SEMINAR ON LIVESTOCK DEVELOPMENT POLICIES IN EASTERN AND SOUTHERN AFRICA

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CURRENT LIVESTOCK POLICIES IN EASTERN AND CENTRAL AFRICA

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(NO TABLES ATTACHED

INTRODUCTION

The paper is prepared on the basis of communications received from participants of the countries concerned as contained in their respective national reports prepared for the Seminar. Of the 26 countries invited to the Seminar, 17 dispatched their reports well in advance to enable their inclusion in this paper. The countries are : Botswana, Burundi, Comoros, Djibouti, Ethiopia, Kenya, Lesotho, Madagascar, Mozambique, Namibia, Madagascar, Mozambique, Namibia, Uganda, Rwanda, Somalia, Swaziland, Tanzania and Zambia.

All available information is grouped under each region within the framework of the Seminar. The East African Region includes the following countries:- Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Uganda, Rwanda, Seychelles, Somalia, the Sudan and Tanzania with South Africa, Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Zambia and Zimbabwe as the 10 countries within the Southern African Region.

The author prepared the present paper in the light of the format proposed for the national reports; namely: importance of the livestock sector in the economy; livestock policies, the potential of the livestock sector, the main technical constraints, Institutional support, and, lastly, support for the livestock development markets. It was not possible to include all the available information in the present paper, however, the national reports are available and will be reproduced in its entirety in the proceedings of the seminar.

The paper is aimed at outlining major policies and, especially, identifying main problems and deficiencies in the national livestock policies. These wil discussed at length during the Seminar.

2. IMPORTANCE OF THE LIVESTOCK SECTOR IN THE NATIONAL ECONOMY

There is, obviously, a high degree of disparity among countries in terms of livestock industry's contribution to the national economy. Estimates do vary fror 10% of the GDP and from 25-30% of the agricultural GDP (Table I). Not exceptions are Ethiopia and Tanzania which have a highly agricultural based econ in which the livestock sector contributes 16% and 18% GDP, respectively. All countries concerned consider it as an important sector of activity in terms of number of people employed and also the fact that most of the population predominantly rural.

Recent statistic on livestock population, production, imports and exports classified in Table 2, 3 and 4. Of the Eastern African countries, Eritrea, Ethio Madagascar and Somalia have high export potential. Kenya, Uganda and Tanz consider themselves to be self-sufficient with a potential for export. Countries Burundi, Rwanda and Djibouti are the main importing countries in view of rec political crisis. In Southern Africa, the major exporting countries are Botswa Namibia, Swaziland with South Africa as the leading importer, Angola Mozambique, now recovering from political crisis.

At the regional level, nomadism is the method used in most countries of EAST transhumance, obviously, is no respecter of national boundaries; hence the diffic encountered in research and follow-up activities. It is for this reason that so countries are complaining of loss of markets and animal health problems encounter The existence of SADC in Southern Africa coupled with the livestock developm method in operation help to ensure a better understanding and control inter-st trade. Swaziland raised the question of heavy imports subsidies which may pos threat to national productions.

3. LIVESTOCK POLICY

Table No.5 shows data on livestock policies in the field of research and development.

3.1. DEVELOPMENT POLICIES

All the countries, with the exception of Somalia which does not have a well defined national Government, have a document on livestock development policies. However, some of these information also appear in the general document of national agricultural development policy. Kenya, Tanzania and Rwanda (Eastern Africa) have a document specifically on livestock, Uganda has major plans for the various livestock sub-sectors, in Southern Africa, only Lesotho and Swaziland possess one document specifically on livestock. Livestock development policies for Botswana, Mozambique, Namibia and Zambia are stipulated in their national Agricultural Policy Documents. These policies are sometimes drawn up in very general term. ~~and~~ Countries like Tanzania and Uganda have well defined document which could serve as example for the drawing up of more detailed policies for easy and effective implementation.

3.2. RESEARCH POLICIES

~~Only two~~ FEW countries reported the availability of specific document on livestock research policy, and ~~also a document~~ EVEN on general agricultural RESEARCH policy. There are indications of such policy in the documents on national agricultural policy provided by Burundi, Comoros, Eritrea, Ethioipia, Kenya, Botswana and Swaziland). Djibouti, Somalia and Lesotho reported the lack of means to undertake research activities. Uganda and Mozambique reported having documents which deal specifically with livestock policies.

3.3. Impact on Livestock Development

Opinions widely differed on this point- impact of development and research policies on livestock development. Countries are grouped in accordance with their response:

Positive Impact : Ethiopia (progressively relinquishing subventions); Kenya (price stability and private development sector); Uganda (better production price and better control of movements and contagious diseases); Swaziland (short-term payment of services and high demand for the launching of private livestock projects)

Medium Impact : Comoros

Little or no Impact : Burundi, Eritrea, Botswana, Mozambique, (very early) Namibia (very early), Zambia (difficult to estimate).

4, FUTURE PERSPECTIVE OF THE LIVESTOCK SECTOR

Table 6 shows the main trends described in the national reports at both national and regional levels.

At the National Level : All the countries reported that the role played by the livestock sector will continue to grow in the years to come and that majority of countries in the East African region (with the exception of Uganda) are greatly concerned about the possibility of meeting the challenges of the ever growing demand. On the contrary, majority of countries in the Southern African region (Botswana, Mozambique, Swaziland and Zambia) reported that they have the necessary potential that could be developed immediately. It is therefore not a surprise to note that countries in the East African region have given priority to the production of ~~small~~ SHORT SPECIES AND PERI-URBAN SYSTEM. ruminants. All the countries recognised the need to redefine the role of different ~~inputs~~ in the livestock sector, especially the Government.

At the Regional Level

It is difficult to make any prediction for countries within the East African region in view of the social and political instability in most of them. Kenya is looking forward to a surplus in white meat and dairy products and Uganda intends do transform its diary products excesses in to cheese for export while Somalia, is hoping to extend its exports to Saudi Arabia.

The existence of the SADC in Southern africa region is considered a positive factor for livestock development by its member countries and most of them are planning to continue with and develop intra-community exports (mainly towards South Africa) but also outside the region, specifically to central africa (Zambia). Countries like Botswana and Namibia are greatly concerned with the uncertainties over accessibility to the European Markets within the content of the Lome Conventions.

5. LEADING TECHNICAL CONSTRAINTS TO LIVESTOCK DEVELOPMENT

Table 7 shows the leading technical constraints to livestock development as reported by the various countries.

In Central Africa, with the exception of Ethiopia, Kenya and Uganda, animal health is no longer cited as the leading constraint. It has been replaced or being considered in the same way as the other problems: nutrition and availability of water. It is also very interesting to note that most countries now regard as priority constraints, problems related to access to inputs, loans and structural and socio-cultural conditions.

In Southern Africa - Animal health and nutrition no longer considered as priority constraints but the lack of trained personnel (Botswana, Swaziland) problems of rangelands or herd management (Lesotho, Namibia and Zambia) or the low productivity of animals (Lesotho, Namibia and Mozambique)

6. INSTITUTIONAL SUPPORT TO LIVESTOCK DEVELOPMENT

Table 8 presents a summary of data received from the different countries on their current situation and especially on their future requirements at the national and regional level. The level of data received from countries is somehow hetegenous.

At National Level - future requirements will include : Establishment of a high - powered private sector, strengthening of public services particularly by ensuring better coordination among research training and institutions.

At Regional Level - Only few countries made suggestions, ~~on~~ e.g. the harmonization of sanitary regulations and a better coordination of sanitary surveillance, particularly on the need to exchange information, technologies and other available means.

7. MARKET SUPPORT FOR LIVESTOCK DEVELOPMENT

Table 9 shows the actual situation of national markets and requirements proposed by countries at the regional and national levels.

At National Level

Analysis of the current situation reveals some shortcomings and highlight the need to ~~establish~~ BETTER ORGANIZE THE production chains and markets. Of specific priority are : improvement of roads and transport systems, organization of producers' associations, access to loans, organization and implementation of information collecting systems and units for the ~~treatment~~ PROCESSING and ~~preservation~~ CONSERVATION of animal products; and also encouraging private initiative. ~~encouraging private initiative~~.

At Regional Level -

First priority is for the establishment of Information System on the markets and improvement of inter-state communications so as to ensure better knowledge of prevailing market trends for adaptation. Other priority areas : an effective regional approach to problems affecting livestock development (sanitary control, pastoralism, research etc.), harmonization of national policies and the creation of public investment code which would encourage regional identity: those are some of the proposals made to help provide support for development of livestock markets in the regions.

8. TRENDS, PROBLEMS AND SHORT COMINGS

The first item for discussion at the seminar will be the ~~interest shown in~~ FUTURE OF the national reports and the significance of analysis such as this one, especially where ~~most of the~~ A FEW leading countries in the region have not been covered in this report. Furthermore, although the ~~report is~~ OUTLINE WAS quite detailed and restrictive to some extent, the level of information received from countries are ~~homo~~hetero geneous. Countries that have not yet done so are urged to submit their reports and all those whose reports have already been received are called upon to verify the information contained therein and, where necessary, provide additional information. This will make it possible to include a complete and more useful analysis in the final report of the seminar.

It is quite surprising TO NOTE that only few documents on Livestock Development and/or Research Policies ~~were submitted~~ ARE AVAILABLE. Participants will most likely debate on the usefulness and effectiveness of such specific documents with those dealing with general agricultural policy and draw conclusions either for or against the need for such documents.

It is ~~hoped~~ EXPECTED that the livestock sector will make positive contributions to the national economies of the countries within the two regions. This Sector has a promising future and its expansion will be centred mainly on the production of ~~small~~ SHORT CYCLE ~~ruminants~~ SPECIES. In the light of this, particular attention should be given to ensure that both national and private livestock services are closely adapted to the difficulties resulting from the implementation of these new systems without,however compromising the more traditional cattle ~~breeding techniques~~ PRODUCTION SYSTEM. All the countries stressed the need to give support to the small-scale farmer rather than to the large-scale producers.

