Excluding calves, the total herd in 1989 was estimated at approximately 2.5 million head.

Expected performance parameters (1989-94)

Annual mortality rates:

Calves: 25%
1 to 3 year-olds: 8%
3 year-olds: 5%
Calving rate: 60%

Average annual offtake rate: 8% of the herd, excluding calves.

The offtake rate for cows is assumed to be 10% per year, with the residual number of stock slaughtered consisting of males over three years old.

Exercise: (estimated time required: 3 hours).

Question 1. Project herd numbers by category of stock in the table provided, and calculate the annual growth rate of the herd for the period 1989-94.

Herd projection and annual growth ('000 head).

Year	Stock category	Opening no.	Births	Deaths	Net sales	Closing no. (year end)	Opening no. (next year start)
1989	0-1 y.o males		312	78		234	
	0-1 y.o females		312	78		234	

	1-2 y.o males	150		12		138	234
	1-2 y.o females	150		12		138	234
	2-3 y.o males	140		11		129	138
	2-3 y.o females	140		11		129	138
	Bulls/oxen	1250		63	111	1076	1025
	Cows	700		35	67	599	728
	Total	2530	624	300	178	2677	2677
1990	0-1 y.o males						
	0-1 y.o females						
	1-2 y.o males						
	1-2 y.o females						
	2-3 y.o males						
	2-3 y.o females						
	Bulls/oxen						
	Cows						
	Total						
1991	0-1 y.o males						
	0-1 y.o females						
	1-2 y.o males						
	1-2 y.o females						
	2-3 y.o males						
	2-3 y.o females						
	Bulls/oxen						
	Cows						
	Total						
1992	0-1 y.o males						
	0-1 y.o females						
	1-2 y.o males						

	1-2 y.o females						
	2-3 y.o males						
	2-3 y.o females						
	Bulls/oxen						
	Cows						
	Total						
1993	0-1 y.o males						
	0-1 y.o females						
	1-2 y.o males						
	1-2 y.o females						
	2-3 y.o males						
	2-3 y.o females						
	Bulls/oxen						
	Cows						
	Total						
1994	0-1 y.o males						
	0-1 y.o females						
	1-2 y.o males						
	1-2 y.o females						
	2-3 y.o males						
	2-3 y.o females						
	Bulls/oxen						
	Cows						
	Total						

Question 2. Complete the following animal health staff and recurrent budget table:

Item	Annual 1989 growth rate (%)	1994
Total staff (no.)		
Veterinarians	20	3%

Auxiliary staff	500	5%
Wages rates/annum (L$) (per person):		
Veterinarians	12,000	7%
Auxiliary staf		7%
Staff budget (L$)	740,000	
Non-staff budget (L$)	500,000	
Total recurrent budget (L$)	1,240,000	6%

Question 3. Relate the above table to the herd projection results you have derived and:

- Estimate the total herd:senior staff ratio and total herd:total staff ratio for 1989 and 1994.

- Calculate the staff:non-staff budget ratio for 1994; compare this ratio to that for 1989 and comment on the results.

- Calculate the level of non-staff expenditure/head of cattle for 1994 in real terms, assuming the appropriate price indices for 1989 and 1994 are 100 and 112, respectively (1989 prices). Compare this result with that obtained for 1989. What does the result imply about the effectiveness of the veterinary service?

- Do you think that the projected herd size and production levels can be achieved as assumed, given the envisaged changes in manpower and budget resources? If not, why not? Which production parameters are most likely to be affected by these changes?

Question 4. What could be done to maintain or even improve the effectiveness of the animal health service if these budgetary and manpower trends continue?

Question 5. The information given in Tables 6.10 and 6.11 relates to the animal health services of two African countries, A and B. Examine the financing and staffing structure for each country and compare the two countries in terms of:

- The absolute level of expenditure in US$/LU, taking into consideration such factors as livestock density (LU/km^2) and staffing density (LU/staff).

- The average annual rate of change in total, staff and non-staff expenditure per LU between years one and nine.

- The operating funds available per staff member per month for years five and eight.

Exercise 6.3: Group Exercise: Budget and manpower planning for the livestock services.

Policy making involves people and organisations at different levels within government. Discuss the extent to which managers of livestock services, in one country to be selected by the group, are able to influence policy changes with respect to the following:

- the total budget available for livestock services
- staff:non-staff cost ratios
- the ratio of high level:auxiliary staff.

To pursue the discussion, let the group divide into subgroups of three. Assign one of the following roles to each member of the subgroup:

- Minister of Agriculture
- Director, National Livestock Services
- Head, Livestock Policy Analysis Unit.

Persuade the Minister on a proposed change of policy.

Table 6.10. *Financing and staffing of livestock services in Country A[1].*

[1] For country A, the total area of agricultural land (arable plus grazing land) is 76,200 km^2.
[2] In year 6 constant prices.

Table 6.11. *Financing and staffing of livestock services in Country B[1].*

[1] For country B, the total area of agricultural land (as defined above) is 56,460 km^2.
[2] In year 6 at constant prices.

Important points (6.5-6.6)

- Africa's animal health services are in decline primarily because of poor budgeting and manpower planning by governments.

- Livestock services in African countries do not receive an allocation proportionate to the contribution of the livestock subsector to GDR

- The major cause of poor performance in animal health services is the disproportionately high expenditure on staff costs in relation to non-staff costs.

- The ratio between staff and non-staff recurrent costs is expressed as the coefficient of efficiency (CE) where:

CE = non-staff expenditure/staff expenditure

- The CE has declined in recent years for most African countries.

- Besides CE, two other ratios affecting the efficiency of animal health services are:

- the ratio of senior to auxiliary staff

- the ratio of staff to tropical livestock units (TLU).

• In order to improve the effectiveness of animal health services, a staff: non-staff expenditure ratio of 1:1 appears desirable. The chances of attaining such a ratio are remote in most sub-Saharan African countries.

• Three major approaches to improving the effectiveness of animal health services are:

- cost recovery and removal of subsidies
- privatisation
- organisational reforms.

• Cost recovery may not prove effective since revenue recovered from such a measure will constitute only a very small fraction of the total operating cost.

• Privatisation of veterinary services and supplies seems promising in improving the efficiency of animal health services. However, some essential services Should not be privatised.

• Privatisation will not be successful unless governments encourage private enterprise.

7.1 Performance objectives

Module 7 is intended to enable you to:

1. Define land tenure and discuss three principal forms of land tenure.

2. Describe the effects of different forms of land tenure on attaining the four national policy objectives.

3. Cite case studies of land legislation to convert communal tenure into individual tenure and open-access tenure into well managed group tenure. Discuss the potential conflicts and trade-offs among national policy objectives in the implementation of these tenure reforms.

4. Discuss the roles of tax policy and stock control in controlling overstocking.

5. Describe important factors contributing to "spontaneous" tenure changes led by herders.

6. Discuss the merits and demerits of customary tenure in relation to mixed farming systems.

7.2 Introduction

Land tenure, with respect to the livestock sector, is concerned with the nature and range of rights that livestock producers have to land, water and other natural resources necessary for livestock production. Land tenure policy is concerned with the effects of different tenure arrangements on range and livestock productivity and on the distribution of grazing rights.

In this module, the two principal forms of grazing tenure are defined: individual tenure and communal tenure. Under communal tenure, we again distinguish between two principal forms *viz* "common property" tenure and "open-access" tenure. Next, the effects of different forms of land tenure on attaining four (of the five) main policy objectives are considered.

The potential conflicts and trade-offs among policy objectives are summarised and illustrated through case studies of the Botswana Tribal Grazing Land Programme and the Kenya Maasai group ranch programme. Other policy instruments for influencing stocking decisions, grazing fees and taxes and stocking controls are also discussed.

Spontaneous tenure change is discussed next. In many parts of the rangelands of Africa, tenure change is being led by herders. Some government land policies, such as land titling and registration programmes in Kenya, encourage farmers and herders to assert private claims to rangelands. Herder-led tenure changes will raise equity and other issues which require the attention of policy makers and policy analysts.

Finally, there is a discussion of two particular issues in relation to tenure in mixed farming systems: security of tenure and how more efficient farmers can gain access to more land.

7.3 Land tenure policy and African livestock development

7.3.1 Concept of tenure

Tenure refers to the nature and range of rights that individuals have to land, water and other natural resources in relation to rights exercised by other individuals, social groups and the state. Tenure to a given area of land may be vested in an individual, in some group of individuals who may exercise co-equal use rights to the land, in some corporate entity such as a co-operative or a church, or in the state, which may establish rules or regulations defining who may use the land and for what purposes.

Tenure is usefully described in terms of the **bundle of rights** an individual, group or the state holds to the land. With respect to individual tenure, the minimum, definitive right in the bundle of rights is the right of exclusive use for certain purposes. Other rights in the bundle might include the right to use the land in perpetuity, the right to designate heirs, the right to sell the land etc. Rarely, if ever, are an individual's rights unlimited. For instance, in the interests of public health or safety, it is common for states to prohibit certain uses which may cause pollution or injury. In many customary tenures, the local ethnic group retains the right to allocate individual farms only to qualified members of the group. Most states retain the right to confiscate

land for public purposes, with or without compensation, if this should be deemed necessary. Thus, states invariably hold at least a few of the rights in the bundle. An individual's right to harvest for his or her exclusive use of a crop may be conditioned by the right of all stockholders in the community to graze their livestock on that crop's residues after harvest. Here, there are overlying individual and community use rights to the same area of land.

7.3.2 Types of land tenure

Individual tenure

There are different forms of individual tenure. However, two major forms of individual tenure are **freehold** and **customary tenure.**

Freehold tenure is common in Western countries. Freeholders have what are considered private property rights over the land, which include the ability to sell the land, rent it to others and to use it as collateral for a mortgage. Under most forms of customary land tenure in Africa, the bundle of rights farmers may hold over individual farms is not as large as those under freehold. Typically, land cannot be bought or sold. Rather, it is allocated to qualified applicants (e.g. *bona fide* members of the community or local ethnic group) by the local land trustee on the basis of need. Land is not alienable from the community trust, so it cannot be used as collateral for loans. Usually, however, an individual's land use rights are very secure, subject to certain conditions; i.e. that land be more or less continuously cultivated, subject to periodic fallow. Land is usually heritable, another measure of long-term, essentially perpetual, tenure.

Controversy surrounds the question of the effects of customary tenure on agricultural investment and productivity on the individual farm (Cohen, 1980). Some critics argue that customary tenure provides insufficient security, thus contributing to low levels of investment, is inflexible in responding to market signals affecting choice of technology and crops, and, because land is not marketable, better farmers have difficulty gaining access to land that they are capable of farming more productively than their fellows. Alternative views are that, although there are disadvantages for some people, customary tenures provide low-cost access to land for the majority of the rural population, that farmers have long-term and secure usufruct rights, and that in many places, customary tenures are evolving to accommodate new technologies and formal land markets, at costs lower than would state-run land titling and registration systems. This debate over the effects of customary tenure on investment on individual farms is particularly relevant when considering questions of investment in on-farm infrastructure and adoption of technologies necessary for intensive production, such as dairy.

Communal tenure

Communal tenure refers to situations where a number of people use the land simultaneously. In much of sub-Saharan Africa, livestock are grazed on communal pastures. Grazing rights, in terms of the number of livestock an individual may graze, or where they may graze at different times of the year, may or may not be limited by some local governing structure or by the state. A group's rights may extend to prohibiting non-group members from using the pastures.

Alternatively, the pasture may be open to all who own livestock and have the labour and other necessary inputs to maintain them.

When considering communal tenure, it is useful to distinguish between two types of situations, namely **common property** and **open access.** In common property situations, there are relatively high levels of control over who has the right to use the resource and at what intensity. Common property situations are characterised by rules which define individual rights to a common resource. In open-access situations, individuals of any ethnic or other group have more or less unrestricted use rights to the resource. Open-access situations are characterised by an absence of defined property rights.

In most pastoral areas in sub-Saharan Africa, access to grazing is minimally restricted to members of the community or ethnic group which claims territorial rights over the area. In these cases the areas would be considered common property, in terms of the definitions offered for common property tenure and open access. However, an important concern for the analyst is the extent to which a common property system asserts effective controls over the range-use practices of those who have access to a given range. Very few of these systems apply such controls.

7.4 Tenure as an issue in rangeland management

Tenure policy bears on four of the five national policy objectives of concern to the policy analyst: resource conservation, economic efficiency, stability and equity. With regard to the fifth objective, economic independence, the relevant issues are similar to those raised under economic efficiency.. In the past, policy analysis has focused principally on the effects of tenure, and specifically communal grazing tenure, on resource conservation and economic efficiency. Most analyses have not given much attention to the stability and equity issues arising in tenure policy, with the effect that some of the more important tenure reforms in the range sector have been promulgated without the benefit of a complete understanding of the issues at stake.

In this segment of the manual we will present first the conventional critiques on the relationships between tenure and resource conservation and economic efficiency. analysis of the relationship between tenure and economic efficiency is complex, and will receive special attention. Relationships between tenure policy and stability and equity will be taken up in subsequent discussions of experiences with state-led tenure reforms, where their importance became apparent in the course of implementation.

7.4.1 Resource conservation

Most livestock in sub-Saharan Africa are grazed on communal pastures. Many analysts describe pasture tenure in Africa in terms of open access. Open access, uncontrolled grazing, is considered to be a principal cause of overgrazing and land degradation. Grazing land is a renewable resource. It regenerates at rates determined by natural factors, such as soil fertility and especially rainfall, and by management factors such as intensity of use. Any given area of land

has a **carrying capacity,** the number of livestock which it can sustain while maintaining biologically optimum levels of forage production. **Overgrazing** is defined as a reduction in forage production below the biological optimum, when considered in terms of some unit of time. Degradation will result when natural forage productivity is reduced more or less permanently, because of long-lasting damage to the productivity of the resource base. This might be due, for instance, to soil erosion caused by chronic overgrazing or change of vegetation composition towards less desirable forage species (Jarvis, 1984).

Maintaining optimum levels of long-term forage production requires that livestock numbers be maintained at carrying capacity. Livestock holders who wish to maximise the forage production and livestock over the long term must make their short-term stocking decisions consistent with long-term maximisation criteria. On communal rangelands this would require individual users to group together to determine the optimum number of total livestock to be allowed on the range, and to distribute grazing rights among all users so that the total number of livestock does not exceed carrying capacity. Experience has shown that, in the absence of strong institutional controls over individual stocking decisions, it is difficult to achieve this kind of co-operative outcome. In communal use situations an individual herder has no incentive to limit his or her stock numbers in order to conserve the range resources, if other herders are able to increase their herds to take advantage of the additional forage made available by one farmer's decision to hold down stock numbers. Hardin (1968) described the logic of over-exploitation of common resources, including communal pastures, as the **tragedy of the commons.**

"As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, 'What is the utility to me of adding one more animal to my herd?' This utility has one negative and one positive component.

The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.

The negative component is a function of the increment of one animal. Since, however, the effects of overgrazing are shared by all herdsmen, the negative utility for any particular decision-making herdsman is only a fraction of -1.

Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd."

For Hardin, the only practical solution to this dilemma was to internalise the costs and benefits of pasture use by converting communal pasture lands to individual tenure.

7.4.2 Economic efficiency

Land tenure also has implications for economic efficiency. objective of economic efficiency implies maximising the current national income and securing an acceptable rate of growth in it. National income is maximised when the net social value of output is maximised; that is, the gross social value of the benefits of an activity exceed the gross social costs by the widest possible margin. Although there are often divergences between social and private values, we

shall assume for the moment that the two values correspond. Thus, net social value is equal to profit and economically efficient land tenure is one where profits are highest. Two main conditions must be fulfilled for a land tenure system to be economically efficient:

- Land is allocated to that activity whose marginal product is most valuable to society. Imagine a hectare of land which can be used for the production of either milk or wool. If it is used for milk production the net value to society (i.e. the gross value minus production costs) per additional unit of output is $ 90; if used for wool production, $ 95. In this case, an economically efficient land tenure system would be one which allocates land to someone who is prepared to produce wool rather than milk.

- In whatever activity the land is used, it is combined with the other factors of production (e.g. human labour or capital in the form of livestock) in proportions such that the value to society of the marginal unit used of each factor is at least as high as it could be in other activities. If the marginal value would be higher in another activity, then more of that factor should be attracted to that activity.

In what follows, we shall focus on the issue of the optimum combination of land and capital in the form of livestock, i.e. on **stocking rate.** Overgrazing occurs when, as a result of there being too many animals on the range, profits (i.e. the difference between the value of output and the costs of production), are below the maximum achievable level. Jarvis (1984) suggests that overgrazing occurs whenever the present value of all future livestock production is below its potential as a result of an excessively high current stocking rate.

Figure 7.1 illustrates the short-term relationship between productivity per animal (measured in terms of annual weight gain per animal) and stocking rate (measured in terms of number of animals per ha). At low stocking rates, feed is abundant. But as stocking rate increases, animals begin competing for feed. At this point, average productivity per animal declines. At N', each animal will be consuming only enough forage to maintain itself, and will gain no weight.

Figure 7.1. ***Weight gain per animal as a junction of stocking rate.***

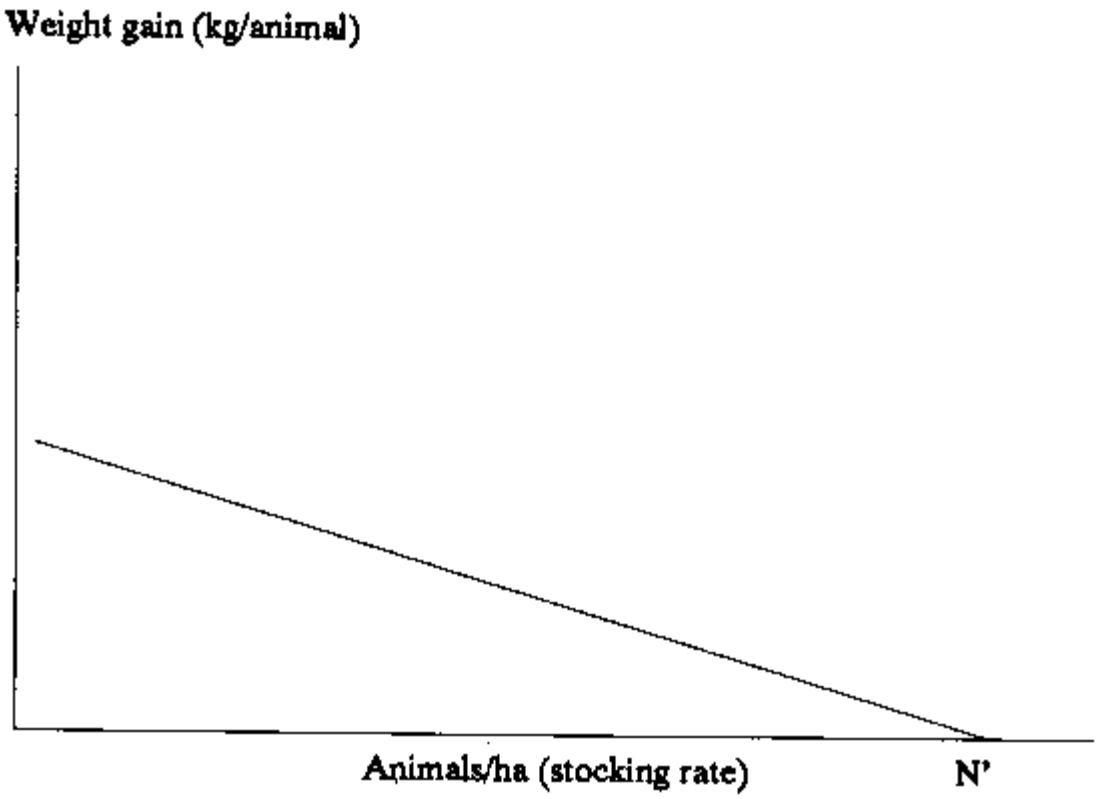


Figure 7.2 presents the same information as Figure 7.1, but superimposed is the relationship between productivity per ha and stocking rate. This second relationship is obtained by multiplying the average productivity per animal by the number of animals at each stocking rate. At low stocking rates, productivity per ha rises with stocking rate. At higher stocking rates, declines in productivity per animal offset increases in the number of animals. The productivity per ha rises to a maximum (at point Ñ) and then declines to zero (at point N').

Figure 7.2. ***Weight gain per ha as a junction of stocking rate.***

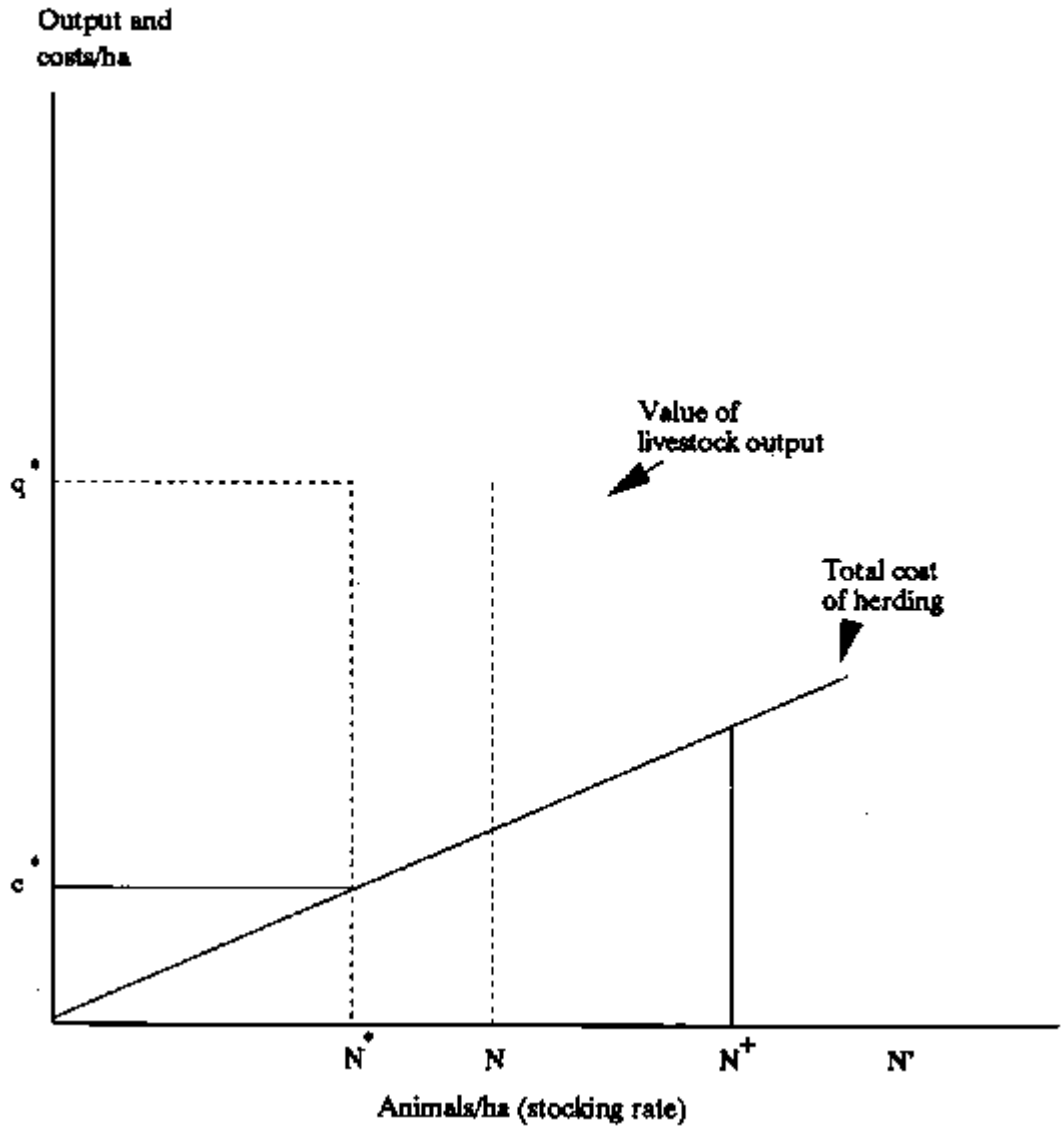
At what stocking rate or "density" is economic efficiency (the level of national income) maximised? In the hypothetical case in which livestock production occurred without inputs (or costs) except land, then, in the short term at least, economic efficiency would be maximised at the stocking rate where per ha output is maximised (Ñ). In reality, however, land is not the only input to livestock production. Other inputs are livestock, labour, water, veterinary supplies and so forth, and these inputs have costs.

Costs are introduced in Figure 7.3 - initially just the costs of livestock, which we can for the moment consider as equal to the interest foregone on the capital invested in the herd. If we assume that all the weight gained by the animals will eventually be sold and that every kg of weight gain has the same value, then the "value of livestock output" curve in Figure 7.3 is identical to the "weight gain per ha" curve in Figure 7.2.

In Figure 7.3, maximum profit occurs at the stocking density where the output value curve is at its maximum vertical distance above the cost curve (point N*). Here, total profit is equal to q*-

c*. Thus, N* is the economically optimal number of animals to graze. Note that this point is to the left of the stocking density at which output per ha is maximised (Ñ). Unless costs per animal stocked are zero (a practical impossibility), the profit maximising stocking rate will always be lower than the output maximising stocking rate. N+ is the open-access equilibrium, the point at which profits are zero. In an open-access situation, this is the stocking level beyond which rational herders will add no livestock to the range, because the value of output per animal is exceeded by per animal costs.

Figure 7.3. ***Value of livestock output and costs of herding as functions of aggregate herd size.***



Some aspects of these relationships merit further discussion. First, the precise values of N*, Ñ, N+, and N' will vary depending upon the average gain per animal, the price of the gain and the costs per animal. The distribution of animal locations will always be the same.

The model predicts open-access ranges will be stocked more heavily than those under individual tenure. It also suggests that if controls are put in place to limit access to communal ranges, thereby reducing stocking density, then total output and profits will be higher than they would be under open access. Any stocking density to the left of N+ but to the right of Ñ will yield higher output and higher profits than will the open-access equilibrium.

Why does the stocking density under open access exceed the levels at which economic efficiency and profits are maximised? Profit maximisation is achieved at stocking densities below maximum total output. Where there is no control over access to the commons, new entrants will know that they will benefit by adding livestock to the range. As long as the aggregate stocking density remains below the open-access equilibrium livestock production is profitable, although net profit will be less than the maximum. In terms of the model, profit maximising stocking density will more likely result when an individual or some grazing authority has exclusive control over the range. The profit maximising stock density will be maintained where potential users can be prohibited from adding their stock to the range. Once that restriction is removed, the animals added will shift the stocking density above that yielding maximum profit.

The relationship between weight gain per head, output per ha, and costs and profits at different stocking densities is illustrated in Table 7.1. Results are hypothetical but realistic. The table shows how, on a 10-ha piece of land, stocking rate and weight gain per head determine levels of output, costs and profits. also determine stocking densities under different forms of tenure if stockholders are profit maximisers.

Table 7.1. ***Maximum, optimum and de facto stocking rates.***

Note: 1 kg weight gain = $ 1. Costs are $ 30/animal irrespective of stocking rate.

* = Level of maximum profit (optimal)/ha (N*).

** = Level of maximum output/ha (Ñ).

+ = Limit *(de facto)* at which existing stockowner with one animal will add one further animal.

++ = Limit *(de facto)* at which new stockowner will introduce one animal.

De facto = What will probably happen in practice when there is no unity of control and benefit.

Under individual tenure, the single herder or enterprise will stock the land at a level of 0.3 head/ha (3 animals/10 ha) - the point at which aggregate profits are maximised. This is less than the stocking rate of 0.4 animals/ha (4 animals/10 ha) at which the gross value of output per ha is at maximum. Under open access, the stocking rate is unlikely to stabilise at either the maximum profit or the maximum output level because individual enterprises do not bear the costs of the decline in all animals' productivity caused by adding an additional animal to the grazing area. Herders will continue adding livestock to the range as long as the benefit for doing so outweighs the cost. For enterprises with no animals on the range (but entitled to put some) this, for the situation shown in Table 7.1, is true of all stocking rates below and including 0.6 head/ha. However, if an enterprise already has one animal on the range, it will add another at all stocking rates below and including 0.5 head/ha (but not 0.6) because at the level of 0.6 head/ha the joint profit it makes from two head (i.e. 2 x $ 35.00) is less than the profit it makes on its single animal (i.e. $ 72.50) at the lower stocking rate.

The analyses presented above suggest that stocking rates are higher and levels of economic efficiency and profit (but not necessarily total output) are probably lower under open access than they would be under individual tenure. Although much lower stocking rates are expected with individual tenure than with other tenure forms, they may not correspond to carrying capacity. Carrying capacity is a biological optimum. The stocking rate associated with the economically efficient optimum (N* in Figure 7.3) may diverge from this for a variety of reasons. This may be especially true if individual herders attempt to maximise short-term profits without concern for long-term consequences. Thus, there may still be scope for public policy intervention to encourage resource conservation, even under individual tenure.

Despite the lower stocking rates and improved resource conservation associated with individual tenure, reforms which attempt to convert communal tenure to individual tenure are likely to have implications for two other policy objectives, stability and equity.

7.4.3 Stability

Areas of livestock production in Africa tend to be characterised by low and variable rainfall. Rainfall varies in time and in space. On a year-to-year basis, a given area of rangeland may receive highly variable levels of rainfall. Forage production will, of course, vary with rainfall. Livestock producers in many arid and semi-arid regions of Africa maintain their herds at stable levels by moving livestock among areas which have received relatively higher rainfall levels. Livestock may range over extensive areas and follow regular patterns. For instance, during dry seasons, stock may be kept near permanent water sources. During rainy seasons, stock may be dispersed to pasture areas where ephemeral water supplies have been recharged by rainfall. Such opportunistic grazing strategies may in fact contribute to optimal utilisation of available forage in areas where forage production varies significantly in space and time (Sandford, 1982). Long-distance nomadism and transhumant pastoralism are rational adaptations to variability in forage production over extensive grazing lands.

If, under such circumstances, livestock were maintained within individual "blocks" of land, the number of livestock which could be maintained within the blocks on a year-to-year basis would be highly unstable. The smaller the block of land, the greater the inter-year instability in the number of animals which can be kept. If stable levels of production were to be maintained, the carrying capacity of the area would be determined by the amount of forage produced in low rainfall years. If herd size were permitted to increase to the carrying capacity of the block during high rainfall years, or even to average long-term carrying capacity, the stockowner would be forced to dispose of a high percentage of the herd, probably at depressed prices, during low rainfall years, assuming that he or she wished to maintain proper stocking rates.

These principles are illustrated in Table 7.2. Areas A, B and C are contiguous blocks of land which can either be allocated separately under an individual form of land tenure or merged together to form a single block under a common property or open-access system. On average (i.e. over several years) block C can support somewhat more animals than block A, which in turn can support more animals than block B.

The table contrasts three different scenarios. In scenario one, there is no inter-annual variability in rainfall or carrying capacity. In scenario two, there is inter-annual variability but each block varies between years in the same direction and to the same degree, i.e. rainfall varies in time but not in space. In scenarios one and two, there is nothing to choose, in terms of stability, between individual tenure and common property or open-access tenure.

In scenario three, however, rainfall varies not only over time but also over space. Block A may be having a "good" year while block C is having a "bad" one. It now makes a great deal of difference (almost 100%) to the maximum number of animals which can be kept in the "worst" year, whether animals are kept in three small blocks or in one large one, since the latter option would allow them to move further afield in search of better conditions. Herders would be realising higher levels of overall long-term average income by moving among the three grazing areas in pursuit of available forage. Open access and common property tenures, more so than individual tenures, permit herders to move over extensive areas in pursuit of available forage. The importance of mobility to livestock production in areas where rainfall is spatially variable is borne out by the fact that in some areas where individual grazing units have been demarcated and titled, herders will still graze their stock outside their own areas, as grazing conditions warrant.

7.4.4 Equity

Where land is a principal input to production, land tenure will have crucial implications for equity. In theory, open-access tenure should be more equitable than individual tenure or even common property. The smallest holder, regardless of his or her social affiliation, will have an opportunity to put livestock on the communal range. In practice, however, largeholders get a disproportionate amount of the communal forage by virtue of their large aggregate holdings. Smallholders may face labour constraints which limit their ability to range over extended areas.

Table 7.2. ***Capacity of three areas to support livestock under different rainfall scenarios.***

	Rainfall (mm) and number of animals for which there is sufficient feed		**Number of animals which can be kept in the worst year**	
	Years			
Area	**1**	**2**	**3**	
Scenario one: Rainfall does not vary from year to year				
A	400	400	400	400
B	300	300	300	300
C	500	500	500	500
Total	1200	1200	1200	1200
Scenario two: Rainfall varies from year to year and is highly correlated between areas				
A	400	600	200	200
B	300	450	150	150
C	500	750	250	250

Total	1200	1800	600	600
Scenario three: Rainfall varies from year to year and is not highly correlated between areas				
A	400	600	200	200
B	150	300	450	150
C	750	250	500	250
Total	1300	1150	1150	600

Many land-improving investments involve economies of scale. For example, it costs only a third as much per ha to put a perimeter fence round a 100-ha square block of land as around a 10-ha square block. Similar economies can apply to other investments, e.g. livestock water supplies. Not only may it be more economically efficient to install such facilities on large common property or open-access blocks than on smaller individual ones, but also forcing poor producers to accept the individual tenure of small blocks which they cannot afford to develop may make them uncompetitive producers and drive them out of business. Where a general land reform is contemplated, which would convert large areas of communal land to individual tenure, smallholders could effectively be denied access to grazing land altogether.

7.4.5 Relevant exercises

Exercise 7.1: Land tenure theory (estimated time required: 1 hour).

Question 1. The data in Table 7.3 relates stocking rate in animals per ha to weight gain in kg live weight per head. In addition, it is known that 1 kg of weight gain is worth $ 1.00 and that the costs per animal remain constant at $ 27.50, irrespective of the stocking rate applied. Complete Table 7.3 as per Table 7.1 above and graph the results as per Figures 7.2 and 7.3.

Table 7.3. ***Stocking rate, weight gain and output value.***

Stocking rate	**Weight gain**		**Value ($)/10 ha**			**Value ($)/marginal animal**		
animal/ha	**kg/head**	**kg/ha**	**output**	**costs**	**profit**	**output**	**costs**	**profit**
0.1	200.00							
0.2	177.80							
0.3	155.60							
0.4	133.30							
0.5	111.10							
0.6	88.90							
0.7	66.70							
0.8	44.50							
0.9	22.20							

1.0	0.00							

Question 2. Assuming intentions to maximise profits, derive the following:

- The stocking rate limit for an individualised land tenure system.
- The *de facto* limit at which an existing owner with one animal will add one further animal.
- The *de facto* limit at which a new stock owner will introduce one additional animal.

Important points (7.2-7.4)

- Tenure refers to the nature and range of rights that individuals have to land, water and other natural resources in relation to rights exercised by other individual, social groups and the state.

- Land tenure policy is concerned with effects of different tenure arrangements on range and livestock productivity and distribution of grazing rights.

- Three major land tenure systems in Africa are:

- individual
- common property
- open access

- There are different forms of individual tenure. Of these, customary tenure is most prevalent and involves exclusive use rights on a long-term basis with no right for buying and selling the land.

- Common property tenure involves collective use, subject to rules of access.

- Open-access tenure also involves collective use of land but without defined individual property rights.

- Tenure policy has important implications on four national policy objectives: resource conservation, economic efficiency, equity and stability.

- Open-access tenure with uncontrolled grazing causes overgrazing and land degradation in Africa.

- Since most grazing lands are communal, a strong institutional control over individual stocking rates is essential.

- An economically efficient land tenure system should fulfil two conditions:

- It must ensure that land is allocated to that activity whose marginal product is most valuable to society,

- It must ensure that in whatever activity the land is used, it is combined with other factors of production in such a proportion that each factor gives more return than if used for any other

activity.

• Studies in Africa have shown that economic efficiency and profit are lower under an open-access system than under individual or common property tenure.

• In Africa, where most areas under livestock production are characterised by low and variable rainfall, communal land tenure provides greater stability of income than individual tenure.

• Both communal and individual tenure may cause equity problems. Open-access tenure is more equitable than common property and individual tenure.

7.5 Land tenure policy instruments: Government-led tenure reforms

In sub-Saharan Africa, most livestock are grazed on communal rangeland under open access or rather loosely controlled common property tenure. Herds are owned and managed by individuals and families. Overgrazing is widespread on communal pastures. In many places, overgrazing is contributing to permanent land degradation. For these reasons, legislation to reform land tenure is likely to emerge as a policy instrument which analysts must be prepared to evaluate thoroughly.

A tenure policy intervention often recommended by those who concentrate on the effects of communal grazing on range productivity and output is land legislation which converts communal tenure to individual tenure. However, we have seen that individual tenure may have implications for stability and equity objectives, and that given the extreme temporal and spatial variation of rainfall in many of Africa's pastoral zones, open access and common property tenure may result in higher long-term returns to livestock and range than individual tenure. Recognising this, other analysts have suggested interventions which attempt to achieve better control over how individual herders utilise communal rangelands. This would involve establishing more effective common property institutions in areas where open access or very loose common property prevails. Two case studies are presented below which review attempts to reform grazing land tenure. In Botswana, the policy instrument chosen was individual tenure; in Kenya, group ranches.

Box 7.1: Botswana case study: The Tribal Grazing Land Programme and the establishment of individual rangeland tenure.

Few African government have contemplated policies which would convert communal tenure to individual tenure. Only Botswana has attempted to implement a policy where extending individual tenure rights was seen as a key policy instrument for improving range productivity and conservation. The Tribal Grazing Lands Policy (TGLP) granted large stockholders exclusive lease rights to what were considered under-utilised and undeveloped grazing lands to the west of the more densely populated areas of eastern Botswana. The rationale for the policy was drawn

directly from the tragedy of the commons critique of resource management under communal tenure.

The TGLP provided that in areas zoned for commercial production individuals and small groups would be granted exclusive rights to ranches. Ranches would be about 6400 ha. Commercial areas were to be designated after the grazing land requirements of smallholders in communal zones were properly taken into account. Areas of reserve land for future expansion were also to be identified. Policy planners generally assumed that there was sufficient land in Botswana to accommodate the needs of different kinds of producers. Many potential benefits were expected to follow upon granting individual title to commercial producers. With exclusive rights, commercial producers would be more likely to undertake permanent investments in water development and fencing. These investments would increase range and livestock productivity. With exclusive rights, individual lease holders would be in a position to limit stock numbers at carrying capacity. Grazing pressure in overcrowded communal areas would be reduced, as largeholders would move their herds to commercial areas. Revenues generated by leases would be used for development purposes in communal areas.

During policy implementation problems arose which emphasised the difficulties of pursuing conservation and economic efficiency objectives without regard to the impact upon stability and equity considerations. Some of the important outcomes are summarised below.

- Most of those granted long-term individual rights to grazing land did not adjust their grazing practices so that stock numbers remained at grazing capacity. Large stockholders who were granted leases to ranches enjoyed exclusive grazing rights. But provisions that ranch holders graze their stock only on their ranches were not enforced. Many stockholders allowed their ranches to become overgrazed and shifted excess stock on to communal areas. By allowing holders to move stock between individual and communal areas, the new "mixed" tenure system was not providing a test of the benefits to range productivity attributed to the individual tenure model. Total livestock output may have increased due to the fact that loan capital for ranch development financed water development in previously unsettled areas. However, research found that livestock grazed on communal range in eastern Botswana were 95% more productive in terms of live-weight production equivalents than the commercial ranching systems, when measured on a per ha basis (Ridder and Wagenaar, 1984).