Another interesting observation is the importance of animal health in livestock development which is of serious concern in certain countries, but which no longer constitutes a major constraint. Animal health problems are gradually yielding place to zootechnical and socio-economic ones; and this phenomenon will have repercussions on ~~animal population~~ HUMAN RESOURCES NUMBERS, discipline and training ~~of personnel~~. The Seminar will have to deliberate on this and map out strategies thereon.

On the question of Institutional support, ~~opinion is divided~~ CONFUSION STILL EXISTS on the roles to be played by the public and private sectors particularly regarding distribution of inputs, production and marketing instead of relegating everything to the private sector. On research institutions, the problem is more complex (should all the various types of research on production systems be funded by the public sector?) or ~~publicising~~ EXTENSION (should companies marketing inputs be made to provide advice on mode of application?). The last aspect deals with the privatisation of animal health services and the need to guarantee a descent income to those wishing to establish their own services, ~~and~~ leaving sanitation and public health to Governments authorities.

Countries are also becoming increasingly aware ~~of~~ THAT the solutions to problems inherent to the agricultural development sector such as livestock ~~which is~~ ARE no longer exclusive to the field of "Science and Technology" but ~~to~~ ALSO IMPLY the Socio-economic and the environment. The organisation of ~~national and regional~~ markets is ~~no longer~~ of national ~~but~~ AND regional priority concern.

Surprisingly, almost all the countries concerned highlighted the difficulties encountered in the collection of relevant information, hence the need to improve communication systems.

Finally, it should be reiterated that only few countries reported on the role each is playing or activities undertaken to promote livestock development with the context of the region. There is also a vast difference between the situation prevailing in the East African Region with that of Southern Africa - this, therefore, calls for an indepth study on the positive as well as negative effects of SADC on Livestock Development and of other regional organizations such as SACCAR and ASARECA dealing with agricultural research; this will, most certainly provoke enriching discussion at the seminar.

This report is incomplete, analysis of information received from the 17 countries in both regions, HOWEVER IT CAN ~~can be of great benefit, and~~ serve as a clear pointer to an interesting development in the perception of livestock development problems. These will have to be incorporated in the national policies which obviously, are rarely specific to the livestock sector and in other policies in order to help strengthen regional integration and promotion.

LIVESTOCK PRODUCTS

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Nobody involved with livestock, and particularly in Africa, needs to be convinced of the importance of animal diseases as a constraint to production. For the same reasons, it is clear to anyone involved in the international marketing of livestock or meat that animal health restrictions are a major constraint to these endeavours. Some of the most important epizootic diseases for which countries have made huge efforts to prevent and/or control can be transmitted not only by animals but also by meat. In response to 'globalisation of the economy', national livestock producers are not prepared to let their Veterinary Services risk unrestricted importation of animals and animal products when, in their own interest and often at great expense, they support and cooperate with disruptions to national trade in order to control important diseases.

The bovine spongiform encephalopathy (BSE) saga serves as a dramatic recent reminder that animal disease control and trade are inextricably linked. Another is Taipei China's pork export losses of hundreds of millions of dollars caused by introduction of foot and mouth disease (FMD) resulting in an outbreak this year.

Africa where livestock keeping is so important to such a large part of many countries' populations has its share of transmissible diseases greatly affecting those from smallholders through entire national economies. Some of these diseases in Eastern and Southern Africa are, through long-standing efforts, under control. As elsewhere, reversals occur, such as a worsening contagious bovine pleuropneumonia situation and the recent spread of rinderpest southward. The presence of diseases which do not exist or have been controlled or eradicated elsewhere continues to inhibit the development of a meat export industry which many in Africa consider would greatly contribute to improvement of animal husbandry in their countries.

The international community, however, strongly supports loosening of trade restrictions as evidenced by the considerable country participation in the newly established World Trade Organisation (WTO). In addition to benefiting consumers, the WTO aims to obtain a proper balance between protecting producers and allowing them the opportunity to profit from increased international trade. For agricultural producers and traders one of the most important associated agreements signed upon establishment of the WTO was the Sanitary and

The SPS states, among other things, that for trade purposes animal health measures established by countries to ensure the protection of human and animal life and health should be based on international standards, guidelines and recommendations developed under the auspices of the Office International des Epizooties (OIE). The OIE, the world organisation for animal health, was uniquely prepared to assume this role.

The OIE is the organisation of the official Veterinary Services of 144 countries. In the 72 years since its establishment, the organisation's three principal aims have remained unchanged: the provision of information on animal health worldwide, the coordination of research on and control of important animal diseases, and the harmonisation of the regulations for international trade in animals and animal products. The methods by which these aims are accomplished have, however, evolved and will continue to do so at an accelerated pace. It was mainly due to its work over the years in harmonising trade regulations that the OIE was designated as the WTO-SPS reference organisation for animal health. Food standards under the SPS are addressed by the joint FAO/WHO Codex Alimentarius Commission.

The OIE *International Animal Health Code* is a continuously updated volume containing internationally agreed import/export requirements for trade in animals and animal products. A companion volume, the *Manual of Standards for Diagnostic Tests and Vaccines*, is also regularly updated and contains the agreed scientific support information for those requirements. The *Manual* is in reality the main international harmonising text for the diagnosis of the most important transmissible animal diseases.

The procedure for updating these two volumes assures international scientific and regulatory consensus. An International Animal Health Code Commission, the members of which are chosen by the world's Veterinary Services, meets twice annually to propose amendments to the *Code* resulting from Member Country concerns and/or new information on the diseases. All Member Countries are asked to comment on or contribute to new or revised draft chapters regarding import and export requirements before these are adopted by the OIE.

In addition to chapters on important animal diseases, the *Code* also has sections on other subjects relevant to trade, such as disease reporting, certification, import/export procedures and import risk analysis. As with many subjects, the chapter on risk analysis is currently being updated and expanded. The SPS agreement recognises that sanitary requirements more stringent than those otherwise agreed to in the *Code* or *Manual* may be justified. An objective

its 101 chapters on diagnostic techniques and standards for vaccines for the most important livestock and poultry diseases are periodically revised in light of new scientific findings. Diagnostic tests for diseases are classified according to their degree of reliability for international trade. The *Manual* also contains internationally agreed chapters on subjects such as test validation and sampling methods, good laboratory practice, quality assurance and biotechnology.

A growing number of genuinely internationally validated diagnostic reference reagents for the most important animal diseases for trade are being made available by OIE Reference Laboratories and Collaborating Centres. For diseases important to Africa, the Collaborating Centre for ELISA and Molecular Techniques (FAO/IAEA, Austria) has been particularly active. Not only reagents but considerable support for their use are provided. The distribution of well-characterised and documented primary reference sera is expected to greatly increase confidence in trade between countries. The internationally designated experts of these Reference Laboratories are expected to be valuable resources for the OIE's role in supporting the WTO.

The lack of good quality veterinary drugs and vaccines in developing countries is a constraint to both livestock production and trade. Costs and quality both suffer because of inadequate or regionally variable criteria for their registration and control. At the request of Member Countries the OIE has held several international training courses and workshops in Africa with the aim of harmonising the control of vaccines and drugs used to prevent transmissible diseases. For their possible use African countries are also routinely informed of harmonisation progress among other regions.

Globally, FMD is the most important disease constraint to international animal and meat trade. In addition to insular FMD free Madagascar, some countries have FMD free zones which satisfy European requirements for beef importation. The FMD and Other Epizootics Commission has added a responsibility to its duties that will assist trade: a list of internationally recognised FMD-free countries and zones within countries has been initiated. To date three countries of southern Africa have taken advantage of this initiative, presumably with a view to expanding their markets between themselves and beyond Europe.

Another initiative aimed at harmonising trade criteria has been the establishment of internationally recommended standards for epidemiological surveillance systems for rinderpest and contagious bovine pleuropneumonia, with which countries follow time-bound steps to verify freedom from disease and infection for these two important diseases. Both of these diseases are recognised by OAU/IBAR and the Pan African Rinderpest Campaign (PARC) as priorities for continental action. The main promoters of the surveillance standards for rinderpest, known as the 'OIE pathway', were African countries, several of which are using them to transparently and objectively demonstrate their freedom from the disease to the world.

Several publications directly relevant to the trade in animals and their products are available not only to official Veterinary Services but to anyone with an interest in considering trade. Some of these are also immediately available through the OIE web site, such as weekly updates of the most important reported animal disease outbreaks, a worldwide resumé of the previous year's global animal health situation, a list of countries and zones within countries recognised as being free from FMD, and the *International Animal Health Code*. (www.oie.int).

Colleagues from the veterinary departments of other international organisations such as the FAO, IAEA, WHO and OAU/IBAR participate along with experts from Member Countries in the work of the OIE thus assuring that there are complementary efforts and that Veterinary Services fully participate in what is being done about animal health internationally.

Transmissible animal diseases are classified as OIE List A and B, the former list containing those that for trade and advising neighbours at risk should be immediately reported internationally. Developed countries are largely free of List A diseases through stringent prevention measures and eradication if they enter their territory. Uncontrollable borders characterise husbandry in a large part of Africa making regional coordination of disease control even more essential for success than elsewhere. OAU/IBAR, the programmes it coordinates, and technical and donor agencies involved in Africa recognise this.

The OIE Regional Commission for Africa reflects this as it addresses concerns of its 43 Member Countries on the Continent in coordination with those of the rest of the world through the International Committee. The organisation's long-standing efforts in scientifically harmonising trade criteria have recently intensified. With both a regional and global approach, the OIE, in cooperation with other international organisations, works to fully and transparently participate in facilitating trade while protecting animal and human health.

Policy Research for Livestock Development : Relevance, Approaches and Methods

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SUMMARY

These notes were prepared to stimulate discussion on this complex, albeit critical theme. They combine an insight on the ***ways and means*** used in policy research, with an outline of the ***planning sequence*** necessary to put in practice its findings, through concrete investments in institutional, human and infrastructural capital assets.

Policy research, whenever it is possible to carry it out, is an important if not critical component in the identification of policy options for new policies and/or the continuing adjustment of existing policies.

Suitable approaches, methodologies and tools exist for policy research in livestock development, but they must be adapted and improved for local use - this requires a local research capacity and international scientific cooperation may be effective in Policy research, whenever it is possible to carry it out, is an important component in the identification of policy options for new policies and/or the continuing adjustment developing this capacity.