- Rights of smallholders to rangeland were reduced. In areas where ranches were demarcated, an estimated 20,000 people, including smallholders, persons without stock and hunter-gatherers, lost their rights to utilise or occupy the land. Solomon Bekure and Dyson-Hudson (1982: p. 30) noted:

"Virtually all persons so far allocated ranches dispossess the people [living] there;...for the ranchers exclusive use rather than commercial use best defines their immediate concern; [and] dispossessed people will be removed to already overcrowded communal areas."

- In many cases, the ranches proved too small to provide herds with sufficient forage on a year-to-year basis. Some stockholders developed a seasonal strategy where they grazed stock in communal areas during the wet season and retreated to their exclusively-owned ranches in the

dry season.

Although the government sought to implement a balanced policy which would improve the management of communal grazing lands as well as those areas under individual tenure, the bulk of planning and development resources were, in practice, channelled to the commercial sector and to individual ranches. The policy did not contribute to a significant improvement in range management or livestock productivity. In some areas, it resulted in a reduction of smallholder welfare.

Box 7.2: Kenya case study: Maasai group ranches.

In Kenya's Maasai areas, herd sizes are highly unequal. Rainfall is relatively low and variable in space and time. Periodic drought forces herders to move over extensive areas in search of grazing. Herders have worked out reciprocal arrangements with neighbouring and even distant herders to share available forage. Taking into account the environmental and production conditions in Maasailand, the Kenya Government designed a range development programme based on **group ranches.** Exclusive rights to defined grazing areas were granted to groups of users instead of individuals. Groups were composed of persons with traditional use rights to an area, as determined in an adjudication process which settled competing claims. Group ranches varied considerably in size. In Narok District, for example, the smallest group ranch was 891 ha with 43 members, while the largest was 78,700 ha with 200 members (Helland, 1977).

Although group ranches were intended to preserve communal use rights, the rationale for the group ranch model was drawn from the tragedy of the commons model.

The specific objectives of the group ranch programme were to:

- Increase the productivity of rangelands by bringing them into commercial production.

- Maintain production by keeping the stocking rates of the ranches within limits set by the carrying capacity of the rangelands.

- Provide the human population of those areas with an adequate standard of living (Helland, 1977: p. 100-101).

Range development plans stipulating overall stocking and culling rates were prepared by staff from technical agencies. Members of each ranch elected a management committee to supervise implementation. Committee responsibilities included: enforcing the grazing system and culling rate stipulated in the management plan, supervising construction and maintenance of facilities and supervising the purchase, distribution and fattening of steers purchased on credit.

The key to success of a common property grazing system is the ability of the group's management structure to control how individual members utilise the resource. It was the intention of the programme designers that management committees would be able to limit stocking rates to the carrying capacity. Individual members were to be granted grazing quotas,

basically a limit on the number of stock they would be able to graze on the ranch.

Management committees immediately encountered difficulties in reaching agreement among ranch members over principles for assigning stock quotas. Largeholders favoured quotas based upon the existing distribution of livestock. This would have limited smallholders' herd sizes permanently. On some ranches, a compromise agreement was worked out, where all members were granted a minimum quota, large enough for an individual household to meet its basic income requirements. Additional allocations were given to wealthier members. The net effect was that richer members would have to reduce their holding. Some wealthier members agreed to cull their stock, but none actually did so. Elected management committees tended to be dominated by wealthy and influential stockholders.

Technical agencies lacked sufficient staff and transport to provide management committees with up-to-date information on stocking rates and carrying capacity.

As important, management committees had no social authority or legal sanctions necessary to enforce stocking limits. While Maasai have a long tradition of co-operating on herding and other management activities, the question of stock controls is a property rights issue, and private control over herd numbers and most other management decisions is sacrosanct to the Maasai.

Management in other key respects did not change appreciably. For instance, Maasai still grazed beyond the area of their demarcated ranches when forage conditions warranted, using agreements which had long been in existence for sharing grazing.

Of particular interest to the Maasai was that the groups received title to the ranches, forestalling competing claims to the land by neighbouring cultivator groups. Clarification of tenure rights was seen as a principal benefit of the group ranch scheme (Galaty, 1980).

Why was it so difficult to achieve voluntary co-operation in setting overall stock limits and agreeing upon individual stock quotas? A partial answer might be that there may exist divergences between individual and social benefits if all costs (e.g. externalities) have not been properly accounted for. This may complicate the achievement of co-operative outcomes and make them difficult to secure. Individual assessments of optimum herd size and composition, and growth and development strategies will vary among individual producers for a number of reasons. For instance, Lawry et al (1984: p. 249) argued that the changing nature of intra-group economic relationships works against co-operative strategies.

"A key aspect of economic change is the emergence of entrepreneurship, a term used in the broadest possible sense. Simply stated, as herd ownership becomes less constrained by collective economic and managerial controls, private rather than collective benefits are maximised. Or, put another way, the economic interests of the household or herd ownership unit are pursued with increasing reference to external market institutions, and commensurately less so to local social obligations. This process of increasingly autonomous decision-making reinforces the breakdown of local-level management controls".

It is also possible that "opportunistic" strategies, which in the Maasailand environment allow

herders to make optimum use of available forage production on a yearly basis, may, in fact, result in higher levels of long-term animal output than would be possible where controls limit stock numbers to a "conservative" stocking rate based on worst-year forage production. An opportunistic strategy is one which varies the number of livestock according to current forage availability, so that the extra forage available in good years can be converted into greater economic output (milk, meat) or into productive capital in the form of a bigger herd. A conservative strategy is one where livestock numbers are maintained at a relatively constant level yearly without overstocking. There may be less range degradation, but economic losses result also from under-utilisation of the forage available in relatively good rainfall periods (Sandford, 1982).

The Maasai group ranches avoided some of the problems associated with individual tenure. Smallholders were incorporated into the scheme and ranches were sufficiently large so that, in most years, grazing needs were met within the confines of the individual group ranch. However, no range management institutions emerged to regulate individual herd sizes so that aggregate stocking rates approached or exceeded carrying capacity. Individual livestock owners continued to exercise management prerogatives over their herds, and especially over determination of herd size. The Kenya experience brings out some of the problems involved in extending a greater range of common property controls over individual range users.

7.6 Other policy instruments

Granting individual tenure rights is one option for addressing overstocking problems. Two reforms intended to improve communal tenure are tax policy and stocking controls administered by national governments.

7.6.1 Tax policy

Unable to control the stocking decisions of others, individual herders will compete for available forage by increasing their individual herd sizes. The net effect is that total profits and economic efficiency will be less than that which could be achieved at carrying capacity. However, stocking levels above those which maximise profit are still profitable, up to open-access equilibrium, where profits equal zero.

One possible external control on the stocking decisions of individual herders would be a livestock tax levied per animal grazed on the range. The purpose of the tax would be to make the cost to the owner of keeping an extra animal equal to the total cost of doing so to the community as a whole. This would include the opportunity costs of the feed the animal eats on the common pasture and which it diverts from the mouths of animals already there, thus lowering production. As illustrated in Figure 7.4, the optimal tax rate from the point of view of the nation as a whole would be one that made total costs (tax cost plus other costs) to producers equal to the total value of output at stocking rate N*. Herders would then have no incentive to stock beyond the level of N*. Of these total costs at stocking rate N*, c* would represent other costs and q* - c* would represent tax costs. However, q* - c* also represents the totality of the profits which would otherwise have accrued to the community of herders, who will probably be violently opposed to

the imposition of this tax unless it is redistributed to them. However, this must be done in a way which does not restore the incentive to stock above stocking level N*.

How this works at the level of the individual producer is shown in Table 7.4. It shows the effect of an animal tax (at the rate of $ 129/animal) on outputs and stocking rates. As a consequence of the tax under open-access conditions, the marginal new stockholder wondering whether to put one animal on the (10 ha) range will do so only if the existing stocking rate is less than 0.3 head/ha, which is the (socially optimum) level of maximum profits in the no-taxed situation.

Table 7.4. ***Maximum, optimum and de facto outputs and stocking rates with and without an animal tax.***

* = level of maximum profit (optimal) per ha before tax.

+ = level of maximum output per ha.

01 = limit *de facto* where in the absence of tax, existing stock owner will add one further animal.

02 = limit, *de facto,* where in the absence of tax, new stock owner will add one animal.

00 = limit, *de* facto, when tax must be paid, existing stock owner will add one animal.

** = limit, *de facto,* when tax must be paid, new stock owner will add one animal.

Figure 7.4. ***Effect of grazing tax on pastoralist production and income.***

Jarvis (1984) points out several problems with grazing taxes. First, precise information on the relationship between stocking rate and livestock output would be needed to determine the appropriate tax. This is difficult to do and subject to variability in time and place. Unless adjusted, taxes would remain too high during a drought and too low during a recovery. A centralised government bureaucratic institution would be unable to determine the optimum stocking rate at a particular time sufficiently promptly and would thus be unable to adjust the tax appropriately. Collecting the tax would incur high administrative costs, offsetting much of the benefits resulting from achieving the optimal stocking rate.

According to Jarvis (1984), pastoralist income over the short and long run would also decline. Over the long run, total profits might rise but pastoralists would receive none of the additional profits because they would accrue to the government in the form of the tax.

In the short run, imposing a tax will force herders to reduce their herds dramatically, thus flooding markets and depressing prices. Paying the tax might force pastoralists with small herds yielding only minimum subsistence to reduce their holdings to sub-subsistence levels. However, as a matter of policy, holdings below a certain minimum level could be made exempt. Jarvis believes that the most likely outcome of a livestock tax would be a herder revolt and a political crisis.

There is an urgent need to analyse various tax policy options. Three policies or programmes have been proposed to relieve a perceived overstocking problem. These are:

- improved livestock marketing
- range improvement measures
- cost recovery.

Improved livestock marketing

One of the most widely advocated proposals is to improve livestock marketing to increase the marketed offtake. A variety of measures have been proposed including improved or more extensive marketing infrastructure (sale yards, trek routes, water points en route, transport equipment), higher prices or producer subsidies, better market information and direct government participation in marketing. To the extent that these measures are successful, they will raise the farmer's return on livestock sales and/or lower selling costs. Figure 7.5 plots how these measures will raise the value of output curve and/or rotate the cost curve downwards.

Figure 7.5. ***Effect of marketing and range improvements on open-access equilibrium.***

The result would be to shift open-access equilibrium from N^{+} to N^{++} (if both actions occur simultaneously). Thus, improved marketing will tend to increase rather than decrease stocking rates. This apparent paradox can be understood once it is realised that stock owners can increase offtake rates in only two ways: from more favourable herd dynamic parameters or from larger herds. In the absence of the former (which marketing programmes do nothing to address), stockowners will build up their herds in order to take advantage of the higher incomes from higher off-takes that the improvements imply. Whatever may be the usefulness of marketing improvements in raising rural incomes, improving urban meat supplies or as an adjacent to a sound culling programme, they will not stimulate destocking. In fact, they will tend to worsen the problem.

Range improvement measures

These are aimed at improving range productivity or quality and are often proposed to relieve overstocking. Range improvement measures may include reseeding the range, rotational grazing or providing watering points. If successful, these will shift the weight gain/ha curve in Figure 7.2 upwards and, as a result, also the value of output curve (as in Figure 7.5). Thus, incentives will be provided for stockholders to increase herd size. While short-term improvements in range condition may be registered, these are likely to be eliminated in the long term by increases in the stocking rate.

Cost recovery

Proposals are increasingly being made that subsidies currently provided to livestock keepers be eliminated and that the costs of veterinary, marketing and, perhaps, extension services be at least partially recovered from users. While these proposals are motivated primarily by declining livestock service recurrent budgets, they can contribute to solving the overstocking problem. By

increasing the costs of livestock keeping, they make it less profitable for farmers to retain low productive animals. As costs rise, farmers reduce herd size, as can be seen from N^{+} to N^{++} in Figure 7.6.

Figure 7.6. ***Effect of cost recovery measures on open-access equilibrium.***

7.6.2. Stock control

Governments could attempt to control stock levels by assigning quotas on grazing rights. As is the case with determining an appropriate tax, timely information on carrying capacity would be needed to make such a system work. In addition, widely acceptable principles for distributing grazing rights among herders would have to be worked out. This would be difficult.

One approach sometimes suggested would be to divide the overall quota of grazing rights in a given area equally among all qualified users. In this case, those having livestock in excess of an individual's quota could seek out persons owning less stock than their quota and negotiate to rent or purchase surplus grazing rights. Establishing such a "market" in grazing rights would assure a flow of income holders of few or no livestock and would provide a mechanism by which larger holders could maintain larger than average holdings. This approach overlooks the fact that in most of Africa, grazing rights are exercised through owning and grazing livestock. In most pastoral societies there is no recognised a *priori* grazing right apart from that asserted by grazing one's animals; and it may be difficult to obtain public acceptance of such an *a priori* right.

7.6.3 "Spontaneous" tenure changes

Tenure change will not result from state action only. Herders themselves may assert privileged rights to rangelands in relation to other herders or groups. At minimum, common property tenures establish some qualifications by which individual rights to use a commons are determined. Qualifications will often be based on some social criterion, such as residence in a village or membership in an ethnic group. Often, these qualifications are not established or enforced by the state, but are nonetheless recognised to be legitimate by all affected.

In the future, it is likely that policy analysts will be faced increasingly with situations where individual herders assert exclusive rights to extensive areas of previously communal rangeland. Attempts at "spontaneous enclosure" have already taken place in several countries, including Somalia, Sudan, Kenya and Botswana.

In central Somalia, land around concentrated borehole development has become intensively utilised and subject to overgrazing. Those living closest to the wells have extended their fences around cropping areas to incorporate extensive range areas as well. Commercial producers and livestock traders, because they are able to employ labour, have enclosed far larger areas than poorer households (Behnke, 1986). Since the late 1960s, collective forms of range management based on claims by clans to grazing areas have broken down, giving further scope to individuals to assert private claims to rangelands.

The Idd el-Ghanam District in south Darfur Province of Sudan is on well-drained soils and provides a refuge for nomadic stock fleeing seasonally flooded areas to the south and the west. Under open-access tenure, local herders are forced to share their wet season grazing with nomads. The result is that the amount of forage available for local use during the dry season is much depleted and the economic welfare of local producers is reduced considerably. Local herders responded by enclosing a portion of the local rangelands for their exclusive use (Behnke, 1986).

As problems with group ranches in Maasailand became apparent, some Maasai refused to allow their traditional grazing areas to be adjudicated as group ranches and argued instead for individual holdings. Jacobs (1984) noted that by 1979, 29 of the 52 group ranches in Kajiado District had passed resolutions calling for the ranches to be sub-divided into individual holdings.

Pressures for individualisation and attempts to enclose rangelands will result from the interaction of a number of social and economic factors. Behnke (1986) believes the myriad of factors can be summarised in terms of a process. The process has three interrelated components:

- a decline in the supply and a corresponding increase in the scarcity value of grazing land
- increases in the commercial value of range or livestock production
- decreases in the relative costs of enclosure, costs which are social and political in nature as well as monetary.

Governments can consider a number of options in response to enclosure. One option might be to sanction and accommodate the enclosure process by officially recognising the *de facto* distribution of tenure rights in law. Such a response would be likely to accelerate the process of enclosure by setting off a scramble by herders to make claims before others. However, "spontaneous" individualisation may have serious implications for stability, equity and even economic efficiency considerations. Policy analysts would need to consider these implications.

7.6.4 Relevant exercises

Exercise 7.2: Group exercise: Land tenure problems in Alphabeta.

Question 1. Identify and briefly describe the principal land tenure systems in Alphabeta relevant to the livestock subsector. In your view, are communal grazing pastures more accurately described as open access or common property? Explain. What are the principal controls operating under common property systems in Alphabeta?

Question 2. How well does the model portrayed in Figures 7.1-7.3 describe rangeland conditions in Alphabeta? Explain. What impact does this have on stockholder investment in rangeland improvements?

Question 3. Although many factors can affect the condition of the range (e.g. drought), do you consider land tenure to be a major policy issue for the livestock subsector of Alphabeta? Why do you think so? How does it affect stocking rates?

Question 4. In Alphabeta, have individual herders attempted to assert private control over grazing land by enclosing previously communal areas? What are the factors behind and circumstances leading up to such enclosure? What has been government's response?

Question 5. What could be done to improve tenure systems in Alphabeta? How might these improvements be geared to overcome the problem of overgrazing and land degradation?

Question 6. What would be the implications for the stability and equity objectives if the Government of Alphabeta undertook to individualise land tenure in grazing areas?

(Hint to instructors. Alternatively, the questions in Exercise 7.2. can be posed about participants' own countries. However it is ILCA's experience that, in the absence of carefully pre-digested data and under time pressure, participants often do not analyse their own country situation rigorously enough).

7.7 Tenure as a factor in mixed farming systems

Thus far we have considered tenure issues which arise where livestock are produced on natural rangelands. However, tenure problems may arise where farmers undertake intensive livestock production, such as dairying, on small-scale, individual farms. Here, the policy analyst will usually be concerned with the effects of customary tenure rules on security of tenure and on the functioning of land markets.

7.7.1 Security of tenure

A common criticism of customary tenures is that they do not provide farmers with sufficient assurance that their long-term land rights are secure, so that they will benefit over the long run from investments in fixed capital and other improvements.

This interpretation of the nature of farmer security under customary tenure is often based on an incorrect interpretation of individual land rights under customary tenure. Because original allocation rights are vested in the community (or delegated to the community by the state), there is a tendency for outsiders to attribute to the community or to its trustee the ability to act with the full force of ownership in the Western sense. In this view, farmers are sojourning on the land and can be ejected at the of the land authority. In practice, and in customary law, this is not an accurate characterisation.

Under most systems of customary tenure, an individual's long-term use rights are secure, and virtually permanent, as are his or her rights to the returns on any improvements. In most places,

land is heritable. Usually, conditions for losing land are explicit and well understood. The most common condition for maintaining use rights is that the land be cultivated, taking account of periodic fallow. (In places, some classes of farmers have more limited rights. Stranger farmers, an important phenomenon in parts of West Africa, are treated as guests in the community. Undertaking permanent improvements may be interpreted as an assertion of permanent rights and will be resisted by the host community. Women do not usually qualify for independent use rights, but gain access through marriage and may lose them through divorce or death of the husband.)

When considering the effects of customary tenure on security of investment, the analyst should assess the tenure/security relationship. Appropriate questions would include:

- What are the individual farmer's land rights in relation to the community and the state? Are the farmer's long-term rights insecure? What are the specific tenure issues giving rise to insecurity?

- Are there factors other than tenure causing farmers not to invest in new technologies or practices, such as the unavailability of product markets or low returns to investment? If non-tenure factors become less constraining, will tenure still constrain adoption or might tenure rules themselves adjust?

- What are the options for enhancing security, taking into account the whole array of costs associated with any given strategy? Achieving tenure change is not a matter of simply changing land law. Land titling and registration systems based on Western models require establishment of costly administrative machineries which could place severe strains on many budgets.

A second common criticism of customary tenures is that prohibitions against land transactions mean that farmers better able to put land of a certain quality or in a certain location to more productive use than a farmer currently occupying it will be unable to buy or rent the land. Of course, this constraint affects both parties to prospective transactions. The current landholder may be able to realise higher income from the land by renting it out than he or she could by farming it, but is prohibited by customary tenure from doing so. Land as a factor of production is less mobile in relation to other factors. As such, customary tenure may be a source of inefficiency.

This could become a particular problem in the case of dairy production. Dairying is a relatively capital intensive activity and is economical near urban or other densely settled areas with a relatively high and reliable demand for milk. Two constraints must be overcome. First, the farmer will need assurance that returns to investments in fixed capital such as fencing, watering facilities, milking parlours etc will accrue to him or her over the long run. This is the security of tenure issue which was addressed above. The second constraint relates to rights to land transactions. This will be addressed in the following section.

7.7.2 Rights to land transactions

The second constraint will arise when an entrepreneurial farmer, possessing skilled labour and sufficient capital to start a dairy enterprise, is unable to secure suitable land. The farmer might be

a local person and already hold a small piece of land, but would need to rent or purchase a neighbouring field to expand forage production. The farmer may originate from a distant province and have no customary land rights in the farming areas near the town.

The farmer needs functioning markets in land rights to allow him or her to purchase or rent a holding of appropriate economic scale. In the absence of thorough-going land reform, the policy maker's options would appear to be severely constrained. However, options do exist.

First, the analyst should determine if formal or informal markets are not in fact operating. As farming land takes on increasing value near urban centres, customary tenure rules are accommodating a greater variety of transactions, including long-term rental and sale of customary land rights. For instance, in Lesotho, dairy producers are successfully negotiating purchase of customary land rights near urban areas (Lawry, 1988). Once purchased, they believe the customary right provides sufficient security to warrant all types of fixed investment.

Second, the state could sanction transactions in customary land rights, subject to certain conditions and limitations. For instance, approval for each transaction might be sought from local land allocation authorities. When the state or a local authority witnesses rental contracts and sale agreements, both parties to transactions will have greater assurance that the agreements will not be subject to subsequent dispute and litigation. By reducing uncertainty, the state enhances security.

Changes affecting tenure rights on the farm will have far-reaching consequences and must be carefully considered. An important social goal of customary systems is to provide the largest possible number of qualified members of a community with sufficient land to make a basic living. Where competitive land markets supplant traditional allocative principles, poorer households will undoubtedly find it more difficult to secure land.

Important points (7.5-7.7)

- One policy instrument to control overgrazing and land degradation is legislation to reform existing tenure systems.

- One tenure policy intervention is land legislation to convert communal tenures to individual tenure.

- An additional tenure policy intervention attempts to achieve better control over how individual herders utilise communal rangelands.

- Both types of 'Interventions have been tried in Africa. Individual tenure could deny smallholders access to extensive communal rangeland.

- Interventions aimed at resource conservation and economic efficiency may conflict with stability and equity objectives.

• Besides tenure reforms, two important measures to control overstocking are tax policy and stocking controls administered by national governments.

• A grazing tax may lead to optimal stocking rates from the national point of view, but it hurts herders. Further, implementing a grazing tax is not a simple task.

• Stock control could be exercised by assigning the right to graze a certain number of animals to Individual herders. This is again likely to be resented by herders.

• Spontaneous land enclosure and individualisation of rights may become more common in the future. However, spontaneous tenure reform may conflict with national objectives.

• Two main criticisms of the customary tenure system are:

- insecurity to long-term land rights
- prohibition against land transactions.

• Customary tenure is not usually as insecure as outsiders believe.

• Economic efficiency requires that the state sanction transactions in land rights subject to certain conditions and limitations.

8.1 Performance objectives

Module 8 is intended to enable you to:

1. Sketch and explain some alternative policy formulation models.
2. List the components of a policy paper.
3. Prepare a policy paper.

8.2 Introduction

In module 8, we shall discuss how to write a policy paper. To accomplish this, we shall consider briefly the institutional structure of livestock policy formulation by governments and how the policy analyst can be an effective actor in the overall process of policy formulation and implementation.

8.3 The institutional structure for policy formulation

The level at which policy decisions are taken (e.g. by officials, minister(s), the cabinet or president) is in part determined by the intrinsic importance of the particular policy issue in question. However, other aspects are important as well and include: where (organisationally) new ideas influencing policy are generated; which organisation(s) plays the lead role, who evaluates alternatives and formal proposals for policy changes, and the extent to which each organisation formally involved is given a genuine opportunity to influence outcomes.

Numerous actors may be involved in the policy formulation process. Actors will often have their own roles to play in this process and their own agendas for action. Actors in the livestock policy formulation process may include: policy implementers (e.g. officials in the veterinary, extension or livestock marketing services), planning or policy analysis units, academicians, major donors and special interest (pressure) groups. The interplay between these actors, and their relative "power" base in the policy formulation and implementation hierarchy, can have major impacts on policy change in terms of, for example:

- the extent to which implementers of policy feel a sense of commitment to policy change
- the expertise available for policy analysis
- the degree to which policy proposals take a wide, national rather than a narrow, sectarian point of view
- the political, bureaucratic and financial support for new proposals, regardless of their intrinsic merit.

8.3.1 Some models for the policy formulation process

Figures 8.1-8.5 show alternative models of the policy formulation process. Each model gives a central position to a different actor, relegating other actors to subordinate roles or to the sidelines. Each model reflects, in exaggerated form, the policy formulation process observed in some African countries. All are based on a common set of assumptions:

- an overall national interest can be defined, legitimised and gain commitment
- rational solutions emerge from thought and discussion
- there is a general expectation that policy decisions will be implemented in practice
- policy makers welcome, rather than punish, dispassionate advice and information
- the zeal with which policy commands are executed is fairly independent of the precise process leading to the commands' issue.

Figure 8.1. ***Model J: The economist's dream.***

Figure 8.2. ***Model K: The populist's dream.***

8.3.2 Relevant exercises

Exercise 8.1: Group Exercise: Matching institutional models to reality and identifying characteristics determining effective performance.

The group should consider the models presented in Figures 8.1-8.5 in terms of the characteristics of effective processes of policy formulation and the basic assumptions underlying all models. The answers to the questions below should be presented at a plenary session.

Exercise: (estimated time required: 2 hours including plenary).

Question 1. Which model (J-N) best fits your country or countries in your region? If none fits well, describe a more realistic one, defining where policy ideas come from, who makes formal proposals, who decides and who implements.

Question 2. What are the advantages/disadvantages of each model?

Question 3. Examine the assumptions underlying models J-N. Are they valid in your country and region?

Figure 8.3. ***Model L: The director of livestock's dream.***

8.4 Communication

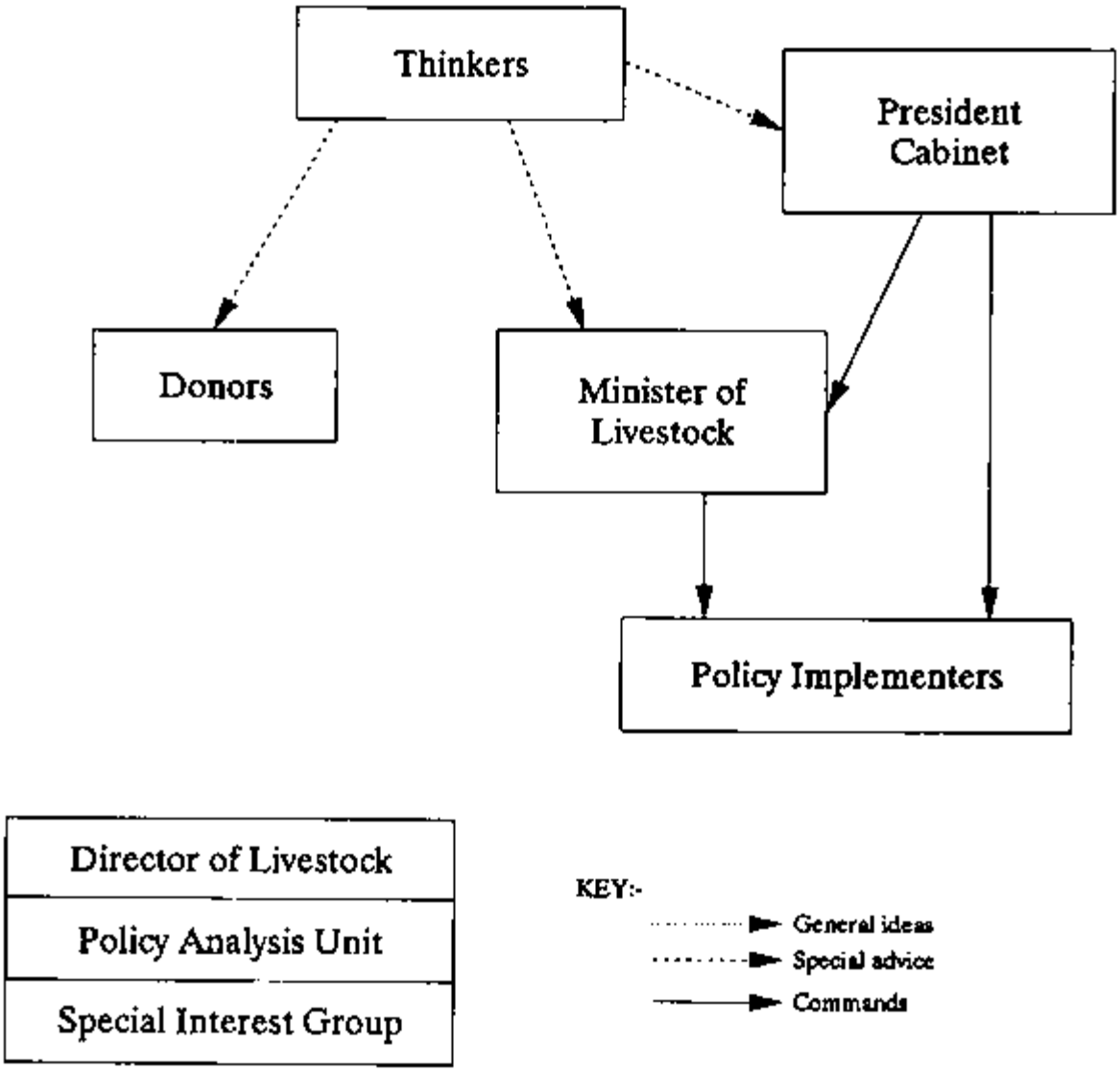
Effective policy formulation and implementation require skill in policy analysis and the ability to articulate the rationale behind the analysis, and convey conclusions to policy makers and others clearly and persuasively. The policy paper is the key form of expression and communication in the policy formulation process.

8.4.1 Preparing policy papers

The most important aspect of policy papers is that they present policy options to decision makers and provide a balanced summary of advantages and disadvantages for each option. Policy papers should:

- Minimise the risk of taking inappropriate decisions.
- Indicate the need (or lack of need) for taking a decision.
- Present complex issues in a straightforward fashion.
- Ensure that decisions which are taken are based upon a sound understanding of the issues involved, a reasonably good database and an appreciation of the consequences.

Figure 8.4. ***Model M: The professor's dream.***



Policy papers are advisory in nature. They may or may not advocate a particular course of action. However, they should examine the trade-offs between alternative courses of action.

There are normally five main components of a policy paper:

- A statement of the particular problem, or problems, that need(s) to be addressed.

- A summary of the various objectives involved (drawn from existing policy) including, when relevant, the various objectives of different interested parties.

- The information that is needed to take a decision.

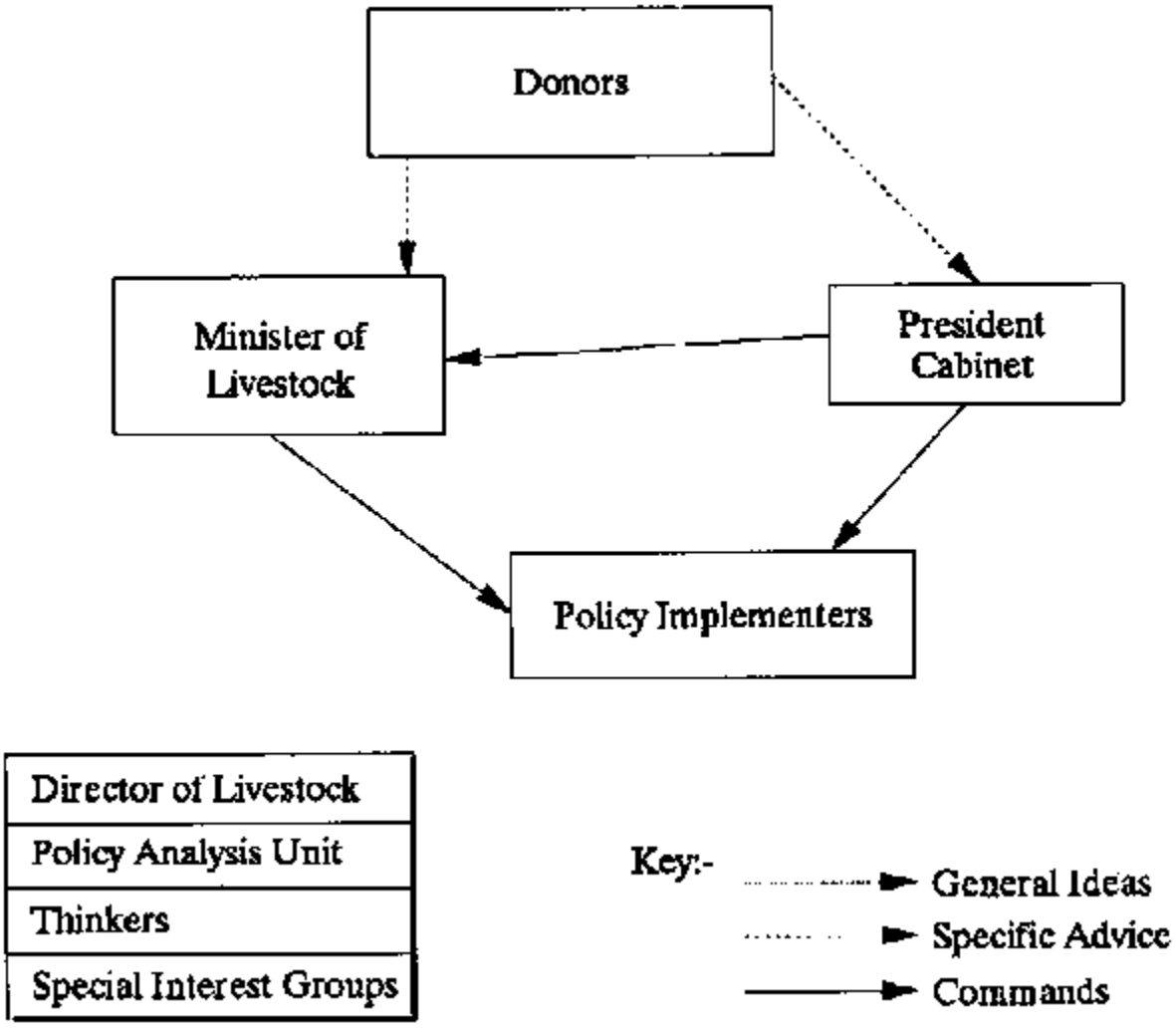
• An assessment of the problem(s) in terms of the particular policy issue involved. (In some cases, there may be problems which are not appropriate for any immediate decision; there may be other decisions which are already in hand elsewhere.)

• A presentation of policy options on the particular issue or issues identified.

If the policy paper is to be discussed in a meeting, the Chair of the meeting should be able to use the structure of the paper to guide discussion, agree on the problem and the objectives, survey the information, identify the issue to be decided upon and, finally, make a choice.

In practice, the process of formulating and presenting policy options is not orderly. Often, competing interest groups and agendas will have an impact on both the policy options chosen and policy implementation. However, the key for the policy analyst is to present options in as objective and reasoned a fashion as possible - acknowledging perhaps the special interests and agendas at play - but standing apart from these interests and agendas.

Figure 8.5. ***Model N.: A wicked slander.***



8.4.2 Relevant exercises

Exercise 8.2. Group Exercise: Preparing a policy paper.

Example: The policy for marketing of beef in Alphabeta.

You have been asked by your Permanent Secretary to prepare a paper for the Minister of Agriculture to present to Cabinet. The paper will relate to beef marketing policy in Alphabeta since an argument has arisen between the Meat Marketing Corporation (MMC) and the Urban Retailers Association over proposals for modified relaxation of laws governing the operations of private butcheries in urban areas.

The proposals, in the last stages of legislation, would permit (under license) a restricted number of butcheries to operate slaughter facilities in the main urban centres of the country. Until now, such operations have been illegal and the MMC has been vested with full control of all beef marketing operations, supported by government price controls. Government price controls at the producer, consumer and retail levels would remain unchanged according to the proposal.

The Board of the MMC is completely opposed to any revision of laws governing private slaughtering and retailing of beef in urban areas. Such operations have been active in the past (despite regulations) and have been difficult to control. They have eroded MMC's urban market outlets and serious problems of excess capacity and escalating costs of operation have caused the parastatal to run at a loss in recent years. Figures on the extent of this loss have just been leaked to the press and resulted in public protest and wide comment.

The Board of the MMC argues that a relaxation of laws controlling urban butcheries will both encourage licensed traders to expand operations and develop the tendency for more illegal butcheries to enter the trade. This, the Board argues, would further threaten the viability of MMC's operations. It would also become increasingly difficult to maintain adequate health standards for urban consumers.

The argument is that MMC was initially empowered with monopoly control over the beef market in order to provide subsidised beef to the consumer and to develop export outlets. MMC's capacity to perform these functions has diminished with time and it is the responsibility of government to support its original intention, not to undermine it. The proposed legislation would do the latter according to the Board. Furthermore, proposals by some segments of the community (notably the commercial farmers) to remove the consumer subsidy and hence raise the producer price (which is held at an artificially low level) would be opposed by the Board. This, it is argued, would reduce the demand for beef and would at the same time be politically contentious. An increase in producer prices would, however, be supported by the Board since production would increase and the MMC's throughput of beef would increase. A reconsideration of grade differentials to encourage greater production of prime quality beef for export would also now be supported by the MMC. The Board, therefore, now proposes that:

- producer prices be increased
- present consumer price subsidy policy be retained
- proposals for deregulating the urban beef trade be scrapped.

Representatives of the Urban Retailers Association, on the other hand, vigorously support a relaxation of the restrictions currently imposed on butchering operations. They argue that trading controls on private butchers should be scrapped and that this would stimulate competition and efficiency within the industry. Both consumers and producers would then benefit from a deregulation of the urban beef trade. Inefficient operators would be driven out of practice and competition would help to maintain or even improve current health standards of private operators

MMC's poor performance is, according to the Association, a consequence of the fact that it is an outmoded service and that it will never effectively compete with the private trade even under the present system of controls. This is supported by the recent growth in urban demand for private trader beef at the expense of MMC and by the drift in supply towards these outlets. The MMC has failed to meet its mandate and has become costly for the taxpayer. It now merely serves the interests of large commercial producers who have an aversion to uncontrolled marketing and of a select group of high income earners in the urban sector. Its operations should therefore be phased out or its original objectives altered.

The Association, on the other hand, opposes any alteration in consumer or producer price policy. An increase in consumer price, by relaxing the subsidy, would shift urban demand away from beef and this could threaten the viability of operation for a number of butcheries. It would also discourage new entrants because of the narrow margin between producer and consumer prices. Any attempts to increase the price paid to the producer would be opposed for similar reasons. The Association, therefore, recommends:

- a continuation of existing price policies
- a further relaxation of laws governing the private butchering trade
- a phasing out or complete redefinition of MMC's meat marketing operations.

Exercise: (estimated time required: 2 hours).

(This exercise should be done in groups of 4-8 people). In the light of this information and given the data and discussion on the operations of the MMC in the central case study, examine the consistency of the arguments presented and prepare a draft Cabinet paper as requested by the Permanent Secretary. Your Minister will shortly present the paper to the Cabinet for a decision.

In preparing your paper you must ensure that the Cabinet does not confuse the short-term problems with the longer-term issues involved. You must draw upon what you understand of government policy to reiterate the objectives that the Ministry has to keep in mind in executing policy decisions. You should ensure that the Cabinet has the information it needs to take the decisions from among the various options you are suggesting to them. But they should not be inundated with data (use appropriate statistics where possible, but sparingly). Remember that

your Minister will have only ten minutes to present his case and the Prime Minister will allow thirty minutes' discussion at most.

Exercise 8.3. Group Exercise: Preparing and making an oral presentation to ministers.

Exercise: (estimated time required: 1.5-2 hours).