International scientific partnerships bring additional dimensions and benefits to policy research: they provide enhanced focus on global aspects associated to the market for livestock products, to the sustainable management of natural resources and the prevention of desertification as well as the promotion of foreign direct investment.

Policy research, in addition to building up human capital levels which are critical to governance, promotes investment on institutional capital by: establishing linkages between scientists and decision-makers; and involving all relevant actors in society in a continuing and constructive dialogue about livestock development and sustainable economic growth.

Last but not least, policy research promotes investment into self-sustaining management information systems which are essential in the sound management of the livestock sector, in facilitating trade and in promoting investment.

What is policy research ?

1. The concept of policy research is not familiar to most people, including scientists. More often than not it is confused with political science and/or with politics. In both instances, the end result is the same: scientists and decision makers tend to shy away from anything that "smells" of politics, either because they feel that this will lead them to uncharted or dangerous waters or simply because their vision of the world does not include an

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objective awareness and consideration of the various policies that shape the socio-economic environment in which individuals and societies live and produce.

2. Policy research looks at policy options that have been adopted in the past, through legal or regulatory means, and to those that can be followed in the future. In this way, policy research does have a direct link with politics, to the extent that its results can be used by decision makers at all levels to direct and influence policies. Policies, once approved by the society concerned, provide individuals, their associations and companies with objective signals which tell them what can and what cannot be done (*regulatory function*) and, even more importantly so, which incentives and penalties are associated with certain courses of action (*stimulatory and repressive functions*).

3. It is these two latter functions - stimulatory and repressive - that constitute the prime target of policy research, since the regulatory function is normally taken care of by legal experts. The policy options identified and analysed by policy research should provide clear indications to decision makers about the likely consequences of pursuing this or that policy course, in terms of societal objectives such as economic growth, equitability, environmental sustainability, etc. Naturally one of these options is always "business-as-usual", i.e. a continuation of the prevailing situation. This no-change scenario represents, for all policy researchers, the baseline against which other policy options are compared and assessed in relation to their beneficial or detrimental effects.

4. In policy research this is a fairly generalized approach to assessing and projecting in time the likely consequences of *policy options* facing decision makers. Only by weighting the likely consequences, beneficial and detrimental, of their intended actions, can decision makers prepare the political and institutional ground for widespread popular support; and/or to mitigate the negative impact of policies on certain sections of society. Since few people have the ability to predict (divine) the future with any degree of certainty, scientific knowledge generated through policy research becomes an important if not critical part of decision making. However, it must be underlined that policy research does not replace decision making. Therefore, no confusion must be made between policy researchers and those that have to integrate the research results with intangible variables governing society (such as people's perceptions about their well-being, the future of their children, their ability to influence their society's destiny, etc), all of which pertain to the domain of *political judgement and action*.

5. Policy research must then use objective and if applicable quantitative methods of *measuring* past and ongoing events and trends, identifying the most important *descriptors of reality* and concocting the *algorithms* needed to integrate all these variables into a **coherent and meaningful ensemble**. The resulting *models*, once validated through the existing data and information, are used to build *future scenarios*, each based on a set of assumptions about what is likely to happen in several time horizons. While model building and the scenario simulation are activities in which scientists excel, the participation of decision makers in the identification of **relevant sets of assumptions** is irreplaceable. This is why, in policy research, it is critical to establish scientist-decision maker partnerships which capitalize on each other's competences and viewpoints.

And why do we need policy research in livestock development ?

6. Earlier on, an example was given of a concrete sectoral situation in which the introduction of a specific animal health policy, resulted in marked economic improvements for the cattle industry, reflected in higher production efficiency, higher quality and the corresponding access to higher priced markets. Other examples of sectoral issues that can and should be addressed through policy research are, *inter alia,* the choice of a carcass or milk grading schemes which brings into question immediately the type of production systems that will be promoted or discouraged; or the introduction of price support schemes differentiated according to quality; or policies aiming at the protection of public health; etc.

7. But livestock are not produced in isolation from a natural resource base and this implies that animals convert feed resources of a lower value into higher valued products. These feed resources are either in the form of pasture (including browse) or in the form of high energy/protein concentrates based on grains, tubers or industrial by-products. This means that feed is either produced on-farm (as is the case mostly with pastures) or purchased as with most concentrates. Policy decisions favouring or discouraging certain production systems will have consequences on the way natural resources are used, through changes in the level of investment and variable inputs determining land productivity (e.g. increases in stocking rate consequent to pasture improvement). Increasing the ecological footprint of a production system through the promotion of feed consumption produced elsewhere can have direct environmental consequences as well as indirect ones on pasture based system through demand and price linkages between different but partially competing livestock products. In addition, there are often for alternative uses for land currently used for grazing, e.g. cropping, forestry or wildlife production. For these reasons, livestock policies have necessarily a *crossectoral nature* provided by their intrinsic association with land resources and other agricultural activities.

8. Another major set of variables determines the shaping of livestock policies, namely those related to the socio-economic environment : examples of negative impacts of general policies in livestock development can be found in *monetary* questions (e.g. exchange rates that favour imports and/or penalize local production), in *fiscal* matters (e.g. taxes that overburden producers or vital links in the marketing channels), in relation to *credit* (e.g. high interest rates that discourage long-term capitalization at farm level or the purchase of key inputs such as vaccines), or *land tenure* (e.g. lack of investment in pastures, farm infrastructure, etc.).

9. But examples of positive impacts exist also and provide us with food for thought on the prime targets for our activities in policy research. When considering these examples and drawing inspiration for our own *individual and national policy environments* it is important to bear in mind two key aspects:

- Livestock producers are the ultimate target of policies affecting livestock development and they are neither an homogeneous group, nor a static one over time, requiring a perspective view of development as well as continuing fine tuning of policies; and,
- The socio-economic environment is in constant evolution, internally and internationally, affecting the objective conditions for success of livestock development policies.

How is policy research carried out ?

10. The basic tools of policy research are *models*. These models incorporate and interrelate the various types of *variables* which are relevant to our particular interests and use a *set of rules* to extract *results*. Once constructed, models depend on the availability of reliable data to operate. The quality of data is therefore of critical importance and determines to a large extent the quality of the information produced. Who hasn't heard of "GIGO" ?! (garbage-in-garbage-out). It is on the basis of information of the highest quality that knowledge about the potential consequences of alternative *policy options* can be achieved and later on used by decision-makers in *policy formulation*.

11. Model building is not a simple task, nor a mechanical one. Similarly it is not always possible to borrow models from abroad, given the large number of location specific variables and/or differences in their relative weight or importance. However, there exist a number of models which can be improved, adapted to local conditions or rendered more complex. This is neither the place nor the time to discuss the specificities which characterize different types of models, nor the corresponding modelling techniques. We leave it to the scientific community, in close cooperation with the decision makers. It suffices to say here that there are several *levels of aggregation* in model building, reflecting the level and sphere of responsibility of decision makers (e.g. livestock sector, land use planning, financial and monetary, etc.).

12. The choice of appropriate models depends on their capacity to adequately describe a given situation and, by assuming a certain set of rules about the future behaviour of society, project this situation in the future. This *predictive ability* of models depends upon their *validation* using real-life present or past situations. But whichever models are considered and selected for use, the responsibility for *scenario building* (i.e. the values to be assigned to the model's variables which, after processing result in a set of likely consequences) remains entirely with the partnership scientists/decision-makers. In other words, there is no room for independent action by either of these two groups of actors, each having its own specific and fully complementary competences.

How do you go about obtaining the data to operate your models ?

13. As pointed out earlier, there is no point in wasting our time using unreliable data. Quality collection depends on a tight association between the data collector and the user of the resulting information. In other words, data collection must be fully integrated with a *management information system*, underscoring the operation of a given public authority with responsibility say, for the livestock sector. Data which has been collected and validated, can then be safely stored using modern information technology and, even more importantly, can be aggregated at various levels and used by various users. In this way the *unicity and integrity* of data are fully reconciled with the *multiplicity of users*, promoting a high cost-effectiveness in terms of the costs of the logistics of data collection and a basis for long term monitoring of economic and environmental performance.

14. This critical role of information is not limited to sound policy analysis and formulation. A sound and updated information base is also a normal requirement in the *investment cycle* and even more so when investors are from the *private sector*. Moreover, international trade requirements increasingly demand information on the health status of livestock and

15. The second best solution to a well structured and functional information system is to carry out *surveys* to obtain the information required for policy research. This is often the possible solution, but should not be regarded as one that can be eternalized, on account of the magnitude of lost opportunities for development associated with a healthy and performing information environment. Surveys should be the complement of good information systems, providing the necessary detail and/or updating a specific part of the information. Several statistically reliable techniques exist to carry out these surveys, e.g. Rapid Rural Appraisal in relation to livestock farming, epidemiological surveys to estimate disease prevalence and incidence, consumer surveys to assess market preferences and potential demand in urban markets, product quality surveys during distribution, etc. Whenever surveys are carried out, the opportunity exists to plan for the introduction of durable and reliable information systems, as part of a pro-active drive to provide good information for policy research.

What is produced by policy research ?

16. From what was said earlier on, it must be clear by now that policy research can contribute significantly to configuring *future scenarios* for the evolution of the livestock sector, under certain well defined sets of assumptions. Since the future cannot be predicted, the least we can do is to assess presently the likely future consequences of our actions. The concrete outcomes of individual policy research activities are a direct consequence of the questions formulated and of the hypothesis being tested. Examples of these questions are given below.

Who should be responsible for carrying out policy research ?

17. Research should be carried out by qualified scientific researchers. But policy researchers cannot operate in isolation from the socio-economic reality of the livestock sector. If their results are to be meaningful and thus useful to society's development, the above mentioned questions and scientific hypothesis must be formulated after an in-depth consultation with all the relevant actors directly associated to livestock development, namely public authorities, farmers and their organizations, traders and agro-industrialists, and the financial sector. Similarly, these partners-in-research should be actively involved in data collection (laying the foundations for future information systems, if these do not exist already), in the definition of likely future scenarios and in the discussion of the research results.

18. The establishment of functional partnerships for policy research is the only guarantee that research results will be used in decision-making and that these results are appropriated by all those whose activity will be influenced by new or improved policies. This is why policy research projects as well as information systems must be conceptualized and designed bearing in mind the involvement and implications for all the main actors.

And Where do the results of Policy Research feed into ?

19. One immediate consequence is the *Broadening of Development Objectives Assigned to the Agricultural Sector* and specifically:

- Economic: economic growth, local market supply, export earnings;

- Environment: resource protection, resource conservation, biodiversity.

Why should we worry about what happens beyond the "livestock world" ?

20. The main reason is ***Declining Sector Performance*** and in particular:

- Agricultural output increasing at a rate below population growth;
- Per capita grain and protein supply declining;
- Natural resources being heavily over-exploited and degraded;
- Rural poverty spreading.

21. This declining sector performance is often the consequence of ***Discredited Policies and Institutions***, determined by:

- Excessive taxation of the sector via indirect and direct policy measures;
- Urban biais in development expenditures;
- Compensatory direct protection of inefficient food sectors in the name of national food self-sufficiency;
- Compensatory credit, infrastructure, marketing, and technical support that favoured the rural elite relative to smallholder family farms;
- Neglect of the development, adaptation, and dissemination of productive and sustainable technologies and of improved natural resource management practices and a lack of client orientation and farmer participation;
- Adverse land and agrarian policies that reduced the access of the poor to land and encouraged subsidy-dependant large-scale commercial, state, or collective farms;
- Lack of attention to the building of domestic institutional capacity;
- Poor institutional and policy frameworks for the intersectoral and intrasectoral allocation of water and for construction, management, and cost recovery in irrigation and other rural infrastructure;
- Excessive reliance on costly, inefficient, and highly centralized parastatal organisations for marketing, trade, credit, service delivery, management of water, forests, and range resources, and for the construction and maintenance of rural infrastructure.

Where are we now in relation to the EU-ACP Development Cooperation process?

22. Let us consider the procedures adopted in ***the Lomé IV Programming Exercise***:

Under Lomé IV, the Commission has further developed and formalized the programming process for individual ACP countries and regions with the usual five years' planning horizon. This process consists of two phases:

- the strategy discussions;
- the programming discussions.

Both stages move down to the sector level for those sectors chosen as focal sectors for Community support.

23. And also the corresponding ***Sector Approach***:

The sector-oriented approach, driven by government and jointly supported by donors, is seen as a double-pronged process which:

- takes systematically into account the sector policy and institutional framework including the links to the macro-economic level and adjacent sectors;
- defines and designs sector-wide investment programmes (covering both public investment and support to the private sector) based on analysis and strategies.

How do we implement sectoral activities consequent to this sectoral planning approach?

24. First we have to consider the move ***From Sector Objectives through Strategies to Investment Programmes*** :

- Overall development policy and strategy;
- Sector-specific objectives;
- Sector potential and policy framework;
- Basic options and sector policy;
- Sector strategy to meet sector objectives;
- Required measures and action plan;
- Sector investment programme.

25. Secondly, we must, in the context of our ***Sector Approach: Improving coherence and efficiency*** of our interventions

A more sector oriented and holistic approach to development co-operation would allow:

- to abandon piece-meal and contradictory approaches in favour of coherent, sector-wide development programmes;
- to adjust sector policies and institutions and to link more firmly the macro-economic environment with the sector-specific policy framework;
- to improve the coherence between policies and investments;
- to address constraints in parallel sectors affecting agriculture;
- to improve country-leader- and ownership in the development process;
- to provide transparency for increased donor confidence;
- to facilitate and enhance local capacity building and institutional reform;
- to ensure large participation of stakeholders;
- to concentrate more effectively on long-term development efforts (to increase impact and sustainability);
- to tackle more effectively primary development objectives through specifically targeted operations;
- to shift emphasis from monitoring means and inputs to monitoring performance and outputs;
- to increase options for alternative aid-delivery mechanisms (e.g. budgetary aid)

26. And last but not least, we have to consider the ***Institutional Reform Process***.

Policy Research for Livestock Development: relevance, approaches and methods

F.J. Tilak VIEGAS and Michael DALE

Policy Research for Livestock Development: relevance, approaches and methods

- What is a policy research ?
- And why do we need policy research in livestock development ?
- How is policy research carried out ?
- How do you go about obtaining the data to operate your models ?
- What is produced by policy research ?
- Who should be responsible for carrying out policy research ?

Policy Research for Livestock Development: relevance, approaches and methods

- And Where do the results of Policy Research feed into ?
- Where are we now in relation to the EU-ACP Development Cooperation process ?
- How do we implement sectoral activities consequent to this sectoral planning approach ?
- Why should we worry about what happens beyond the "livestock world" ?

Policy research

- Investigates Policy Options
- Studies the type and intensity of signals to be given to social and economic actors
- Provides for continuous adjustments in these signals based on societal response

Levels of Analysis

- Sectoral or sub-sectoral
- Resource base
- Socio-economic environment

Research tools

- Models
- Information Systems
- Scenario building

Data, information and knowledge

- Data quality, validation and integrity
- Unicity of data and multiplicity of users
- Links with the investment cycle and accessibility to a wide range of users

Partnerships for Policy Research

- Researchers and policy makers
- Researchers and the private sector
- North - South scientific cooperation

INTERACTION BETWEEN LIVESTOCK AND WILDLIFE IN SOUTHERN AND EASTERN AFRICA

G.R. Thomson[1]

INTRODUCTION

Sub-Saharan Africa is blessed with a larger number and diversity of free-living mammals than any other comparable land-mass. A consequence of this is an equally impressive array of micro- and macroparasites as well as arthropod vectors that have co-evolved with their indigenous hosts for millions of years so that, in most cases, these parasites have little ill effect on their natural hosts. This is not generally so for livestock that were introduced to sub-Saharan Africa much later and especially when it comes to breeds developed for increased productivity outside Africa and imported even more recently. The net result is that livestock farmers in many parts of Africa have to contend with a wider complex of animal diseases than in other parts of the world. Efficient animal health control is therefore more important as well as being more difficult to achieve in sub-Saharan Africa than elsewhere.

Rapidly expanding human populations in sub-Saharan Africa have encroached on established wildlife areas for years. The result is that in southern Africa at least, wildlife are now predominantly confined to marginal areas where the fluctuation in rainfall and tendency to drought render arable farming unprofitable unless irrigation is available and even extensive livestock production is problematic. In these areas it is increasingly apparent that ecotourism based on wildlife is potentially more profitable than livestock raising, the consequence being that more and more land-owners are deserting livestock production (Anon, 1994). This sometimes conflicts with the policies of developing countries which place a premium on agricultural and

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industrial development and has led to the criticism that wildlife is held in higher regard than people (The Herald, Harare; 22 April 1997). There is, furthermore, a trend for commercial farmers in these areas to pool their resources and to form large wildlife conservancies that can be more effectively managed so as to maximise sustainable profitability from ecotourism. These enterprises require a wide diversity of species and large populations that are easily visible which sometimes results in large-scale translocation of wildlife. This may be accompanied by the reintroduction of species that were previously eradicated such as is the situation with African buffalo in the traditional cattle ranching areas of south-eastern Zimbabwe or the introduction of exotic species. Buffalo were eradicated from farming areas in Zimbabwe because they harbour foot and mouth disease (FMD) viruses and threatened the export of beef to Europe. On the other hand, rural African populations in predominantly communal areas, whose cultures often place great store by cattle (Mostert, 1992), as well as some commercial cattle farmers, have been less enthusiastic in following the trend towards wildlife enterprises and believe that dangerous infections are maintained in the conservancies that threaten their livelihood. Some communities living in over populated areas adjacent to wildlife reserves even lay claim to grazing rights within these national or provincial parks which, if acceded to, would greatly complicate the control of diseases such as FMD and Corridor disease (*vide infra*).

A further development is plans of national or provincial wildlife departments in southern Africa together with international agencies (eg. the World Bank) and multinational companies for extending existing wildlife reserves, sometimes across borders, in order to produce super or transfrontier reserves (Gelderblom *et al.*, 1996; The Economist, May 3-9, 1997). These are now frequently referred to as Peace Parks. Should these come to fruition it will mean less land for expansion of arable and livestock farming as well as limiting settlement opportunities for the landless masses, whatever positive benefits such large reserves may portend. Therefore, while these developments are laudable from ecological and, possibly, financial perspectives, it remains to be seen whether they will be sufficiently beneficial to local inhabitants for them to support such programmes in the longer term as democracy develops in Africa. The entrenchment of wildlife over large areas of southern Africa has obvious benefits for preservation of ecosystems and promotion of tourism but will also mean that control of some important diseases will have to be applied along the extended borders of these parks.

The increasing demand for land in southern Africa, as well as conflicting ideas on how it should be distributed, make adaptability in land use essential. A constraint on this flexibility is statutory policies directed towards the control of potentially devastating animal diseases. These sometimes demand the wide separation of domestic livestock and wildlife and limit access of animals and animal products from wildlife areas and adjacent farmland to markets in metropolitan areas or foreign countries where the best prices prevail. There is therefore an urgent requirement for new and innovative animal disease control policies that limit land-use options as little as possible. Unfortunately, even when such alternatives become available they sometimes cannot be implemented because they conflict with norms adopted by importing countries or international animal health organizations that advise on import requirements. These norms have usually been formulated by technical specialists with European or North American orientations where such diseases either never occurred or have long since ceased to exist. Therefore presently accepted approaches are not necessarily well suited to controlling some disease s under African conditions. In sub-Saharan Africa there is thus a two-fold challenge - to develop disease control policies appropriate to evolving ecosystems that promote sustainability and, where possible, profitability and then to obtain international acceptance of these policies so that they do not interfere with international trade in animals and animal products and thus impede agricultural development.