The central element of this exercise is a simulated cabinet meeting to discuss a policy paper on marketing of beef in Alphabeta. Versions of that policy paper will emerge from Exercise 8.2. The instructor may need to prepare a definitive version drawn from the various drafts. If he or she has no time to do this, a version of the draft, prepared in advance, would be appropriate. Individual participants should be selected to play the role of ministers at the Cabinet Meeting at which attendance should be restricted to 8-10 ministers.

Other participants, not selected as ministers, should act as "advisers" to individual ministers in considering (prior to the Cabinet Meeting) the view each minister should adopt.

Subsequent to the simulated cabinet meeting there should be a plenary of all participants to discuss what happened and what the implications are for policy formulation in general and, in particular, the preparation of policy papers.

(Hints to instructors: The proceedings can be enlivened if you prepare an imaginary personal profile of each minister giving his political views and background including his or her political ambitions and alliances or disagreements with other individual ministers. This "personal profile" is then communicated to the minister concerned but not to other participants).

- Ministers and their advisers confer about policy paper prior to cabinet meeting (30 minutes).
- Simulated cabinet meeting (45 minutes).
- Plenary post-mortem discussion (15-30 minutes).

Important points (8.3-8.4)

- The structure and functioning of policy formulation differ greatly in Africa. There may be important differences in roles played by different organisations and groups of people in generating new ideas, evaluating and approving proposals and influencing outcome.

- Important characteristics of the policy formulation infrastructure are:

- sense of commitment of the implementers to changes in policy
- expertise available for policy analysis
- national interest as a basis for proposals
- availability of required support.

- The policy formulation process can he represented by various models. However, all models are

based on a common set of basic assumptions.

• Policy papers provide policy options to decision makers and describe advantages or disadvantages of each option.

• The five main components of a policy paper are:

- statement of the problem
- summary of policy objectives
- available information
- assessment of problem for decision
- policy options

9.1 Performance objectives

Module 9 is intended to enable you to:

1. Describe the main features of Alphabeta's economy and identify internal and external factors which have contributed to its recent decline.

2. Discuss agriculture's contribution to Alphabeta's economy.

3. Describe the basic features of agriculture in terms of ecological regions, land tenure arrangements, land holdings and government services.

4. State briefly the distinguishing characteristics of the livestock sector.

5. Identify the four main livestock production systems in Alphabeta.

6. Describe the "pastoral production system" and compare it with the "agropastoral production system".

7. List the five main types of production systems in the small-scale dairy subsector and briefly describe them.

8. Discuss the role of the National Livestock Development Programme in increasing beef production on the four main types of ranches in the large-scale livestock production system.

9. Identify the three principal types of dairy operations on the basis of management intensity and ecological location in the large-scale livestock production system.

10. Describe beef and milk marketing in Alphabeta and discuss the impact of government pricing policies on the production, consumption and marketing of these products.

9.2 Introduction

This case study draws on data from a number of African countries. Alphabeta is therefore a composite. The study will be used to demonstrate important features of the livestock sector common to many African countries and will, in particular, form the basis for discussions of livestock policies and marketing issues. In addition, data for Alphabeta will be useful for answering questions and exercises in earlier modules.

9.3 The economic background

Following independence, Alphabeta recorded an impressive economic growth. However, in recent years, a number of problems have arisen and its economy has shown indications of decline. Important indicators of this decline include:

- A fall in real Gross Domestic Product (GDP) growth from 6% annually in the immediate post-independence period to between 2-3% annually in recent years.

- A deteriorating balance of payments, currently in excess of 15% annually.

- Rising urban unemployment and rural underemployment.

- A decline in per caput food production.

- Declining terms of trade for agriculture.

In addition, high population growth (approximately 4% annually) continues to place stress on the economy in terms of public expenditure, food production, resource conservation and employment prospects. The combination of high population growth rate and low GDP growth rates has resulted in a negative growth in per caput GDP *(2* or 3% minus 4%) in recent years. This decline in living standards has been perceptible.

Two major factors have contributed to the decline of Alphabeta's economy: external factors beyond the direct control of government and internal factors involving inappropriate development, trade and pricing policies.

Principal amongst the adverse **external factors** are declining prices for Alphabeta's major agricultural export commodities and rising costs of imported goods (in part because of increased petroleum prices) which have led to a deteriorating balance of payments. An excessive dependency on agricultural exports has also made the economy vulnerable to world market price fluctuations and seasonality in internal supplies. In an attempt to ameliorate the impact of falling export revenues, Alphabeta borrowed heavily. The debt service ratio now stands at *20%* of export earnings. Although the government of Alphabeta could exert little or no influence on commodity prices, policy action to diversify exports could have relieved some of the commodity export dependency and made Alphabeta less vulnerable to world markets.

Internal influences include lack of incentives for agricultural export industries, protection of certain manufacturing industries which has penalised agriculture directly and indirectly, high government expenditure resulting in large budget deficits, over-valuation of the currency and an over-reliance on imported materials and equipment. Protection, for example, has encouraged resources to flow out of agriculture and into the manufacturing sector. Protection of the latter sector has also resulted in higher manufacturing wages. These higher wages were ultimately passed on to other sectors of the economy, including agriculture. As a result, the terms of trade between agriculture and the rest of the economy have deteriorated.

Due to these difficulties, political unrest has become more prevalent and the popularity of the government has declined. In addition, the International Monetary Fund, the World Bank and many bilateral donors are imposing increasingly stringent political and economic conditions on additional assistance. In consequence, policy options are increasingly constrained by domestic political factors and international pressures.

(Hint to instructors: Discuss some of the economic terms used in this section, e.g. GDP, per caput GDP and balance of payments. Make sure participants understand them.)

9.4 The agricultural background

9.4.1 Agriculture in the economy

Agriculture's contribution to Alphabeta's economy is significant, presently accounting for 30% of GDP and 60% of export earnings. Agriculture absorbs 20% of the work force in paid employment. Roughly 80% of the total population (16 million) depends predominantly on agriculture for subsistence.

The principal export earners, coffee, tea and pyrethrum, contribute about 54% of the total export earnings (Table 9.1). The main food crops are maize, beans, wheat and pulses. Maize is the staple food of the majority of the population. Livestock are important for local consumption (beef, dairying and poultry) but export earnings from this source contribute less than 10% of the total (Table 9.1).

Table 9.1. ***Value of principal overseas export commodities at current prices for selected years.***

Items	Export values (A$ '000)		
	Years		
	8	9	10
Coffee	38,387	35,203	35,227
Tea	19,386	22,927	22,930
Pyrethrum	16,956	7,342	3,494
Sisal	4,441	5,410	7,338

Maize	40	5	20
Beans and peas	1,612	1,137	1,788
Cotton (raw)	1,410	3,571	1,282
Cashew nuts	692	426	1,137
Pineapples (canned)	458	286	3,604
Woods	296	368	426
Meat products	5,649	4,970	6,005
Butter and ghee	620	389	
Hides and skins	1,434	1,719	5,413
Animal feeds	1,135	1,282	369
Petroleum products	26,184	30,500	31,666
Soda ash	3,986	5,635	2,378
Felspar			989
Cement	1,544	1,788	5,365
Total	124,230	122,958	128,431

9.4.2 Rainfall and agricultural regions

Rainfall in Alphabeta follows a bimodal pattern. The short rains come in November-December, followed by longer rains in March-May. This pattern prevails in the lower rainfall regions of the country as well, but the length of each rainy period is shortened. Short-season crops such as beans can be grown during the short rains in high potential regions but most cropping activities occur during the longer March-May season.

The country is divided into four ecological regions on the basis of production potential. Management practices, poverty levels and land holdings are highly diverse within and across most regions. Approximately 20% of the total area has been classified as medium-to-high potential and suitable for commercial cropping and intensive livestock production. The remaining 80% is classified as: marginal for cropping but suitable for extensive livestock systems (10%); suitable only for extensive livestock systems (50%); and suitable only for nomadic pastoralism (20%). In the semi-arid and arid regions, rainfall averages less than 600 mm/year. As expected, human population density is greatest in the medium-to-high potential regions but population growth is placing pressure on all land resources. Cultivation is being extended on to higher slopes and into more marginal areas. Excessive tree felling is evident. On rangelands, increasing stocking rates are leading to a loss of vegetation cover and species diversity and the invasion of less palatable species. As a result, soil erosion is considered to be an increasingly severe problem. Already, 25% of the country is at high erosion risk, while 60% is under moderate risk. Only 15% of the land area is not presently under threat and much of this is in the medium-to-high potential regions.

9.4.3 Land tenure

Following independence, efforts were made to redress the imbalance between land occupied by Europeans and Africans and to alter tenure arrangements in some of the communal areas. Land purchase and resettlement schemes became a major ongoing feature of government development policy with titled units being offered to African farmers in the medium-to-high potential regions of the country. In smallholder areas, the government has continued its programme of consolidating and registering land rights, previously under customary tenure. There are now some 900,000 smallholder units registered in this way. Land classification on the basis of size and title is shown in Table 9.2

Table 9.2. ***Distribution of households by size and type of land holdings.***

Classification	% of households	No. of households	% total available land area[1]
Resettled farms			
large (> 20 ha)	3,500	0.1	0.1
small (< 20 ha)	35,000	1.6	1.0
Privately owned large farms and estates	450	-	2.3
Smallholders			
registered	900,000	40.4	7.0
unregistered	585,000	26.4	17.6
Communal pastoralists (estimates)	300,000	13.5	72.0
Landless households (estimates)	400,000	18.0	-
Total	2,223,950	100.00	100.0

[1] Available for agriculture; excluding national parks, reserves and areas unsuitable for agriculture.

9.4.4 Major production systems

Alphabeta has a relatively diversified agricultural sector in terms of production systems. For the most part, these systems are determined by agro-ecological constraints, although smallholding and estate farms coexist in the medium-to-high potential areas, and commercial livestock production may coexist with pastoralism in the more arid regions or with cash cropping in the higher potential regions. Briefly, the following features characterise these production systems.

Smallholder agriculture. Smallholders are found mostly in the medium-to-high potential areas. Maize is the dominant crop and is normally grown in conjunction with beans or other pulses. Small-scale farmers with less than 5 ha produce 90% of the country's maize and normally sell or store surpluses above subsistence needs. They also account for over 50% of the value of gross

marketed production of agricultural commodities (Tables 9.3 and 9.4). Techniques of farm management are basic; cattle are important for draft, manure and milk. Yields are generally low. The use of fertilisers on maize, as well as other crops, is limited. Sorghum and millet are grown more extensively in the marginal cropping areas but maize is the preferred staple. Tea, coffee and small-scale dairying are important sources of cash in the higher potential regions of the country.

Table 9.3. ***Total value and percentage of gross agricultural marketed production contributed by small-scale farmers for selected years.***

Year	Total value of gross marketed production (A$ '000)	Value of smallholders' contribution (A$ '000)	Smallholders' contribution (% of total)
7	105.9	55.6	52.5
8	123.3	63.3	51.3
9	148.4	75.0	50.5
10	162.0	90.1	55.6

Table 9.4. ***Gross value of marketed agricultural production for selected years.***

Year	(A$ '000)		
	8	9	10
Cereals			
Wheat	3,865	6,625	8,275
Maize	8,571	6,482	17,022
Others	2,055	2,251	3,626
Subtotal	14,491	17,658	28,928
Temporary industrial crops			
Pyrethrum	3,259	4,206	4,551
Sugar cane	4,453	5,916	8,230
Others	1,660	2,080	3,041
Subtotal	9,372	12,202	15,822
Other temporary crops	3,563	5,356	7,123
Permanent crops			
Coffee	32,772	35,326	35,345
Sisal	7,051	18,350	7,038
Tea	16,766	19,255	22,914
Others	2,817	3,177	3,274

Subtotal	59,406	76,108	68,571
Livestock and products			
Cattle and calves	16,353	17,610	19,827
Dairy products	11,305	10,100	10,781
Others	4,514	4,747	5,515
Subtotal	32,172	32,457	36,123
Unrecorded marketed production	4,299	4,668	5,404
Total	123,303	148,449	161,966

Table 9.5 presents the frequency distribution of smallholder households by size of land holding. Of the 1.5 million smallholder households, approximately 30% have less than 1 ha, 60% less than 2 ha and 90% less than 5 ha of arable land.

Pastoral production. Pastoralists occupy the semi-arid and arid range areas and subsist primarily on cattle, sheep and goats. Purchasing food from cropping areas, through the sale of livestock and to supplement food of livestock origin, is now common.

Table 9.5. ***Frequency distribution of households by landholding classes.***

Arable holding (ha)	No. households ('000s)	% households	Cumulative % households
0.5	206.4	14	14
0.5-0.9	265.8	18	32
1.0-1.9	400.4	27	59
2.0-4.9	462.9	3 1	90
5.0-7.9	96.4	6	96
>8.0	53.1	4	100
	1485.0	100	

Agropastoral production. On the margin of the cropping and pastoral areas of the country, agropastoralists subsist mainly by cropping and the sale of cattle and/or smallstock which provide cash to meet food deficits. These deficits are common because of the unsuitability of the environment for cropping activities.

Estate and large-scale agriculture. Crops grown in the large-scale farming sector include wheat, sugar, rice, barley, coffee and tea. A number of large, privately owned co-operative, group and company ranches exist but these account for a relatively small proportion of the total national livestock herd.

9.4.5 Government services to agriculture

The agricultural sector is served by five ministries and 18 statutory boards which assist in the marketing of various agricultural products. Marketing boards are broadly empowered to control production and marketing, pricing and related activities. Several boards (e.g. the Maize Board) also have monopoly control over the movement of their products between districts. Local co-operatives and private enterprises also play an important role in the marketing of products from the smallholder sector (e.g. coffee, tea, pyrethrum and dairy goods) and in the provision of inputs and credit facilities.

Agricultural research is conducted by a variety of departments within the Ministry of Agriculture, statutory boards and Alphabeta University (AU). Despite widely dispersed responsibility for research most of the emphasis to date has been on export crops. Little attention has been given to other farm commodities from the smallholder sector.

The extension service is relatively well staffed and works through various Provincial Directors of Agriculture. The impact of the service on smallholder production has, however, been limited, partly due to lack of co-ordination with input delivery systems and partly because of the narrow focus of agricultural research.

Important points (9.2-9.4)

- Agriculture makes a significant contribution to Alphabeta's economy in terms of GDP, employment, exports and provision of subsistence requirements.

- Smallholder mixed farming systems predominate, comprising approximately 213 of rural households.

- Livestock are integrated in the cropping systems in three out of the four ecological zones of the country.

- In most production systems, farm management techniques are traditional and use of modem inputs in agriculture is limited.

- Agricultural research is mainly oriented towards cash crops.

- The impact of most government services on agriculture has been limited because of lack of coordination and the narrow focus of agricultural research.

9.5 The livestock sector

9.5.1. Distribution of livestock populations

Livestock represents a major national resource in Alphabeta. The livestock population is comprised of about 10.0 million cattle and 8.5 million sheep and goats. Donkeys and pigs are relatively insignificant in number. Data on poultry in the smallholder system are lacking but surveys indicate that they constitute an important source of protein for rural households. Out of the total cattle population, 11% are grade dairy cattle, bred in the high potential areas of the country for production of meat (4%) and milk (7%). The remaining 89% are indigenous zebu stock.

Approximately one-half of the cattle and one-third of the sheep and goats are concentrated in the better agricultural regions of the country. The remainder are found in the semi-arid and arid pastoral zones, where rainfall is less than 600 mm/year. The livestock industry is divided into traditional and modern commercial sectors. Grade beef cattle are mostly bred on commercial farms. They include stock of European and Asian origin and some local breeds. For dairying, the African smallholder has become important in recent years with a growing number of grade dairy cattle (currently at approximately 0.4 million head) being owned by this group. Table 9.6 gives data on the distribution of livestock units by species, category of ownership and agricultural area potential.

9.5.2 Livestock output and marketing

Although they account for less than 10% of export earnings, livestock products are important domestically, contributing 23% of the gross value of marketed agricultural production (Table 9.4). Of marketed livestock production by value, about 51% consists of stock for slaughter and 35% of dairy products. The remainder is divided among hides, skins, wool and eggs. However, most of the livestock industry is outside the money economy since 75% of milk production, 80% of beef and over 90% of goat and sheep output is consumed on farm, where produced. Thus, livestock make an important contribution to rural nutrition and well-being.

Table 9.6. ***Distribution of livestock units (LUs), in '000s and percent, respectively, by species and categories of production systems.***

	High potential smallholder districts	**Agro pastoral districts**	**Pastoral districts**	**Large farm districts**	**Total no. LU**	**Total no. head**
Grade dairy cattle	627.0[1]	85.5	1.5	340.5	1,054.5	703.0
	5.0[2]	0.7	0.0	2.7	8.4	
Grade beef cattle	49.0	58.8	-	483.0	590.8	421.4
	0.4	0.5	-	3.8	4.7	
Indigenous zebu cattle	3,446.5	2,291.6	3,069.0	-	8,807.1	8,807.1
	27.5	18.3	24.5	-	70.4	
Total cattle	4,122.5	2,435.9	3,070.5	823.5	10,452.4	9,931.5

	32.9	19.5	24.5	6.6	83.5	
Sheep and goats	311.5	392.5	353.3	53.4	1,110.7	8,545.0
	2.5	3.1	2.8	0.4	8.9	
Donkeys	35.5	30.5	115.7	-	181.7	181.7
	0.3	0.2	0.9	-	1.4	
Camels	-	-	774.0	-	744.0	516.0
	-	-	6.2	-	6.2	
Total livestock	4,469.5	2,858.9	4,313.5	876.9	12,518.8	
	35.7	22.8	34.5	7.0	100.0	

[1] Calculation of LU = grade dairy cattle x 1.5; grade beef cattle x 1.4; indigenous zebu cattle x 1.0; wool sheep x 0.2; hair sheep and goats x 0.13; donkeys x 1.0; camels x 1.5.

[2] Per cent of grand total (total livestock x total LU).

In terms of livestock units (LU), cattle are the most important, accounting for about 83% of total LU (Table 9.6), 90% of marketed livestock production and 95% of livestock exports. Meat sold on the world market is offered in chilled or frozen form (which must originate in foot-and-mouth disease-free zones) or canned. With some exceptions, however, rising local demand has contributed to a stagnation of beef exports (Table 9.7).

Table 9.7. ***Production and disposal of beef by the Meat Marketing Commission.***

Year	Total production	Local sales (MT)	Exports chilled or frozen (MT)	Canned (MT)	Percentage of production exported (%)
4	26,219	14,232	2,011	9,976	45.7
5	27,993	15,621	2,680	9,692	44.2
6	26,094	13,611	2,780	9,703	47.8
7	26,905	12,780	3,992	10,133	52.5
8	22,694	11,752	3,068	7,874	48.2
9	19,770	8,374	2,873	8,523	57.6
10	16,600	3,239	3,335	10,026	80.5
11	26,219	5,903	4,457	16,501	78.0

Although beef cattle on commercial ranches constitute only 6% of the total herd, they account for almost half of the official sales for slaughter. An unknown number of cattle are sold through alternative outlets, bypassing the official marketing organisation. Rough estimates suggest that about 20% of cattle are sold through official channels. Surveys indicate that the average slaughter offtake through all channels is approximately 9% annually. This rate is higher for commercial ranches and lower for agropastoralists and smallholders. However, since about 80%

of cattle are marketed through unofficial outlets, the official beef offtake rate is only about 3% annually.

9.5.3 Livestock production constraints

The two major constraints to livestock development in the pastoral, agropastoral and smallholder subsectors, in particular, are overgrazing and animal diseases.

Overgrazing is a difficult concept to define precisely since it implies both a given range area's carrying capacity and a given level of livestock productivity. Production systems geared to multiple livestock outputs (draft, milk, meat, customary functions) from the same animal can ordinarily sustain rather higher stocking rates than systems aiming for high productivity in a single output. Although there has been heated controversy around this issue in Alphabeta, a consensus has begun to emerge concerning the magnitude of the problem. On communal lands, a figure of between 30-40% overstocking is now widely accepted. This implies a carrying capacity in these areas of between 5.1 and 5.5 million LU. While estimates of the magnitude of the problem are not available, it is felt that overstocking is serious amongst some smallholders, but not all.

Overstocking provides a major challenge to Alphabeta's livestock development planners. For a long time, acceptance of the **cattle complex** explanation for large, seemingly low-productivity herds prevailed. Believing that pastoral livestock holders accumulated animals largely for traditional, customary purposes and as a display of wealth, range specialists sought to control numbers through grazing regulations and fines. These aimed to supplement traditional controls on range use. Traditional authority no longer has the legitimacy or effective power it once had, however, and the regulations were widely ignored and had little or no impact on the problem. Livestock economists at AU are arguing that so-called traditional motivations probably play a relatively minor role in pastoralist and agropastoralist stocking decisions. Instead, they are emphasising the economic value that livestock contribute to the household. In the agropastoral system, cattle provide crucial draft power. With an average of less than two oxen per household (and some 30% of households with no cattle at all) most households find their herd size too small. In addition, cows provide milk as a supplement to the household's nutrition, and progeny, sheep and goats provide meat (as do cattle also, infrequently) and livestock sales provide ready cash when needed. Amongst pastoralists, this is particularly important since livestock sales provide them with the cash to purchase other staples. In addition, livestock serve as one of the few repositories of savings open to pastoralists and agropastoralists. The value of bank savings accounts is unable to keep pace with inflation, private land sales in these areas are not sanctioned (although they take place unofficially) and stores and taxis are too "lumpy" to be feasible investments for most households.

Analysis of overstocking now locates the pressure to expand herds in the interaction of low grazing costs (owing to an increasingly free access of communal range, cheap family herding labour and low level of production inputs) and high livestock values. Reinforcing this pressure is the impact of erratic rainfall in the arid and semi-arid regions, which necessitates large herds being built up during good seasons in order to ensure survivors during bad ones.

In addition to overstocking, animal diseases and various parasite infestations cause great economic losses. For the export trade, foot-and-mouth disease, endemic in pastoral areas and difficult to control, remains a major problem. East Coast fever and other tick-borne diseases, measles and internal parasite infestations are also of economic importance.

Important points (9.5)

- Livestock contribute 23% to the gross value of' marketed agricultural production in Alphabeta.
- Amongst livestock, cattle account for 90% of marketed production and 95% of livestock exports.
- Almost one-half of official cattle sales for slaughter comes from commercial ranches,
- Although livestock's contribution to export earnings is insignificant, its contribution to rural well-being and domestic income generation is great,
- Overgrazing and animal disease problems are major livestock development policy issues.

9.6 Major livestock production systems

The foregoing discussion forms the necessary context for a detailed examination of the four major livestock production systems in Alphabeta. After the production systems are described, marketing policies and development strategies relevant to the livestock sector will be discussed.

9.6.1 The pastoral system

Pastoralists derive most of their income or sustenance from keeping livestock where most feed is natural forage rather than cultivated fodders and pastures. Invariably, pastoralists occupy arid and semi-arid regions that are not conducive to rainfed agriculture. In most cases, the bulk of their working time and energy is spent in looking after livestock rather than in other economic activities.

Pastoralism

Approximately 300,000 pastoral family units occupy the arid regions of Alphabeta. Carrying capacities in these regions are comparatively low and rainfall is erratic both within and between seasons. The environment offers few opportunities for subsistence production apart from livestock rearing. The majority of pastoralists prefer to subsist on products obtained from their herds (e.g. meat, milk).

Milk is the principal item of subsistence consumption. Average per caput intake is approximately 25 kg/year. Average per caput consumption of meat from all sources (cattle and smallstock) is 9 kg/year. These intakes are low. Researchers at Alphabeta University estimate that the

human:cattle ratio should be between 1:13 and 1:15 in order to meet full dietary requirements from pastoral activities alone, without depleting herds. In Alphabeta, however, the average ratio, at approximately 1:5, is substantially lower than this ideal (Table 9.8). Historical evidence suggests that it has been declining slowly over the past several decades.

Table 9.8. ***Livestock units (LU) in relation to human population and land area.***

Production system	Grazing area ('000 ha)	LU N('000)	LU per caput	Land area/LU (ha)
Pastoralist	37,834	4,34	4.97	8.77
Agropastoralist	5,809	2,859	0.97	2.03
High potential smallholder	3,788	4,470	0.75	0.85
Large farm	1,590	877	1.27	1.81

Because of their inability to provide sufficient nutrition from their own herd resources, the majority of pastoral households must provide supplements from other sources (Table 9.9). For most, this involves sale or barter of livestock for maize or other grains and commercial products. Marginal pastoral producers become increasingly dependent on community support to meet subsistence needs, and/or alter their consumption habits by supplementing food with purchases from the non-pastoral sector. The majority of Alphabeta pastoralists now sell or barter cattle or other stock to purchase food and to pay for non-food requisites. Surveys have shown, for example, that even during the wet season, pastoralists obtain up to 50% of their caloric intake from purchased food and that this figure can increase to as much as 70% during the dry season. The expanding wage economy in urban centres is also attracting temporary out-migration of some members of pastoral households, particularly young men with a high wage potential (Table 9.10).

Table 9.9 gives data on cash consumption expenditure on non-pastoral commodities for a sample of pastoral households in two different income classes. Table 9.10 provides similar household data by income class on cash income received from different sources. It does not include imputed values for home-consumed products (i.e. milk, meat, hides etc).

From these tables, the following general points should be noted:

- Maize is the main food consumption item. Class I households commit a slightly higher proportion of total expenditure to food purchases than class II households.

- Cattle are the most important income source for both groups but cash received from employment and money transactions is also significant.

- Cash receipts for both income classes are normally in excess of expenditure. In good years this permits the accumulation of additional stock. In bad years and during times of household misfortune, this accumulation can be upon to meet extraordinary cash needs. In this way,

accumulation and disposal of stock help to maintain stability in the household standard of living. Surpluses are- also invested in school fees.

Table 9.9. ***Average pastoralist cash consumption expenditure per caput on food and non-food items by income class (sample survey data).***

Commodity	Income class[1]			
	I		II	
	Total expenditure[2] (A$)	% total expenditure[3]	Total expenditure (A$)	% total expenditure
Food				
Maize	4.50	16.0	6.00	15.8
Sugar	3.25	11.6	4.00	10.6
Tea	1.50	5.4	1.50	3.9
Hotel food & drinks	2.25	8.0	2.25	5.9
Other items	3.50	12.5	3.75	9.9
Subtotal	15.00	53.5	17.50	46.1
Non-food				
Clothing	4.50	16.0	6.25	16.5
Consumables	1.25	4.5	1.25	3.3
Medical & transport	3.00	10.8	4.50	11.8
Household items	0.50	1.8	0.50	1.3
Money transactions	3.75	13.4	8.00	21.0
Subtotal	13.00	46.5	20.50	53.9
Total[4]	28.00	100.0	38.00	100.0

[1] Income classes are based on stock ownership levels per household. Class II (wealthier) households have 8-10 times more cattle and 5 times more smallstock than class I (poorer) households. A middle class was also defined in the survey but results are not included.

[2] A$ 1 = US$ 3.00 (official exchange rate).

[3] The table includes purchases only.

[4] At a mean household size of 6-7 persons, this implies an approximate annual expenditure on food and non-food items of A$ 170-200 for class I households and A$ 230-270 for class II households.

Despite the nutritional constraints imposed by inadequate (from the perspective of the individual household) livestock herds, livestock ownership is highly skewed. Some pastoralists are in a much better position than others to meet consumption requirements from their own pastoral resources alone. Sample data indicate a distribution pattern that has 10% of livestock owners owning approximately 50% of all livestock units (Figure 9.1).

Table 9.10. ***Sources of pastoralist cash income per caput by income class (sample survey data).***[1]

Source of income	Income class			
	I		II	
	Cash income (A$)	Cash income (%)	Cash income (A$)	Cash income (%)
Livestock sales				
Cattle	33.10	58.4	71.65	74.4
Smallstock	1.50	2.6	2.50	2.6
Milk	0.85	1.5	0.85	0.9
Hides and skins	1.50	2.6	0.20	0.2
Subtotal	36.85	65.1	75.20	78.1
Other Income				
Cash from labour	8.25	14.6	10.75	11.1
Money transactions	9.60	17.0	10.00	10.4
Beer brewing	0.95	1.7	0.20	0.2
Other income	1.00	1.7	0.20	0.2
Subtotal	19.80	35.0	21.15	21.9
Total[2]	56.65	100.0	96.35	100.0

[1] Income classes are defined in Table 9.9.

[2] For a mean household size of 6-7 persons, this implies a total cash receipt of A$ 340-395 annually for class I households and A$ 580-675 annually for class II households.

Figure 9.1. ***Distribution of cattle ownership for the pastoral subsector (sample survey).***

Note: Stock unit is equivalent to one or six small-stock.
This ratio approximates the commonly used Tropical Livestock Unit (Table 9.6)

Herd production and composition parameters

Mature cows constitute approximately 40-45% of the average household herd. The average milk yield per cow per lactation ranges from between 150 and 250 kg/year. Approximately 50% of the

milk produced is consumed by the calf. Herd composition figures for a sample of pastoral households were as follows:

Stock category	% of herd
Calves - female	12.9
- male	12.7
Heifers	13.2
Immature males (1-3 yrs)	10.0
Cows	40.6
Mature males	10.6
	100.0

Calving rates average 60-65% but mortalities of 0-1 year old stock are high at 25-30%. Mortalities for other classes of stock are in the order of 7-10%.

Steers (more than three years old) form the majority of the cattle sold. During periods of severe scarcity (drought), few male calves are retained, in an attempt to maintain milk production and herd productive potential.

Net offtake rates for cattle vary between 8 and 13%, the principal determinants being seasonal range conditions and the terms of trade between livestock commodities and food consumption items. In drier years, the offtake rate will tend to be higher to compensate for loss in herd productivity and to reduce the risk of loss through death. In those years, purchased food will also tend be more expensive (or scarce) and higher sales levels will be required in order to meet cash needs.

Pastoralism and environment

Given the overriding importance of producing food for human subsistence, preservation of the herd is more important to the Alphabeta pastoralist than preservation of the environment. Preservation of the herd is synonymous with preservation of wealth and household well-being. The larger the herd, the greater the subsistence standard of living, the greater the household's security, the greater one's wealth and the greater the likely social status. Reinforcing this is the fact that under the communal grazing system, individual herd owners have no effective constraints on herd size except the amount of vegetation on the range itself. Pastoralists show a strong tendency to expand herd size up to the grazing capacity of the land. This tendency, along with human population growth, has put pressure on the environment. As indicated earlier, pastoral grazing lands are considered to be 30% to 40% overstocked and much of the pastoral area is judged to be under moderate to severe erosion hazard. Data on livestock numbers in the pastoral regions are presented in Table 9.11.

Table 9.11. ***Livestock numbers in the pastoral regions.***

Year	Cattle ('000 LU)	Smallstock ('000 LU)	Other[1] ('000 LU)	Total LU ('000 LU)
1	2852.3	333.4	857.6	4043.3
2	2896.7	340.2	872.5	4109.4
3	2912.4	345.1	875.6	4133.1
4	2932.6	350.3	879.4	4162.3
5	2965.8	353.5	883.1	4202.4
6	2998.5	357.2	888.3	4244.0
7	3054.5	354.3	891.3	4300.1
8	3086.2	355.2	895.8	4337.2
9	3080.9	354.7	891.1	4326.7
10	3075.3	354.1	890.4	4319.8
11	3069.0	353.3	889.7	4312.0

[1] Includes donkeys and camels.

9.6.2 The agropastoral system

Agropastoralists derive their living mainly from joint crop-livestock operations. The majority live within the marginal areas of the country, on the fringe of the pastoral zone. Many would prefer to be pastoralists, but are forced by agro-economic circumstances to practice cropping in order to supplement food needs.

Cattle and cropping are complementary enterprises in the agropastoral system. Cattle provide milk, meat, draft power and manure. As in the pastoral community, large herds are a repository of savings and confer status and security on the owner. Crops, on the other hand, provide residues which are used to feed cattle in drier periods of the year.

Agropastoralism

Cattle and smallstock play a critical role in the agropastoralist household economy. Thus, their accumulation is sought. Unfortunately, as with pastoralists, such behaviour has resulted in serious overgrazing and overstocking of grazing lands in these regions. One result is poor average herd performance, as can be seen from the following herd parameters statistics:

• Mortalities	
Calves	25-30%
Stock < 3 years old	9-10%
Adult stock (cows, bulls, oxen)	6-7%
• Calving rates	60-65%
• Milk production	250 kg/year

The distribution of cattle ownership by household is skewed and uneven. About 32% of households own no cattle and approximately 10% own no stock at all. In the sample area, 10% of households owned approximately 50% of the cattle while also owning significantly more smallstock. Table 9.12 provides statistics on the distribution of cattle by household and by owner.

Table 9.12. ***Distribution of cattle herd size by household and cattle owner/category (agropastoral sample survey data).***

Distribution by household[1]			Distribution by owner		
No. of cattle	**% of households**	**Cumulative % of households**	**No. of cattle**	**% of owners**	**Cumulative % of owners**
0	31.7	31.7			
1-3	7.7	39.4	1-3	11.3	11.3
4-7	11.4	50.8	4-7	16.7	28.0
8-10	7.7	58.5	8-10	11.3	39.3
11-14	12.7	71.2	11-14	18.4	57.7
15-17	5.3	76.5	15-17	7.7	65.4
18-20	7.7	84.2	18-20	10.7	76.1
21-30	8.2	92.4	21-30	11.9	88.0
31-40	3.7	96.1	31-40	5.4	93.4
40	3.9	100.0	40	6.6	100.0

[1] The average household owns 10 cattle, 6 goats, 2 sheep and 8 chickens.

The following mean cattle herd size and structure statistics per household were recorded for agropastoralists in the semi-arid regions of Alphabeta:

	(Mean/household)	**% of total**
Calves	2.34	23.5
Stock (< 3 years old)	1.59	15.9
Cows	3.88	38.9
Bulls	0.22	2.2
Oxen	1.94	19.4
Total herd	9.97	100 0

As with pastoralists, agropastoralists tend to retain female stock to produce milk and to maintain the reproductive potential of the herd. Oxen are also important for draft so that stock sold tend to be oxen and cows which have lost their productive capacity. However, because average herd size is generally low, many herders are increasingly forced to sell young males and even females of reproductive age.

Crop-livestock complementarity

Crops occupy an important place in the agropastoral economy. Unfortunately, crop yields tend to be low and rainfall highly erratic. Yields (kg/ha) for selected food crops are given below:

Maize	400 kg
Beans	200 kg
Groundnuts	160 kg
Grain sorghum	400 kg
Millet	400 kg

As a result, farmers grow a wide range of crops in an attempt to minimise the risk of failure for any one. Despite this, subsistence needs can rarely be met by cropping alone and there is a regular need to buy food to supplement domestic production. Cattle and smallstock sales are an important source of cash for regular food purchases. In addition, many, especially those without cattle (hereinafter referred to as "non-owners"), must meet short-term cash needs from the sale of smallstock, handicrafts, brewing products, crop outputs and/or by the use of off-farm remittances. Even more so than with pastoralists, these latter are becoming increasingly important to agropastoralists. In extreme cases, where alternative sources of cash are not available, households must depend on community support for survival whenever crops fail.

The marketed offtake rate for cattle in the short term (+10%/year) tends to be inversely related to seasonal conditions (as with the pastoral economy), the inflow of cash from alternative sources and to short-term movements in the sale price of cattle. Conversely, cattle purchases (if and when they occur) will tend to be directly related to seasonal conditions and/or to the inflow of money from alternative non-farm sources.

Cash consumption expenditure and sources of cash income

Tables 9.13 and 9.14 provide relevant data for average cattle and non-cattle owning agropastoral households. The following should be observed:

- Cattle owning households are generally wealthier. This is reflected in higher levels of income and higher overall levels of expenditure on food and non-food items. Surplus savings tend to be invested in school fees but are inadequate for stock purchases in normal years. Herd accumulation therefore depends largely on natural increase.

- Non-owner households compensate for low livestock income by engaging in activities such as the sale of handicrafts and brewing products. Consumption expenditure on most food and non-food items is also less than for cattle owning households. Surpluses are negligible and stress in times of crop failure is severe. Remittances are a particularly important complement to on-farm income producing activities. For those without remittances, there is a regular need to borrow money in order to survive.

• Overall, cash consumption expenditures for agropastoralists are marginally higher than for pastoralists. This is probably a reflection of the fact that farmers are more exposed to the monetary economy.

• Standards of living for agropastoralists tend to be lower than for the average pastoralist. This is reflected in lower average savings levels per capita.

Table 9.13. ***Average agropastoralist cash consumption expenditure per caput on food and non-food items by cattle ownership category (sample survey data).***[1]

Commodity	Ownership category			
	Cattle owners		Non-owners	
	Total expenditure (A$)	Total expenditure (%)	Total expenditure (A$)	Total expenditure (%)
Food				
Maize	6.00	13.20	7.20	21.2
Sugar	4.50	9.9	3.50	10.3
Tea	2.00	4.4	1.50	4.4
Hotel food	3.50	7.7	2.25	6.6
Other	4.50	9.9	4.00	11.8
Subtotal	20.50	45.1	18.45	54.3
Non-food				
Clothing	7.00	15.4	6.00	17.7
Consumables	1.50	3.3	1.50	4.4
Medical & transport	4.50	9.9	3.00	8.9
Household items	2.00	4.4	1.00	2.9
Money transactions	10.00	21.9	4.00	11.8
Subtotal	25.00	54.9	15.50	45.7
Total	45.50	100.0	33.95	100.0

[1] Higher food expenditure for non-owners reflects the fact that owners tend to have larger families and are able to crop more effectively with available labour. Cattle ownership also permits more timely planting. Yields tend to be higher and consumption purchases lower. For the average household of 6-7 people, owners will spend A$ 270-320/year on consumables. Non-owners will spend A$ 200-235/year

Table 9.14. ***Sources of cash income per caput for agropastoralists by cattle ownership category (sample survey data).***

Source of income	Cattle owners		Non-owners	
	Cash income (A$)	Cash income (%)	Cash income (A$)	Cash income (%)
Livestock sales				
Cattle	20.00	35.2	-	-
Smallstock	1.50	2.7	1.50	4.3
Milk	0 00	0.0	0.00	0.0
Hides and skins	0.20	0.4	0.10	0.3
Subtotal	21.70	38.3	1.60	4.6
Other income				
Cash from labour	20.00	35.2	18.00	51.3
Money transactions	10.00	17.6	8.00	22.8
Beer brewing	3.00	5.3	4.00	11.4
Handicrafts	1.00	1.8	3.00	8.5
Other income	1.00	1.8	0.50	1.4
Subtotal	35.00	61.7	33.50	95.4
Total	56.70	100.0	35.10	100.0

9.6.3. Smallholder production system in high potential regions: The case of the smallholder dairy producer

Approximately 80% of smallholder units are concentrated in the medium-to-high potential zones of the country. Two types of smallholders can be distinguished. One practices mainly subsistence agriculture and concentrates on the production of crops such as maize, beans and groundnuts. Land holdings for this group are small and management practices are basic. The other group of smallholders is actively involved in the cash economy, producing cash crops such as maize, pyrethrum, tea and coffee and utilising grazing resources for the production of beef or milk from zebu or grade animals. Areas controlled by these smallholders typically range from 2-5 ha in non-settlement areas and up to 56 ha (average 12 ha) in settlement schemes.