CONSTRAINTS ON ANIMAL PRODUCTION THAT RESULT FROM INTERACTION BETWEEN WILDLIFE AND DOMESTIC LIVESTOCK

Currently accepted wisdom has it that livestock farming and ecotourism centred on wildlife are incompatible on the same land area because ecotourists find domestic stock and the associated paraphernalia (paddocks, dip tanks etc.) unacceptable in a "natural" environment (Anon, 1994). There are exceptions to this general rule and so-called Afro-tourism encompasses not only wildlife but also examples of traditional African society including raising of indigenous livestock. Since large capital investments in ecotourism based on wildlife in southern Africa are presently being made to provide affluent - frequently foreign - customers with authentic wildlife or big-game hunting experiences, the companies involved usually have no hesitation in getting

Zimbabwe have shown that wildlife businesses in general provides better return on investment as well as social benefits than does cattle farming (Jansen *et al.*, 1992; Anon, 1994). Game ranching, in which the product may be animals for resale, venison, hunting for the local market or merely fulfilment of personal ideology, does not preclude keeping livestock and game together and this is often done. Another option is the domestication of wildlife which has been tried fitfully over many years in eastern and southern Africa but has largely failed to develop a significant commercial following despite the cogent arguments in its favour (Kay, 1987). In the latter two situations direct interaction between livestock and wildlife has ecological implications quite apart from transmission of infectious diseases from wildlife to domestic stock and *vice versa*.

It has been recognized for many years that wild ungulates in sub-Saharan Africa consume a wider diversity of natural plant species than do domestic herbivores as well as different strata of the natural vegetation including woody plants. This does not make wildlife necessarily more productive than livestock but if appropriate mixes of wild herbivores and livestock are selected for the particular veld type and management objectives, increased production may be achieved (Davies, 1992; Pauw & Peel, 1993).

Veld degradation in sub-Saharan Africa is frequently exacerbated by overstocking, particularly where livestock are concerned although it has also been a problem on game farms. On commercial farms this is usually the result of attempts to maximize financial return at the expense of sustainability while in communal areas the value of cattle is partly cultural and cattle contribute to the social status of their owners. Thus sale of cattle from communal areas is limited and overpopulation with consequent overgrazing very common (Anon, 1993). The ecological effects of wildlife/ domestic stock interaction are therefore complex and dependent upon circumstances prevailing on the land in question. For this reason it is probably advisable to leave policy decisions in this area to the owners of such land subject to compliance with national and local regulations aimed at environmental protection and social development.

While there is a wide variety of diseases and parasites that are transmissible between wildlife and domestic stock (the most common are listed in Table 1), those that are usually transmitted from

wildlife to livestock have received most attention and are most feared because of the preoccupation with livestock diseases. However, there are a number of examples of situations where domestic livestock have transmitted diseases to wildlife with serious consequences such as tuberculosis which is now a major problem in buffalo in the Kruger National Park and the Hluhluwe/Umfolozi Complex in South Africa. In this instance the disease is difficult to control in wildlife and therefore wildlife now, paradoxically, pose a threat to the cattle from which the infection was originally derived. So it needs to be acknowledged that wildlife are often the victims of such events and not the cause.

Of the diseases included in Table 1, four have great epizootic potential, *viz.* foot and mouth disease (FMD), African swine fever (ASF), Newcastle disease (NCD) and rinderpest. By this is meant that they have the potential to spread rapidly across vast expanses of territory as well as country boundaries and wreck large-scale damage in livestock and wildlife populations over a short period of time. The others may all cause losses locally that may be serious for the owners or the communities involved but have not previously shown the same potential for causing devastating losses over large geographic areas. Control of diseases of limited epizootic potential is best addressed at the local level with the assistance of veterinarians and wildlife experts with detailed knowledge of such diversified problems. For infections capable of causing transboundary epizootics, however, control needs to be coordinated at both national and international levels because they have the potential to affect the lives of whole populations. As an example, the FMD outbreak in Taiwan in March 1997 has so far resulted in the slaughter of 3.8 million pigs and suspension of Taiwan's pork exports to Japan worth $ 2 billion annually. The outbreak is expected to reduce the projected growth-rate of Taiwan by between 0.5 and 2 percent in the current year (News Week, 7 April; A.I. Donaldson, personal communication). Control of these diseases should therefore be included in the considerations of land and agricultural policy makers. Another disease that has transboundary importance and therefore needs to be considered specifically in policy decisions relating to livestock development is trypanosomiasis. Although this disease does not have unusual epizootic potential in the classic sense, it has long been recognized as one requiring international cooperation for its effective control and is possibly the only disease with significant wildlife involvement that currently enjoys coordinated efforts aimed at its control in southern and eastern Africa.

Effective and co-ordinated control of the five diseases named above is vital for livestock development in eastern and southern Africa. However, in the case of NCD and rinderpest, although wildlife may help to sustain the infections, in most instances it is domestic stock that threaten wildlife and not *vice versa*. This perception has recently been brought into question with respect to rinderpest by the finding that this disease appears to have been prevalent in Kenyan wildlife, particularly buffalo, giraffe and lesser kudu, without obvious cattle involvement. A more definitive view on this issue will have to await the results of investigations currently in progress. FMD and ASF are the two diseases transmitted by wildlife to domestic stock that presently pose the greatest threat to livestock in southern Africa although their effects are very different. ASF is a highly lethal disease of pigs that makes commercial pork production almost impossible in a number of countries in sub-Saharan Africa while FMD, which is generally not a lethal disease, has important economic consequences (Thomson, 1995). These two diseases will be used to illustrate the unique problems they pose in southern Africa as well as potential solutions. The approaches to the control of these two diseases offered here differ significantly from those generally advocated and hopefully serve as examples of how home-grown policies can be developed that offer better long term prospects for managing important animal disease problems.

FOOT AND MOUTH DISEASE (FMD)

The development of livestock industries in sub-Saharan Africa has been inhibited for many years by FMD because countries in the industrialized world are disinclined to import agricultural products from countries where FMD is prevalent. This is unfortunate because much of southern Africa is unsuitable for arable farming and livestock production will therefore have to contribute significantly to agricultural development which in turn is vital for the economic wellbeing of the subcontinent. The disinclination to import animal products from sub-Saharan Africa is due to the potentially catastrophic consequences of re-introducing FMD to developed countries where it took many years and huge sums of money to eradicate. A trend likely to exacerbate the situation is the rapid rate at which other regions of the world where FMD was formerly enzootic are eradicating it, eg. the southern half of South America with its enormous livestock numbers. Thus

cheap meat that is clearly safe with respect FMD is becoming increasingly available. Therefore, the incentive for countries in the developed world to buy meat, particularly beef, from African countries where FMD occurs will decrease progressively because there is little prospect for the eradication of FMD from sub-Saharan Africa where the infection is maintained by wildlife. To counter this development control policies will have to be instituted that are accepted by potential importers, both international and regional, as being capable of ensuring that export products from African countries produced under such conditions pose negligible risk. Vaccines and immunization hold little prospect for solving this problem because importers, supported by the recommendations of the "Office International des Epizooties" (OIE), the official adviser to the World Trade Organization on animal disease matters affecting trade, are disinclined to accept products derived from animals that were vaccinated against FMD.

It has been shown indisputably that three of the 7 types of FMD virus, *viz.* SAT1, SAT2 and SAT3, are maintained by African buffalo in southern and eastern Africa and that, at least in southern Africa, buffalo transmit these infections to cattle, albeit only on rare occasions (Thomson, 1994). The mechanism whereby this occurs is uncertain. Consequently animal health authorities in southern Africa have developed relatively crude FMD control policies over many years that are based, among other things, on the separation of "infected" buffalo and cattle.

A significant development in the international control of FMD is that countries in which FMD is endemic are now (since May 1995) able to make application to the OIE for recognition of "FMD-free zones" within the country if specific conditions laid down by the OIE can be met by the country concerned.

The OIE presently accepts that any land on which buffalo infected with FMD viruses occur is likewise "infected". Up to May 1997 zones recognized as free of FMD by the OIE need to be separated from infected zones by a defined surveillance zone at least 10 km deep (International Animal Health Code of the OIE). This meant that any landowner who acquired even one infected buffalo placed his/her land in an infected zone in the eyes of the OIE and, by implication, neighbours in a surveillance zone. Since May 1997 the OIE has made it possible to dispense with the surveillance zone as long as the infected and free zones are separated by a

"barrier". In the context of southern Africa there is a proposal that double and electrified game fences be accepted as an effective barrier. This is presently a subject of debate and study.

A number of southern and eastern African countries export beef to the European Union (EU) under provisions of the Lomé Convention (Thomson, 1995). These exports are subject to control measures in the country of origin prescribed by the EU but, since these measures were instituted prior to the formulation of the present provisions of the OIE, they differ in some technical respects. Furthermore, individual countries in southern and eastern Africa usually have their own regulations that have evolved over some years and which sometimes differ from those of both the OIE and the EU. In South Africa, the devolution of agricultural affairs to the provincial level of government results in differences of approach within the country. All this obviously results in confusion on the part of land users as well as those whose responsibility is formulation of land and agricultural policies.

In the marginal areas of rural southern Africa where wildlife are mostly concentrated - these are predominantly areas in the border regions between countries of the subregion (Thomson, 1995) - there are four major types of land use, *viz.* large-scale commercial farming (mostly cattle ranching but also crops where irrigation is possible), small-scale commercial farming conducted by developing farmers, subsistence farming in communal or tribal areas and game ranching/ecotourism. The possession of buffalo greatly increases the profitability of ecotourism and game ranching, especially where hunting is involved (Anon, 1994). Game conservancies and ranches therefore set great store by the possession of buffalo which is reflected in the price these animals fetch at game sales and, in South Africa, especially if they are free of FMD (currently about $[US] 17 000 per head). For the other three types of land user, the presence of buffalo in the vicinity interferes with the marketability of their livestock and livestock products. This is because buffalo infected with FMD viruses in or adjacent to livestock areas almost always results in actions by the state aimed at the control of FMD. Hence there are sometimes conflicting attitudes with respect to the presence of buffalo in particular areas and it is difficult to reconcile the demands made by different land users. In South Africa the price differential (about 10-fold) between so-called "infected" and "disease-free" (free of FMD and *Theileria parva lawrencei*

infection) buffalo is cause for concern because this inevitably leads to the temptation for unscrupulous owners to pass their animals off as "disease-free" when they are not. The consequences of this are potentially devastating for the country. It is thus necessary to attempt to find ways in which large numbers of buffalo can be freed of FMD infection or, alternatively, that an effective way be found by which buffalo infected with FMD viruses and *Theileria parva lawrencei* can be prevented from infecting livestock on adjacent properties.