One of the major successes in Alphabeta since independence has been the development of a productive small-scale dairy subsector. This subsector now accounts for about 60% of the grade dairy animals in the country and produces over 30% of recorded milk sales through official channels. This latter figure, however, does not account for localised sales through co-operative societies or sales by private arrangement within rural areas. Nor does it account for milk used for home consumption.

Production systems

Within the small-scale dairy subsector, five production systems, broadly classified according to the intensiveness of production and the use of grade dairy cattle, have been identified:

System I

An extensive milk production system based on the use of local zebu cows, grazed on communal pastures.

System II

A low intensity production system based on the use of cross-bred cows grazed on natural pasture, owned by individual farmers.

System III

A moderately intensive production system based on the use of higher grade stock which are grazed on well managed or cultivated pasture land.

System IV

A highly intensive production system identified by the use of pure exotic grade cattle which are grazed on improved pasture with supplementation from fodder crops and/or concentrates.

System V

A highly intensive zero-grazing system based on the use of exotic grade cattle which are stall fed with fodder and concentrates.

Households in systems II-V normally also practice cash cropping. Crops grown in conjunction with dairying include tea, coffee, maize and pyrethrum. Potatoes and other vegetables may also be grown for home consumption. In System I, cotton is often grown as a cash crop. A detailed summary of the dairy management and cash crop production characteristics of each system is presented in Tables 9.15 and 9.16.

Returns to dairying, particularly under intensive systems, are comparatively attractive. This, coupled with policies designed to assist smallholders in the acquisition and management of grade dairy animals, has been a key factor in the rapid expansion of this enterprise in suitable ecological zones. With continual land pressure resulting from population growth, there has been a growing interest in intensified systems of production using napier grass or green maize for supplementary feeding. In the high altitude zones, oats and fodder beets substitute for these crops.

Dairying has also proved to be competitive with other cash crop enterprises in the medium-to-high potential zones. Its attraction has been enhanced by the fact that the operation does not entail such peaks in labour demand as many of the cash crops do. Dairy prices, fixed by government, are also stable in comparison with prices for crops such as tea, coffee and pyrethrum.

Approximately 45% of the nation's grade dairy animals are found within systems I-III, 12% within system IV and only 3% within system V. Herd performance parameters vary with the management intensity. However, the differences are not marked, as can be seen below:

Parameters	Systems				
	I	II	III	IV	V
Calving rate (%)	65	-	-	70	70
Calf mortalities (%)	25-30	-	-	20	20
Calving intervals (months)	17	17	17	16	15
Age at culling (years)	>9	>9	9	9	9

Table 9.15. ***Characteristic features of small-scale dairy management systems.***

System type	Extensive	Low intensive	Moderately intensive	Highly intensive	Zero grazing
System no.	**I**	**II**	**III**	**IV**	**V**
Breeds and breedingm	• Local breeds	Cross cow (F_1)	• Low upgraded cow	• High grade dairy	High grade dairy
	• Use of bull in natural service	• Use of AI or bulls natural service	• Use of AI		
	• Uncontrolled mating	• Controlled mating			
Rearing methods	Male and female calves suckle dams during lactation	• Male and female calves part-time suckle a restricted amount of milk over a 4-7 month period	Bucket or hand rearing, feeding of whole milk, late weaning, 3-4 months	• Rearing female calves only	• Rearing female calves only
	• Cow cannot be milked without a calf	• It is difficult to milk the cow without a calf	• Cow can be milked without having a calf	• Concentrate	• Bucket feeding
				• Only weaning 2-3 months	• Use milk substitutes
				Bucket feeding	• Concentrate early weaning

Forage production and feeding methods	• Communal grazing of natural grass and bushland	• Individual grazing of naturally regenerated pasture in a fallow system	• Individual grazing on fenced and cultivated or improved pasture	• Grazing cultivated land and	• Growing arable fodder
			• Use of fertiliser	• Feeding of arable fodder crops	• Forage is cut and carried to animals
				• Use of fertiliser	• Fertiliser and manure are used
Cow feeding and management	• Grazing during day and enclosing during night	• Grazing during day and enclosing during night	• Grazing day and night	• Partially grazing	• Stall feeding
	• Feeding salt minerals	• Feeding minerals	• Feeding minerals	• Feeding arable fodder crops in confined areas	• Cattle kept permanently indoors
		• Feeding concentrates occasionally	• Supplementary feeding concentrates	• Feeding minerals	• Feeding minerals
				• Supplementary feeding of concentrates	• Feeding concentrates regularly
Disease control	• Rinderpest and foot-and-mouth	• Tick-borne disease control	• Tick-borne disease control		ditto
		• Rinderpest and foot-and-mouth vaccinations	• Mastitis treatment		
			• Rinderpest and foot-and-mouth vaccinations		
Possible cash cropping enterprises	• Cotton	Maize, coffee, tea and pyrethrum	Maize, coffee, tea and pyrethrum		ditto

* A cow unit (CU) is defined as a cow plus followers

Table 9.16. ***Current production and gross margin data for small-scale dairy management systems.***

System type	Extensive	Low intensive	Medium intensive	Highly intensive	Zero grazing
System no.	**I**	**II**	**III**	**IV**	**V**
Milk production/cow per year (litres)[1]	330-880	800-1600	1600-2400	2000-4000	2000-4000
Meat production/cow unit per year (kg)	40-60	60-120	60-120	70-110	70-110
Calving interval (months)	15	15	15	14	13
Stocking rates (ha/CU)	0.5-1.0	0.6-1.2	0.6-1.2	0.4-0.8	0.2-0.5
Concentrates (kg/cow per year)	nil	0-100	100-200	200-300	200-500
Labour demand/CU (hours/year)	450	325	375	440	500-800
Capital investment (A$)	5	20	30	40	50
Gross margins (A$)[2]					
per cow unit	10-20	12.5-25	21-42	94-188	240-600
per person hour	0.02-0.04	0.04-0.08	0.06-0.12	0.21-0.42	0.48-1.0
per ha	10.00	15.00	25.00	75.00	120.00

[1] Refers to milk available for sale or consumption. Between 20 and 60% of milk is consumed on farm, with the proportion consumed decreasing as scale of intensity increases.

[2] Gross margin is defined as the value of output (-) associated variable costs annually.

Cash income and expenditure patterns

Table 9.17 provides relevant data for high, medium and low income earners within the small-scale dairy sector. Income earning capacity and consumption expenditure levels are not necessarily correlated to size of holdings but depend on crop and herd management practices and the combination of enterprises found on farm. One would expect, however, that incomes will be higher in those regions where the cultivation of crops such as tea and coffee, in conjunction with intensive dairying, can be practiced. Some important points emerging from the data are:

- Higher overall income levels are associated with higher proportions of total income earned from farm activities. On the other hand, remittances and other sources of off-farm income become relatively more important as income levels decline.

- Consumption levels increase in absolute terms as income increases but the relative proportion spent on consumption goods is highest for the lower income group. For this income group,

savings are negative (i.e. consumption exceeds income) and households in this category regularly need to resort to borrowing in order to survive.

With increasing population density in the medium-to-high potential areas of the country, small-scale dairying, with its potential for intensification, offers considerable scope for maintaining or improving living standards, as average holding sizes decline. This capacity for income improvement has undoubtedly been a major reason for the rapid growth of small-scale dairy operations in the period since independence.

9.6.4 Large-scale livestock production system

Beef cattle

Assisted by a number of donor agencies, Alphabeta has developed a National Livestock Development Programme (NLDP). Its principal objective is to increase beef production by providing credit to four different types of ranching enterprises: group ranches, commercial ranches, company and co-operative ranches in unoccupied areas and individual ranches in pastoral areas. The programme provides facilities and services for livestock marketing, range water development on communal land and disease control. The underlying belief is that stock fattened on these ranches and purchased from rangeland pastoralists would both increase the national offtake and expand the export trade. Other stated objectives of the NLDP include increasing employment in rural areas, particularly in the arid regions of the country, thereby encouraging a more equitable distribution of income and contributing to the conservation of national range resources through the adoption of improved management practices by the ranches.

Table 9.17. ***Average value and composition of income, cash expenditure and savings by household income earning category (small-scale dairying).***

Item	Low income class[1]		Medium income class[2]		High income class[3]	
	Amount	**% total income**	**Amount**	**% total income**	**Amount**	**% total income**
Farm operating surplus	49.4	49.5	121.0	58.7	300.0	62.8
Non-farm operating surplus	10.5	10.5	24.5	11.9	45.0	9.4
Regular employment	6.7	6.7	22.9	11.2	90.0	18.7
Casual employment	14.2	14.2	12.2	5.9	18.0	3.8
Remittances from relatives	16.3	16.4	20.8	10.0	18.2	3.8
Other gifts	2.7	2.7	4.7	2.3	7.2	1.5
Total household income	99.8	100.0	206.1	100.0	478.4	100.0
Total consumption	122.2	122.0	181.4	59.3	303.0	63.0

outlays						
Current savings[4]	(22.4)	(22.4)	24.7	8.0	175.4	36.7

[1] Low income class = A$ 50-150/year

[2] Medium income class = A$ 150-300/year.

[3] High income class = greater than A$ 300/year.

[4] Parentheses indicate negative savings.

NLDP funds are provided through the National Finance Corporation (NFC) for:

- development of water resources
- stock handling facilities
- development of feedlots
- purchase of steers and breeding stock
- stock dipping facilities
- stock fattening or breeding operations
- development of housing, tracks and firebreaks
- provision of incremental working capital under the terms of the programme.

A more detailed description of the four types of ranch enterprises planned for development follows.

Group ranches. These have been established on trust land in the pastoral regions of the country. The ranches are adjudicated and title deed is vested collectively in groups of 30-450 pastoralists who are the traditional users of the land. Members retain rights for individual ownership and management of their herds but the group must agree to maintain a given stocking rate and to co-operate in livestock marketing if loan assistance is to be given.

Commercial ranches. These are held on lease or owned mainly on a freehold basis by individuals, although partnerships of small farmers may also operate commercial ranches. Ranches which are under original ownership tend to be well managed and well developed and include a number of feedlot operations producing prime beef for export trade and the urban sector. These ranches are primarily located in the medium potential regions of the country.

Company and co-operative ranches in unoccupied areas. The establishment of company, co-operative and, to a lesser extent, individual ranches has been the approach used by the government to develop unoccupied semi-arid range areas where lack of water and the presence of the tse-tse fly have been the major factors inhibiting migration of people from more densely settled parts of the country.

Company ranches are enterprises on state land, leased from the national government or from local councils, where shareholders supply cattle, or a cash equivalent, to gain membership. Co-operative ranches are similar in operation, differing only in the form of shareholding offered. Under both systems the cattle herd is managed collectively with profits being shared according to formal legal arrangements.

Individual ranches in pastoral areas. Small individual ranches have been established in some of the pastoral areas of the country with loans from the NFC. Individual pastoralists may apply for adjudication for a prescribed grazing area. The size of each individual area is dependent on natural conditions as well as on the ability of the individual to convince the authorities of the extent of his traditional claims to land. Average ranch sizes are about 650 ha and loans have been made available for stock purchase and land and water development. Most individual ranchers in this category have large herds and a portion of their stock is retained in the traditional communal areas, thus relieving pressure on their own ranches. As in Botswana (module 7), however, this relaxes the stocking constraint ordinarily supplied by private ownership of land and permits overstocking.

Table 9.18 summarises data on incremental capital costs required for development and steer purchases in the different ranching systems listed above. Development costs include outlays for watering, fencing, bush clearing and dipping facilities. In all cases, provision of water supplies constitutes the main item of development expenditure (approximately 40%).

Table 9.18. *Incremental capital per ha for average size ranch operations by category of operation (A$).*[1]

Ranch type	Development capital	Steer purchase	Total capital
Commercial	3.00	2.00	5.00
Group	1.60	0.90	2.50
Company/co-operative	2.50	2.50	5.00
Individual	2.00	1.50	3.50

[1] Average sizes were given as follows: commercial = 3250 ha; group = 15,000 ha; company = 26,000 ha; individual = 800 ha.

Performance on group and individual ranches. Performance on different ranch types has varied according to ecological zone, management practices and operation. Group and individual ranching operations in pastoral areas have not performed well. Sample surveys indicate that the NLDP has had minimal impact in persuading pastoralists to move towards commercial beef production. This is indicated by the fact that:

- Cattle herd structures remain similar to those in pastoral areas for both group and individual ranches, when bought-in steers are excluded.

- Sales and offtake rates from the basic herd are also similar. Since herd structures are unlikely to alter in the short-to-medium term, the scope for increasing commercial offtake from these ranches is limited. Table 9.19 presents statistics on herd structures, sales and offtake rates which demonstrate the similarities between developed group, individual and undeveloped group ranches. The latter probably do not differ significantly from traditional pastoral areas and are therefore taken as an indication of performance data in those areas.

The programme has, however, had a significant impact on tick control, with ranches dipping stock more regularly than before. The standard of animal health care appears otherwise little changed and the purchase of drugs, vaccines and mineral supplements by group ranch households is low. Individual ranchers, however, appear to be spending more per livestock unit on animal health measures than group ranch households, particularly those with a predominance of exotic blood in their cattle herds. Evidence also suggests that improved dipping and watering facilities have, in some areas, permitted the introduction of exotic stock with higher milk production potential and this must be viewed as a positive benefit resulting from ranch development.

Table 9.19. ***Basic herd structure, sales and offtake rates (%).***

	Developed group ranches	**Individual ranches**	**Undeveloped group ranches**
Basic herd structure			
Cows + heifers	65	60	52
Males	18	22	27
Calves	17	18	21
Cattle offtake rate (base herd)	8.4	9.5	11.9
Cattle sales rate (base herd)	8.1	8.9	10.1
Smallstock offtake rate	12.4	23.3	19.9
Smallstock sales rate	6.9	10.8	3.5

Performance on commercial and co-operative/company ranches: Another survey concentrating on ranches of these types provided the following information on performance parameters.

• Calving rates: These ranged from 52-80%, with the lower rates recorded on company and co-operative ranches.

• Mortalities: For the sample of commercial and company ranches, the following mortality statistics by category of stock were recorded over a four year period.

Ranching operation	**Mortality rates (%)**					
	Bulls	**Cows**	**Bull calves**	**Heifer calves**	**Maiden heifers**	**Steers**
Co-operative/company ranches	18.5	15.5	26.3	21.7	5.0	4.5
Commercial ranches	1.8	3.0	9.2	8.0	3.2	3.2

Commercial enterprises appear to manage stock better than co-operative or company ventures. Mortality rates for the latter were high during the period of the survey, probably due to inexperienced or inferior management. In addition, company and co-operative ranches in the sample were located in the semi-arid regions of the country while commercial operations were concentrated in the medium potential regions. In comparison with mortality statistics from the traditional sector, however, co-operative and company ranches appear to perform no better and adult mortality rates would seem to be even higher. This occurs despite considerable investment in veterinary facilities under the NLDP. With respect to offtake rates, commercial and company ranches performed similarly, the average offtake rate being 15-17% during the survey period (four years). Herd structure statistics vary depending largely on the nature of the ranch operation and the age at which stock are sold.

Dairy cattle

Large-scale dairy operations account for only 40% of the country's grade dairy stock but are nevertheless important as suppliers of milk to the main urban centres and suppliers of quality grade animals to the small-scale dairy subsector.

Within this category, three sorts of operation can be identified on the basis of the management system practiced and ecological location of the operation. They are:

Dairy ranching in medium potential regions. Farmers in this category provide less than 10% of marketed milk production and operate a complementary dairy activity in conjunction with beef production. Breeds are commonly dual purpose or crossed with dual-purpose stock. Male progeny and cull animals are sold as beef. Production is seasonal to avoid the heavy cost of purchasing concentrate feed and labour demands per cow are low. Favourable milk prices, relative to those obtained from beef, have induced ranchers in these regions to practice this form of extensive seasonal production, despite average annual milk yields of only 1500 kg/cow.

Extensive dairy farming in high potential regions. Farmers in this group manage dairy cattle on extensive natural pasture/ley systems (50:50) with supplementary feeding of concentrates and fodder crops. Milk yields per cow average only 2000 kg/year and stocking rates of 1.0-1.2 ha/cow unit are most common. Management is of a modest standard and rising input costs have forced a substantial number of producers out of production. Improved exotic dairy breeds are used for production and calving intervals average 15 months.

Intensive dairy production in high potential regions. Systems within this group are mainly stall-fed operations with a limited amount of supplementary grazing. Management is generally of a high calibre and stocking rates of 0.75 ha/cow unit are common. Emphasis is given to supplementary feeding with hay and/or silage and-concentrates (300 kg/cow annually). Milk production per cow is normally in excess of 3000 kg/year and exotic grade cattle (Jersey, Guernsey, Friesian) are used for production. The calving interval is 14 months and the calving rate is between 80-90%.

Poorly managed systems in the high potential zones are not competitive with crops such as maize and wheat on a gross margin basis. Thus, some extensive dairy operations are being phased out.

However, since management is often sub-standard, a better option for some of these operations may be to improve management practices and remain within the industry. It is estimated that yields must exceed 2500 kg/cow annually for such operations to remain economically viable.

Important points (9.6)

The pastoral system

- Pastoralists occupy and regions and depend primarily on livestock for their subsistence.

- Because of low carrying capacities and population pressure in these areas, pastoralists. supplement their food needs by purchasing or bartering from other sources.

- In the arid regions optimum human:cattle ratios to meet full dietary requirements from pastoral activities alone should be between 1: 13 and 1: 15 as against the present average ratio of 1:5.

- Mature cows comprise approximately 40-45% of the average pastoralist household herd.

- Overstocking and overgrazing along with human population growth have put pressure on: the pastoral environment.

The agropastoral system

- Agropastoralists occupy marginal areas of the country, deriving their living mainly from complementary' livestock and cropping activities.

- Agropastoralists resemble pastoralists in their herd structure, performance and ownership patterns and in their desire to accumulate stock.

- Food crop yields in agropastoral areas tend to be low.

The smallholder system

- The majority of smallholders are concentrated in the medium-to-high potential areas.

- Smallholders are of two types: one which is subsistence-oriented and another which is actively involved in the cash economy and in beef and dairy enterprises.

- The small-scale dairy subsector accounts for almost 60% of the grade dairy animals in the country.

- Within the dairy subsector, production systems of five degrees of modern or intensive management practice can be identified.

- Returns to dairying in intensive systems are attractive and this offers great scope for improving

smallholder living standards.

Large-scale production systems

Beef

- Improving beef production is the main objective of the NLDP.

- NLDP funds are provided through the NFC to four types of ranches for the development of various facilities related to beef production.

- Commercial and company/co-operative ranches have performed well while performance on individual and group ranches has remained close to that observed on undeveloped group ranches.

Dairy cattle

- Large-scale dairy operations account for only 40% of the country's grade dairy stock.

- For large-scale dairy enterprises to remain economically viable, milk yields must exceed 2500 kg/cow annually.

Economic inferences

- Decisions about herd size and livestock sales are motivated principally by economic factors and constraints.

- Pressures of the cash economy and the expansion of the urban-based wage economy are stimulating temporary out-migration from agriculture. As a result, farm labour is constrained and labour-intensive options for productivity improvement are restricted.

- Farmers are attempting to allocate their resources (grazing land, livestock, family labour) to those uses with the highest net returns.

- Pastoralists and agropastoralists are constrained from expanding their herds by poor herd dynamics parameters and low savings. Thus, herd sizes tend to fluctuate in response to natural conditions.

- Decisions about choice of enterprise are governed by gross margin calculations.

- A lack of concern for the environmental implications of their actions is not necessarily an inherent feature of pastoralists, agropastoralists or subsistence-oriented smallholders. Rather, it is imposed by the relative marginality of their existence, household resource constraints and the imperatives of an increasingly free-access range.

9.7 The marketing of beef dairy products

9.7.1 Beef products

Marketing organisations and control

Marketing beef in Alphabeta has been subject to extensive state control since independence. Control is through the Meat Marketing Commission (MMC) and the Cattle Marketing Division (CMD) of the Ministry of Agriculture. Through the MMC, the Government controls slaughter for export and urban markets. Through the CMD it owns and operates all primary market outlets, stock routes, holding grounds and quarantine facilities. The CMD is active in marketing stock from the arid range areas and in maintaining a system of floor prices for cattle marketed in these areas.

The Government's principal objectives in the controlled marketing of beef products are: to generate a flow of improved grades of meat for urban and export markets; reduce the cost of living for the urban consumer; and limit the spread of disease, particularly foot-and-mouth, in order to improve export prospects.

The MMC operates two large abattoirs and licenses an additional 16 private or council abattoirs to operate within urban areas.

Beef marketing policy

Beef prices are controlled at producer, wholesale and retail levels but prices for smallstock are not controlled. Producer prices for beef have remained well below export parity levels despite periodic increases announced by the MMC in recent years. This has four important effects:

- illegal trading and slaughtering operations
- increase in urban demand for high and low grade beef
- increase in rural demand for low grade beef
- static production in prime quality beef from commercial and other ranches.

Illegal trading and slaughtering within, and adjacent to, urban areas have effectively eroded MMC's monopoly of the urban market and resulted in declining amounts and proportions being sold through official channels (Figure 9.20). As a result, MMC's slaughtering capacities have remained under-utilised.

The pricing system adopted has also contributed to an increase in urban demand for high and low grade beef (Table 9.20). Beef prices have, in fact, declined in real terms (Table 9.21) and relative to prices paid for other commodities (Table 9.20). On the other hand, average urban incomes have increased in real terms, particularly for the upper and middle income groups, as a result of wage agreements.

Table 9.20. ***Urban demand and retail price indices for beef compared with cost of living indices (Year 4 = 100).***

Urban demand[1]	Indices of price and cost of living (food)					
Year	Per capita (kg)	Total ('000 t)	High grade beef price	Middle income	Low grade beef price	Low income C.O.L.
4	20.0	15.1	100	100	100	100
5	18.0	14.3	109	103	101	103
6	19.0	15.8	101	111	111	112
7	20.5	18.0	101	115	111	113
8	23.0	21.2	113	126	121	126
9	24.5	23.7	116	150	121	155
10	26.0	26.4	123	179	140	186
11	26.0	27.7	139	188	140	195

[1] Main urban centres only.

Table 9.21. ***Urban beef retail prices in constant and current dollar terms for low and high grade cuts.***

Year	Current prices (A$/kg)		Constant prices (A$/kg)[1]	
	Low grade in bone	High grade boneless	Low grade in bone	High grade boneless
4	0.26	0.54	0.26	0.54
5	0.27	0.59	0.26	0.57
6	0.29	0.55	0.26	0.50
7	0.29	0.55	0.25	0.48
8	0.32	0.61	0.25	0.48
9	0.32	0.63	0.21	0.42
10	0.36	0.66	0.19	0.37
11	0.37	0.75	0.19	0.40

[1] Deflated by the middle income urban cost of living index (year 6=100).

Figure 9.2. ***Meat Marketing Commission: Official beef purchases and producer prices (CDW).***

Barring changes in preferences, beef prices and prices of substitutes (e.g. mutton and milk), the demand for beef will increase with increases in incomes and population according to the following formula:

$D = p+ng$

where:

D = percentage change in demand
p = the population growth rate
g = the growth in real per capita incomes
n = the income elasticity of demand for beef.

Studies of beef demand in Alphabeta's urban centres have found the following elasticities:

Income elasticity of demand for beef (urban): 1.00
Price elasticity of demand for beef (urban): -1.20

Estimates of cross price elasticities of demand for mutton and milk were not made. However, these are certainly positive (i.e. mutton and milk are substitutes).

Given the 2% annual real increase in urban per capita incomes and the estimated 5% annual increase in urban population, urban beef demand has been increasing by 7% (5 + 1 x 2) annually. Falling real beef prices and high prices for substitutes have caused additional demand.

Less is known about beef demand (as distinct from consumption) in rural areas. However, apart from beef and meat products consumed on farm, there is a rural demand for purchased beef, particularly in the medium-to-high potential regions of the country. The actual amounts sold in these areas are, however, not known. Various estimates of income and price elasticities of demand for beef in rural areas have been made but these can only be treated as approximations. One such estimate is as follows:

Income elasticity of demand for beef (rural): 1.0-1.20
Price elasticity of demand for beef (rural): -1.30

In addition, it has been estimated that the average per capita rural consumption of beef is between 5-8 kg/year. This average conceals substantial variation within and between ecological regions. This is dependent on such factors as income level, household size and structure, consumption habits, seasonal conditions and prices of other food commodities. Consumption per caput of purchased beef has remained static for some time. With rising rural populations, this implies that the demand for low quality beef in rural areas has increased at the rate of population increase (i.e. 4%/year). As a result of this increased demand, inferior quality stock are being marketed in increasing numbers in rural areas. This reduces the stock available for finishing at group, individual and co-operatively owned ranches arid, thus, affects the supply of beef to urban areas.

Government pricing policies have also affected the production of prime quality beef from commercial and other ranches. The MMC price to the producer has consistently been kept below

export parity levels, and price differentials between different grades have been comparatively narrow (Table 9.22).

Because of rising input costs coupled with relatively low prices for beef compared with other enterprise alternatives, there has been little incentive for the production of prime quality beef. This is reflected in the statistics on chilled or frozen beef exports in Table 9.7. The quantity of beef exported in these categories has remained relatively static for the past eight years and the proportion of superior grades delivered to the MMC has also remained comparatively unchanged during the same period (Table 9.23). Since commercial ranches account for approximately 50% of official MMC sales for slaughter, the inference is that over half the sales from the commercial ranching sector must have been of standard or poorer grade cattle.

Table 9.22. *Beef producer prices grade differentials (CDW).1*

Year	Current prices (A$/kg)		Constant prices (A$/kg)	
	GAQ[2]	FAQ[3]	3rd Grade	4th Grade
4	0.170	97	81	70
5	0.175	95	78	68
6	0.203	93	70	61
7	0.222	92	68	59
8	0.239	93	73	63
9	0.265	94	78	67
10	0.299	93	79	69
11	0.334	97	72	63

[1] CDW = cold dressed weight.

[2] GAQ = good average quality.

[3] FAQ = fair average quality.

Table 9.23. ***Proportion of deliveries in different grades delivered to MMC (%).***

	Year 4	Year 11
Good average quality		
Prime	0.03	0.02
Choice	7.4	6.7
FAQ[1]	15.0	16.1
3rd Grade		
Standard	25.0	25.2
Commercial	48.1	47.6
4th Grade		

Manufacturing	3.97	4.38

[1] FAQ = fair average quality.

Beef marketing efficiency (MMC)

Information on meat processing costs incurred by the MMC over time demonstrates serious inefficiencies within the formal marketing structure for beef products. The following evidence supports this statement:

- Between years one and six, MMC's total costs rose by 31% compared with the Wage Earners' CPI which rose by 13% and the implicit GDP deflator of Manufacturing and Repairs which rose by 22% during the same period.

- Between years 7 and 11, total MMC costs increased by 139% compared with a corresponding GDP deflator growth of 38% and a CPI growth of 63%.

- When costs are compared with licensed private slaughtering operations in urban areas, it can be seen that the latter operate on a margin of 5 cents/kg CDW compared with an MMC margin of 7.5 cents/kg CDW (i.e. 50% higher). Private operators can therefore afford to offer a higher price to the producer and/or offer a lower price to the consumer. This is one explanation of the diversion of urban supplies from the MMC in recent years. However, larger producers of high grade export quality beef continue to sell through the MMC largely because they prefer to operate through established and regular marketing channels.

Cattle marketing

Little is actually known about supply-price response relationships in cattle marketing from the traditional sector (particularly the pastoral and agropastoral subsectors). Only a small proportion of stock sold from these areas go through official channels. The major portion is sold to rural butcheries and traders or to other rural households. However, the following general comments on the supply response of traditional cattle owners, based on studies within and outside Africa, can be made:

- There is conflicting evidence within Africa on short-term price-supply relationships. Surveys conducted in Sudan argue that the price elasticity of supply in the short-term is positive. On the other hand, time series studies done in Swaziland and Zimbabwe indicate that the response to price changes is negative. Another time series study in Botswana shows a positive short-run relationship and only one study in Swaziland has shown a long-run negative supply response between the cattle offtake rate and price.

- A negative short-term price-supply response relationship has also been observed for beef ranches in North and South America. Producers in these countries may withhold sales (in anticipation of a long-term price rise) in order to maximise long-run profits. Steer sales, for example, may be withheld to increase body weight and thereby increase the average price

received on sale. Cows designated for culling may likewise be withheld from sale in an attempt to increase herd size through additional carvings.

• One explanation for the observed negative supply response relationship for African cattle owners is that cattle are held as a store of wealth and are required for consumption and production purposes. Owners will therefore be reluctant to sell, but if forced to do so to meet cash needs, will sell the minimum number of cattle. A real price increase for cattle may therefore result in an overall decline in the offtake rate, since cash needs can be met by the sale of fewer cattle. Although they are difficult to discern, price-supply relationships for African herders are of critical significance to livestock development policy.

9.7.2 Dairy products

Marketing organisation and control

The processing and urban sale of milk is controlled by the National Dairy Co-operative (NDC) which normally handles an estimated 25% of total milk production and 96% of all milk passing through commercial channels. The NDC is a commercial company; it is also a producer co-operative. Membership has grown since independence, largely resulting from expansion of the small-scale sector. There are now 294 registered co-operative societies, 3100 individual members and approximately 2500 temporary member suppliers. Retail prices for all goods marketed through the NDC and prices it pays to farmers are controlled by the government.

Important trends in raw milk deliveries to NDC and milk demand patterns over a period of 11 years have been as follows:

• NDC liquid milk sales have steadily increased since independence but deliveries have recently declined despite an eight year upward trend in producer prices (Figure 9.3).

• There has been a rising demand for liquid milk in urban areas (Table 9.24). The proportion of total deliveries by NDC consumed as fresh milk and cream has thus risen from 40% in year one to 72% in year 11. This has reduced the amount available for manufacturing purposes. With rising population and urban income levels, this trend is likely to continue, reducing the amount available for manufactured export products (Table 9.1). The pattern of overall demand for milk is unknown however, because informal sales in the rural sector account for a substantial proportion of the milk sold.

Milk pricing systems

Milk production in Alphabeta is highly seasonal, and difficulties have arisen in maintaining supplies during the off-season when urban shortages become a problem. In an attempt to iron out such seasonal fluctuations, NDC initially used a differential pricing system. Under this system, premiums were paid to large-scale producers who maintained supply levels throughout the year, and lower prices were paid to seasonal producers who reduced their supplies during the off-season (December-March). Milk produced in remote areas was only accepted in the form of butter fat to reduce the NDC's transport commitments.

Figure 9.3. ***Milk purchases and prices paid by NDC.***

However, political pressure in year five forced the government to abolish this differential pricing system and to announce a uniform price for all milk, irrespective of season or distance from manufacturing facilities. This price was equivalent to the premium price paid to large-scale producers under previous pricing arrangements. In effect, all small-scale producers benefited from a price rise of 45%. Figure 9.4 demonstrates the impact of the price increase on seasonal supplies to the NDC before and after the policy.

With the availability of grade dairy stock in medium-to-high potential areas of the country, smallholders responded to the new pricing system by increasing production. But, limited dry season supplies were diverted to higher priced (informal) local markets in rural areas, and surpluses during the flush period (normally April-October) were sent to the NDC.

The NDC was then faced with a serious over-supply problem during the flush period, and the requirement that it purchase all supplies offered at the established price strained its financial resources. Moreover, to cope with seasonal gluts in supply, additional manufacturing capacities were needed and built, but these were under-utilised during the off-season.

Table 9.24. ***Deliveries of raw milk to and production by NDC.***

The pricing system adopted in year five also encouraged production from remote areas, effectively concealing the transport costs involved in supplying milk to consumers. As a result, the NDC's marketing costs increased and were passed on to consumers (Figure 9.5). Consumers were taxed in other ways. The consumer pricing system adopted by the NDC is based on using profits generated from liquid milk sales to subsidise the sale of manufactured products. Whole milk which requires minimal processing (cartons or bottles) is sold at more than double its purchase price (Figure 9.5). In contrast, processed products are sold at prices which do not cover the costs of purchase, transport and processing. Surpluses of manufactured products intended for the export market are therefore subsidised by the Government's price policy. Furthermore, as consumption of liquid milk has increased, the production of manufactured goods has declined (Table 9.24), resulting in excess capacity in NDC's processing plants. This, in turn, has raised the cost per unit of manufactured goods, increasing the subsidy required on these items.

Factors behind rising urban milk demand and decreasing NDC deliveries.

Since year seven, the CPI for milk has remained relatively stable compared with increases for all other important urban food commodities (Table 9.25) and this partially accounts for the rise in urban milk demand from year seven onwards (Table 9.24).

Despite recent price increases for whole milk, supplies marketed through the NDC have declined (Figure 9.3 and Table 9.24). The following reasons have been given:

- Input prices for the dairy sector increased more rapidly than producer prices during this period. Oil price increases directly affected prices of inputs such as chemical fertilisers and insecticides. Therefore, the real price paid to the producer declined.

• At the same time, output prices for competing farm enterprises increased relative to milk. This was particularly the case for coffee and maize, which are produced as cash crops in the high potential zones of the country where dairying is also practiced on an intensive basis. Resources (labour and land) were therefore transferred out of dairying into cash cropping. The rise in maize prices also increased concentrate costs (refer to Table 9.26 for a comparison of price indices for maize, milk and coffee).

• Rising prices for these crops increased rural incomes for cash croppers in these areas and this, given a high income elasticity of demand for milk in rural areas, probably resulted in a diversion of supplies from the NDC (Table 9.24).

Figure 9.4. ***Seasonality of milk supplies to NDC (years 5, 7).***

Table 9.25. ***Index of consumer prices for milk compared to other food items (Year 7=100).***

Year	Milk	Maize meal	Wheat flour	Low grade beef	Sugar	Rice
7	100	100	100	100	100	100
8	100	100	100	110	130	100
9	100	129	148	110	130	130
10	100	165	189	110	189	139
11	119	165	189	127	243	182

The farm-gate price for whole liquid milk paid to the producer is significantly less than the border price per unit at the official exchange rate. Adjustments for overvaluation of the local currency widen this gap even more (Table 9.27).

Table 9.26. ***Index of producer prices for coffee, maize and whole liquid milk (year 4 = 100).***

Year	Coffee	Maize	Milk	Milk: Maize	Milk: Coffee
4	100	100	100	100	100
5	119	100	100	102	86
6	101	121	133	110	132
7	124	141	148	105	119
8	146	141	148	105	101
9	160	168	148	88	93
10	170	253	163	64	96
11	410	278	202	73	50

Figure 9.5. Consumer ***and producer price differentials for whole liquid milk* (years 1-10).***

Table 9.27. ***Ratios of liquid whole milk producer prices to border prices.***

Year	Unadjusted official exchange rate	Adjusted shadow exchange rate
5	0.38	0.30
6	0.64	0.51
7	0.71	0.57
8	0.73	0.56
9	0.71	0.55
10	0.58	0.48
11	0.66	0.53

Response to price changes

Estimates of the short-term (less than one year) supply response of the small-scale dairy sector are not available, but the evidence cited in the previous section suggests that it is elastic. In the short term, when production cannot easily be augmented or reduced, supply changes will mostly result from changes in home consumption. Peasant dairy producers consume milk produced on farm. Given that local markets are saturated, increases in milk prices relative to other products will normally result in increased sales to the NDC and reduced levels of home consumption. With a reduced price, however, sales to the NDC are less attractive and more milk is retained for home consumption. Households' ability to adapt milk supplies to changing economic circumstances also means that supplies to the NDC may be irregular. In the medium term, adjustments to a long-term milk price rise may be made by increasing or decreasing the size of grade dairy herds. The effectiveness of this strategy will be limited by the availability of grade dairy animals from the large-scale sector.

In rural areas, the price and income elasticity of demand for milk is high and comparable to beef. Rural per caput consumption has been estimated at approximately 50 litres/year. This will vary with levels of cattle ownership, cultural practices, age structure of the household and seasonal conditions. The vast bulk of milk is consumed on farm and never sold, so that it is estimated that only 25% of the total ever reaches the market.

In conclusion, rising urban and rural demand for whole milk is eroding surpluses available for production of manufactured products and exports. Such a trend is obvious from Tables 9.1 and 9.24. This, in itself, is not too problematic but trends in production and consumption also indicate that local production may soon be inadequate to meet local demand. Alphabeta would then be forced to import milk and other dairy products. Recent proposals to introduce free school milk will only add to this need.

Important points (9.7)

Beef products

- Beef marketing in Alphabeta is subject to extensive state control.

• Through the MMC, government controls slaughter for the urban and export market and through the CMD it controls the domestic marketing of stock.

• Two main characteristics of the beef pricing policy are: beef producer prices have remained well below export parity levels, and beef prices have declined in real terms and relative to. prices paid for other commodities.

• The marketing and pricing policies pursued by the Government have resulted in: 0 illegal trading

- increased urban demand for beef 6 static export trade
- increased rural demand.
- MMC's economic performance in beef processing is unsatisfactory

Dairy products

• The processing and urban sale of milk is controlled by the NDC.

• The NDC handles 25% of total milk production and 96% of all milk passing through commercial channels.

• Urban demand for milk is rising.

• Political pressure forced the government to abolish the differential pricing system and to adopt a uniform pricing system for all milk products.

• The policy revision placed NDC in financial difficulties and a serious over-supply problem. Consumer prices also increased.

• Other consequences of the revised policy are: subsidisation of the price of manufactured dairy products and increased cost per unit of manufactured products.

• Rising urban and rural demand for whole milk is likely to reduce the export of manufactured products and increase their import.

Economic inferences

• Government attempts to control prices are seldom ultimately successful, especially if controls are not in line with underlying demand and supply conditions, Controls on consumer prices lead to shortages and illegal markets. Most consumers pay more. for controlled items in terms of time spent in obtaining the items, bribes or premiums and inflated black market prices-if they can find the items at all. The effect is often worse than if no controls had been in existence in the first place. Ceiling prices for producers cause them to abandon production and substitute an uncontrolled output, sell on the black market where returns are higher or smuggle their output

across the border. These outcomes were observed in Alphabeta's meat and milk markets.

- A properly functioning price system should convey information about relative resource scarcities to consumers and producers. This helps ensure efficient resource utilisation as items in comparative abundance (and relatively cheap) are used, and items in comparative scarcity (and relatively expensive) are conserved. As was the case in Alphabeta, when relative prices change, consumers will substitute other items in consumption and producers will shift to other output. The differential milk pricing system in Alphabeta helped with this. When it was abandoned, milk processing and marketing resources were less efficiently used. In addition to resource allocation, prices that accurately reflect resource scarcity will often stimulate technological innovations to overcome it.

- A price system will only operate to allocate goods and resources efficiently if it does not contain gross distortions. In addition to government controls on prices or outputs, these distortions may be due to monopsony or monopoly factors, inadequate market information, high transaction or and unforseeable risk. In all of these instances, there may be a legitimate role for government to play in ameliorating or eliminating the distortions. The key is finding the proper balance lack of regulation and excessive regulation. In most African countries, including, Alphabeta, the balance has tipped towards excessive, regulation.

- Marketing entails costs. These costs involve transport and storage charges, costs of acquiring market information, financing charges and risk premiums. The presence of a large number of middlemen is not sufficient evidence to conclude that marketing charges are excessive. Under African conditions, with poor infrastructure and high risk, marketing costs are often intrinsically high. It is better to look at the degree of competition amongst middlemen,

- Changes in the amount of an item demanded are affected principally by changes in its price. Changes in income, the price of substitutes and complements, and changing tastes and customs may also affect demand. Planning and projections of future supply requirements must try to account for these factors.