Condy & Hedger (1978) working in Zimbabwe showed that buffalo calves removed from their mothers at an early age and raised in isolation can be prevented from becoming infected. However, this is logistically complicated, expensive and difficult to conduct on a large scale. These young animals also suffer the disadvantage of not growing up in a natural herd. An experiment in which it was attempted to prevent buffalo calves becoming infected by immunizing them at an early age, ie. in the face of maternally-derived antibody, with vaccine containing high antigen payload and an oil adjuvant, failed because the controls did not become infected (Hunter *et al.*, unpublished data). Therefore the potential of this approach remains uncertain.

In Zimbabwe a relatively simple but practical approach is being tried which so far has involved isolating three large game conservancies in the south-eastern part of the country, the largest of which is about 320 000 ha in extent, using double game-proof fences (Anon, 1994). The two fences are separated by a defoliated strip about 7.5 m in width. Domestic stock are excluded from conservancies but are present on adjacent land. In some places the cattle immediately outside the conservancy have not been vaccinated against FMD. The rationale behind the idea is that FMD virus in Africa is not usually transmitted by air currents as has shown to be the case on rare occasions in Europe (Fogedby *et al.*, 1960; Donaldson, 1979). Reasons as to why air-borne transmission of FMD apparently does not occur in southern Africa have been explained elsewhere (Thomson, 1994; 1995). Essentially they are the warm dry climate, very small numbers of domestic pigs in the FMD endemic areas and low stocking rates. In order to evaluate the risk posed by this new and innovative approach a risk analysis has been conducted and will be published in due course (Sutmoller *et al.*, in preparation). This shows that the risk of FMD spreading from the conservancies to livestock on adjacent properties is extremely small

irrespective of whether the animals are vaccinated or not. This appraoch is in line with the most recent amendments to the FMD chapter of the International Animal Health Code of the OIE.

A more general constraint on establishing effective counters to the various problems posed by FMD in sub-Saharan Africa is the poor coordination of efforts in the various ecoregions. In other parts of the world where FMD has serious trade implications such as Europe, South America and South-East Asia, special FMD commissions supported by the countries of the region as well as international animal health organizations have been established. They coordinate policies, facilitate resolution of border problems, take responsibility for information distribution and training, establish standards for vaccines as well as independent testing thereof and co-ordinate research. A further important activity of such commissions is to ensure that farmers in general and livestock producers in particular realise that FMD control is of direct benefit to themselves and that they are actively involved in control actions. In southern and eastern Africa, despite the unique problems that countries in this region have in controlling FMD (Thomson, 1995) and the limited availability of expertise, suitable facilities and resources, there is little collaboration between countries in this respect and there is therefore a strong case for the establishment of such a FMD commission or commissions within these two ecoregions.

AFRICAN SWINE FEVER (ASF)

Because ASF is highly contagious and one of the most lethal infections that affect mammals(**insert**), its effects are dramatic when introduced into domestic pig populations, while the lack of even the prospect of an effective vaccine renders its control difficult. These attributes allied to the increasing number of countries in sub-Saharan Africa that are afflicted by it, makes ASF one of the most challenging animal disease problems facing the continent today. Countries in eastern and southern Africa that are currently troubled by this disease include Mozambique, Malawi, Angola, Kenya and Uganda.

In its sylvatic state ASF virus is maintained cryptically in an arbovirus cycle; the invertebrate host being argasid ticks of the genus *Ornithodoros* and wild suids, particularly warthogs, provide

the vertebrate hosts (Plowright *et al.*, 1994). However, once the virus infects domestic pigs it is able to persist in pigs without the agency of the free-living hosts. This was shown dramatically by the escape of the virus from Africa to the Iberian Peninsula in the 1950's and 60's and its subsequent spread to other European countries, Brazil and the Caribbean. By dint of strict zoosanitary measures the disease was subsequently eradicated from the affected countries with the exception of the island of Sardinia.

In Africa, control of the disease has generally been less successful, not only because free-living hosts complicate control but also because the infrastructure and resources available for effective control are inadequate. Another important aspect is that most pigs in Africa are free ranging. This means that most African countries and communities that have pork as an important part of their diet are helpless in the face of the disease. Perhaps more important is the negative effect the disease has on the prospects for feeding the rapidly growing population of Africa. For provision of animal protein, increasing reliance is being placed on expanding production by animals with rapid population turnover and growth such as poultry and pigs. ASF is clearly a problem in this respect.

The proven success of zoosanitary measures (movement control, quarantine of infected farms, slaughter-out in the face of disease outbreaks, destruction of carcasses derived from diseased animals etc.) for the control of ASF outside Africa has led to this approach being advocated by aid agencies in a number of African countries afflicted by ASF. That the animal health departments in those countries do not have the infrastructure, political authority, trained personnel or a law abiding rural population with which to implement these measures is usually insufficiently recognized. The net result is that, at most, little success is achieved by these aid programmes which leads to dissatisfaction on both sides. The failure of these programmes is usually assumed to be due to poor execution rather than considering the possibility that the measures instituted were themselves inappropriate. For example, an established practice, doubtless borne of necessity, that makes disease control difficult in many parts of Africa is the utilization for human consumption of food animals that are ill or have died and there is little point in trying to dissuade people desperately short of protein from doing this. As a further example of ill-suited approaches, almost all the research into ASF control conducted in

developed countries with the objective of aiding developing countries has concentrated on attempts to produce an effective vaccine despite the fact that this approach has yielded nothing positive in the last 30-40 years. On the other hand, despite there being evidence for resistance to ASF in wild African suids as well as domestic pigs that have been raised over many years in enzootic localities in Africa, the possibility of developing resistant animals in order to control the disease has not been seriously considered. Resistant animals would be far more effective in minimizing the effects of ASF in rural communities than vaccines because the expensive and difficult exercises of vaccine production, transport and administration would be obviated. It is proposed that an attempt to produce resistant pigs for subsistence and small-scale farmers is something that could be fruitfully pursued by a consortium of African countries since the potential benefits to Africa are enormous. It is furthermore essential for the establishment of pork as a reliable source of animal protein in sub-Saharan Africa that pig farmers be encouraged to move away from free-range systems of management because only then can effective zoosanitary measures be implemented for ASF control. That too will require innovation because such policies will only be implementable if small-scale producers are provided with ways of feeding penned pigs cheaply and conveniently.

The above is a personal view of how some fundamental problems arising from wildlife/domestic livestock interaction could be addressed. However, further development followed by effective implementation of these or alternative strategies is required if the supply of adequate protein to Africa's ever growing population is to be achieved. A commitment to action in this regard is probably our greatest current deficiency.

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Disease	Causative agent	Direct transmission (D), arthropod-borne (A) or metazoan parasite (P)	Maintenance hosts	Domestic animals affected	Usual direction of spread[3]	Epizootic Potential (1-3)[4]
Trypanosomiasis	*Trypanosoma* spp.	A (*Glossina* spp. flies)	Elephants, African buffalo, kudu, warthogs, bushbuck & other artiodactylids	Cattle, horses, pigs sheep & goats	1, possibly 2	2
Foot and mouth disease	Aphthovirus	D	African buffaloes & cattle	Cattle, pigs, sheep & goats	1 & 2	1
African swine fever	African swine fever virus	A (*Ornithodoros* spp. ticks)	Warthogs & domestic pigs	Pigs	1	1
Theileriosis (Corridor disease)	*Theileria parva lawrencei*	A (*Rhipicephalus* spp. ticks)	African buffaloes	Cattle	1	2

[2] - the order in which these diseases are listed accords with the author's subjective assessment of their relative importance

[3] - 1 - wildlife to domestic stock
2 - domestic stock to wildlife

[4] - 1 - great potential
2 - moderate potential
3 - little or no potential

Disease	Causative agent	Direct transmission (D), arthropod-borne (A) or metazoan parasite (P)	Maintenance hosts	Domestic animals affected	Usual direction of spread	Epizootic potential (1-3)
est	Rinderpest virus	D	African buffaloes, kudu & giraffe	Cattle	Usually 2	1
	Lyssavirus serotype 1	D	Dogs, jackals, bat-eared foxes & yellow mongooses	All domestic animals	1 & 2	2
ılosis	*Mycobacterium bovis*	D	Cattle & African buffaloes	Cattle	Usually 2	2
ıle disease	Newcastle disease virus	D	Domestic poultry	Poultry & ostriches	2	1
ımt catarrhal fever	Alcelaphine herpesvirus 1	D?	Blue & black wildebeest	Cattle	1	3
festation	Members of the Ixodidae (hard-shelled ticks)	P	Many	All	1 & 2	3
skin disease	Lumpy skin disease virus	Uncertain	Uncertain	Cattle	2	2
ıthiasis	Intestinal helminths	P	Domestic ruminants & various antelope spp. including blesbok & impala	Sheep & goats	1 & 2	3
ater	*Cowdria ruminantium*	A (*Amblyomma* spp. ticks)	Uncertain	Cattle, sheep and goats	1 & 2	2
ı horsesickness	African horse-sickness virus	A (*Culicoides* spp. midges)	Zebra	Horses	1	2

Disease	Causative agent	Direct transmission (D), arthropod-borne (A) or metazoan parasite (P)	Maintenance hosts	Domestic animals affected	Usual direction of spread	Epizootic potential (1-3)
gue	Bluetongue virus	A (*Culicoides* spp. midges)	Various artiodactylids	Sheep	1	2
osis	*Brucella abortus*	D	Cattle, African buffalo & hippopotamus	Cattle	Usually 2	2
vascular myiasis	*Gedoelstia* & *Oestrus* spp.	P	Members of the Alcelaphinae	Cattle & sheep	1	3
iosis	*Besnoitia besnoitia*	D?	Unknown	Cattle	1	3

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MANAGEMENT IN POLICY-MAKING AND IMPLEMENTATION

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SUMMARY

For the purpose of this paper we define policy as *"the framework within which strategies for livestock development are devised"*. A "good" livestock policy should be consistent with other sectoral policies and provide a coherent framework for development. It should take into account the national resource base in defining the impact it is to have. However, all policies are influenced by the macro-economy, the political environment and international factors. Where the objectives of different policies conflict, compromise is necessary. Stakeholders at all levels should participate in formulating policy to identify their resources and constraints, linkages and potential conflicts, as well as their policies and expectations. Policy is implemented by applying appropriate strategies.

Each strategy's purpose, outputs and activities have to be defined to ensure the optimal use of available resources to achieve specific outputs. In this connection, the logical framework planning matrix is a useful tool and the strategy should be based on a thorough analysis of institutional, environmental, sociological, technical and economic forces.

The process of formulating policy and devising strategies is dynamic and iterative; they have to be reviewed to ensure that they remain relevant. Their development and revision depends on the timely availability of reliable data on a wide range of subjects. In collecting data, it is necessary to determine the objectives of data collection, the types of data to be collected, and the costs of collection. Rapid appraisal, low cost techniques should be used whenever feasible. Examples of such methods include aerial surveys of cattle densities; single interview, multiple topic socio-economic surveys; and epidemiological surveys. Data should be collected and managed to cater for the needs of the widest possible range of users. In countries where appropriate analytical skills are lacking, short, skills-oriented training courses should be provided.

Information sharing through, for example, a network, reduces duplication of effort and costs. Networking also increases the critical evaluation of data which improves reliability. The flow of information is not one-way. Feedback is imperative. Data collection and information management are an integral part of the feedback mechanism needed to continuously refine policy and strategy to ensure that the desired impact is being achieved.

The term policy is often loosely used; many people confuse it with politician. A dictionary definition of policy is: *a plan of action adopted or pursued by an individual, government, party or business; wisdom, shrewdness or sagacity.* As this definition implies, policies are devised and applied at all levels of society by a spectrum of people and organizations. For the purpose of our discussion related to national livestock policy, we define policy to be *"the framework within which strategies for livestock development are devised"*; we consider step by step the main building blocks related to policy-making, strategy formulation and implementation, and the need for adequate information at all stages.

Policy

It would be comforting to believe that policies are the products of logical thought and careful analysis but this is not always the case. The policies of different sectors should, ideally, form a coherent, consistent and visionary framework. Each policy should support, and be supported by, other policies but there is almost always conflict between some of their objectives which necessitates compromise. This indicates the need for good communication at the interministerial level but, in reality, this may be undermined by personal ambitions and agendas.

All policies are influenced by the macro-economy, the political environment, and international factors. More specifically, livestock policy is affected by other policies related to:

- Agriculture
- Environment and natural resource management (including wildlife)
- Land tenure
- Marketing and trade
- Transport
- Human resource development and institutional capacity building
- Public health and food processing
- Regional co-operation (or lack of it!)

It is useful to define the main properties that characterize a "good" livestock policy. We believe that a good policy for agriculture (of which livestock is a sub-sector) will be

economic development by providing opportunities and indicating ways of overcoming constraints. It will, therefore, address major issues, including equity considerations (income distribution between communities, men and women, access to grazing resources, markets and infrastructure), environmental sustainability (for example, overgrazing and overstocking), sustainability of interventions and resources (budgetary and human resources), sustainability (e.g. cost recovery and service provision through the private sector), economic growth (production, trade and income) and stability (markets, incomes and the environment). The policy should recognize the importance of these considerations at both the macro- and micro-levels. Above all, policy should take into account the national resource base in defining the impact it is expected to have.

In formulating policy, it is important to obtain the participation of stakeholders at all levels to answer questions such as:

- *what are their resources/constraints?* (needs)
- *how do the different groups and subsectors interact?* (linkages)
- *what are the potential conflicts?*
- *what are their own policies and expectations?*

Answers to these questions help to answer the key question at the policy level "W*hat impact, or impacts, should implementation of the policy achieve?*"

Policy is usually a political statement that is expressed in broad terms, equivalent to the terminology of the goal level of the logical framework planning matrix: it focuses on achieving broad impact. Thus, policy is a relatively fixed, or given, fact although, of course, it should be subject to analysis and review. Policy is implemented through appropriate strategies which aim to achieve some or all of the stated impacts.

Strategies

Strategies are planned to co-ordinate activities that are implemented by using optimally the resources available, in order to achieve specific results, or outputs. At the level of strategy, another series of questions has to be answered.

realizing the goal or policy?)

- *What results (or outputs) will fulfil the purpose?*
- *How will the results be achieved?* (what activities have to be undertaken?)
- *Where will activities take place?*
- *When will they be undertaken?*
- *Who will do them?* (what are the roles of public and private sectors, their skills base and organizational structure?)
- *What impact will the activities have?* (what are the benefits and costs associated with the strategy?)
- *What resources will be used?*

In this connection, the logical framework planning matrix is a useful tool. It follows that while different stakeholders may adopt different strategies to implement a policy, implementation may be sequential or concurrent, depending on the availability of resources. Strategies to support sustainable livestock development and production should take into account numerous factors (Table 1). They should, therefore, be based on a thorough analysis of institutional, environmental, sociological, technical and economic forces (Fig. 1).

Almost inevitably, conflicts arise. It may not be easy to resolve them but they should be identified and recognized. A systems approach which identifies linkages as well as conflicts is required, although this is rarely practised. Additionally, competition for resources between different strategic activities should be identified.

A good strategy will:

- contribute significantly to the policy "goal". (This requires unequivocal statements of policy and strategy with clearly defined linkages.)
- take into consideration existing or potential conflicts between policies of other sectors and sub-sectors. (For example: agricultural/crop expansion *vs* environmental stability [national parks]; crop expansion *vs* grazing resource availability; grazing area expansion resulting from tsetse control *vs* wildlife populations.)

implementation of the different components and activities of the strategy.

- be based on a realistic assessment of the resources available nationally and within the sector.
- identify the linkages between factors within (internal/endogenous) and outside (external/exogenous) the individual systems which impact on strategy, e.g. the farming system (Fig 2).
- be based on an adequate, reliable information about the sector and other related sectors.
- encourage the participation of stakeholders and beneficiaries (through organizations and associations).
- make adequate provision for evaluation of the impact achieved as a result of its implementation.

Unfortunately, many livestock development policies and strategies:

- lack clear definition.
- fail to recognize conflicts.
- fail to prioritize and optimize the use of resources (overambitious aim).
- fail to specify linkages (indicated in Fig. 2).
- are based on inadequate information.
- do not secure adequate levels of participation from beneficiaries at the formulation stage. (Participation can be achieved through representatives of institutions and associations; where associations do not exist, their formation can be promoted as part of an appropriate strategy.)

The process of formulating policy and devising strategies is dynamic and iterative. Policies and strategies have to be reviewed and, in a global environment of increasingly rapid change, feedback mechanisms to evaluate their impact must be established (Fig. 1) to ensure that they remain relevant. The development and review of strategies depends on the availability of reliable data on a wide range of subjects. These data may be available as secondary data or may have to be collected.

Data are needed, in the first instance, to enable policies and strategies to be formulated but, subsequently, they are needed to analyze the impact of the strategy and, by implication, that of the policy. The reliability of data is of paramount importance to formulating policy and strategy and this needs to be determined.

In deciding on the method(s) to be used to collect data, several questions have to be answered.

- *What are the objectives of collecting the data?*
- *Which types of data are needed and why are they needed?*
- *Does the information required already exist?*
- *What quality of data is required?*
- *How long will it take to collect the data?*
- *At what cost will they be obtained?*

Data collection is not an end in itself and the specific requirements of the end users should be defined at the outset. Collection should, therefore, be carefully planned and directed towards clearly defined objectives; one set of data maybe used at various levels (Fig. 1). Collecting data is costly and time-consuming and data should be of a consistent and reliable quality. Collection should be selective and should be done in the most effective and cost efficient manner, and only relevant data should be collected. A lot of time has been wasted in collecting data which have not been analyzed. Furthermore, many sets of data are often incompatible and cannot be analyzed in a comparative manner. Consequently, before data collection starts recording formats should be designed to provide compatible data sets. We have adopted this approach in the Regional Tsetse and Trypanosomosis Control Programme and are establishing compatible databases in four countries of southern Africa. Rapid appraisal, low cost techniques of data collection should be used whenever feasible. Examples of such methods include aerial surveys of cattle densities; single interview, multiple topic socio-economic surveys; and epidemiological surveys.

Types of data

A wide range of data types is required (Table 2). Having collected data from various sources, they have to be managed properly and then analyzed to provide appropriate

and strategy.

Information management

The management of information encompasses data collection, entry, storage, retrieval, analysis, presentation and reporting. Essentially, data contribute to three categories of information.

- *Knowledge base* (e.g. reports and texts)
- *Resource database* (e.g. inventories)
- *Geo-referenced databases* (e.g. climate, resources, populations, diseases and practices)

Computerization has facilitated the management of data and provided powerful analytical tools. Recent developments have established compatibility between databases, each of which should be a reliable source and should be useable at different levels of resolution by people with different requirements. Data should, therefore, be collected and managed to cater for the needs of the widest possible range of users. In many countries the capacities to synthesize, collate and analyze data are poorly developed. This constraint should be recognized at the outset and measures should be taken to address the problem (such as delivering short, skills-oriented training courses).

Information dissemination and feedback

Decisions have to be made at the outset of data collection about:

- *what information will be disseminated?*
- *to whom it will be disseminated?*
- *how it will be disseminated?* (e.g. networking)
- *how it will be used?* (e.g. planning, monitoring, evaluation and feedback)

Ideally, there should be a commitment to sharing information so that as many users as possible have access to what they need. However, obtaining information is costly and the subject of sharing information is complex and, often, controversial. A network enables information to be shared which reduces duplication of effort and costs. It is important,

they have access.

Simple ways of validating and cross-checking the data in various databases have to be established. The use of networking, especially through training and research programmes, promotes the exchange of information and increases the critical evaluation of data collected. Information is being marketed and it is important to establish confidence in the validity of the sources of data and methods of collection and analysis. At the higher level, the main interest may be to identify deficit areas and obtain an early warning of the effects of drought or the spread of vector-borne diseases. Although this approach has been established in the case of crops, it may not be appropriate for livestock because of the delayed response of livestock to changing conditions.

The flow of information is not one-way. Information is needed not only to formulate policies and strategies but also to evaluate them. Monitoring implementation and evaluating the impact of interventions generates data which should provide feedback. Policies and strategies may then be refined to meet changing conditions and achieve greater relevance and impact. Producers should not be overlooked. They may not be literate but they need information on recommended practices, sources and costs of inputs, markets and prices, and availability of training (acquisition of skills).

Conclusion

The formulation of policy and development of strategies is dependent upon the timely availability of reliable information, as is the monitoring of implementation. The impact of each intervention has to be evaluated to ensure that objectives were achieved and that the outcome is acceptable. Both policy and strategy are influenced by numerous external factors (preconditions and assumptions) and these also have to be monitored to ensure that the interventions retain relevance and that they have the intended impact. Data collection and information management are, therefore, an integral part of the feedback mechanism needed to refine policy and strategy.

Data collection and information management play a critical role in the formulation, implementation and evaluation of policies and strategies.

Table 1

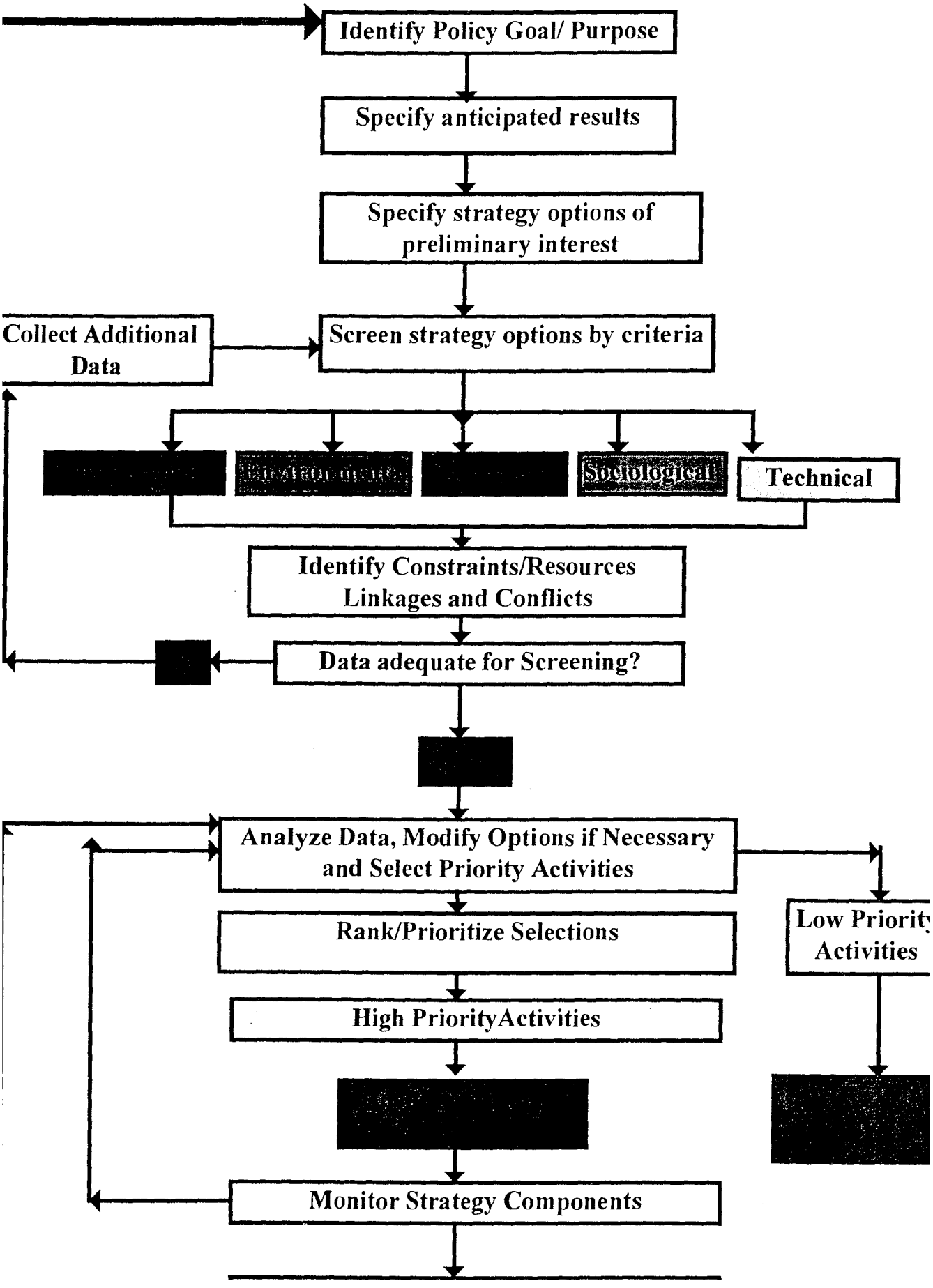
Outline of major factors to be considered in developing strategies in the livestock sector

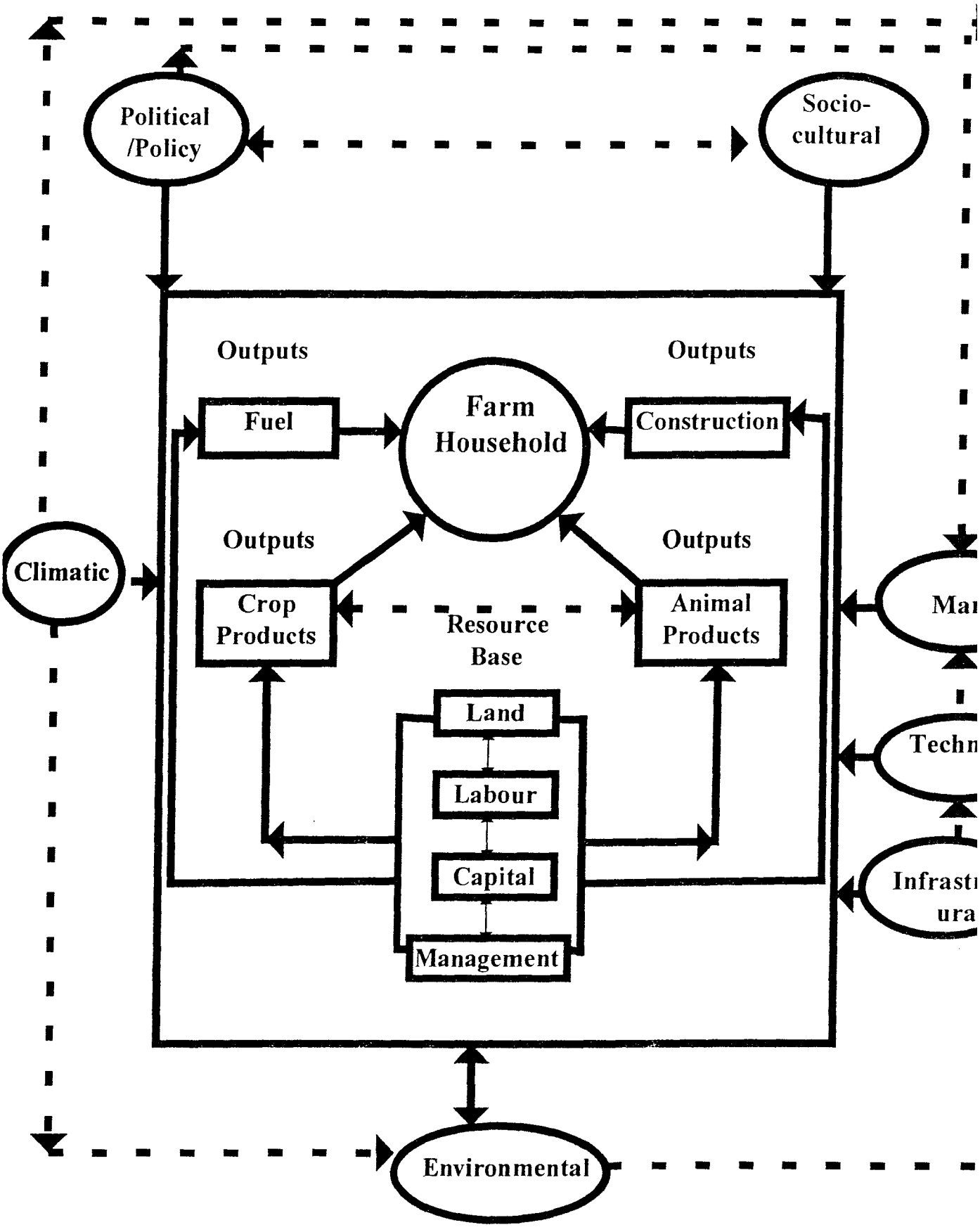
Category	Examples of factors
Resources and constraints	• government and private sector capital • human capacity • livestock numbers • existing and proposed infrastructure • land in different farming systems • grazing resources
Conflicts foreseen	between • different desired results (outputs) • different related policies • different stakeholders (individual *vs* national aspirations)
Linkages/relationships	between • herd growth and environmental sustainability • offtake and price "policies" • growth and equity (who benefits from interventions?) • land tenure and overstocking • environmental sustainability and degradation • disease interventions and enzootic stability • animal health interventions and environmental sustainability • short- and long-term sector objectives

Table 2

Types of data needed to formulate and evaluate strategies in the livestock sector

Category	Type of data
Institutional data	• Organizational structure of formal (government) and non-government (traditional and private sector) institutions • Budgetary and human resource capacities and skills • Land tenure regulations
Infrastructural data	• Market facilities • Research facilities • Animal health facilities • Rural facilities • Roads and communications
Ago-economic data	• Climatic data • Soils • Land use data • Livestock population (species, census, structure and distributio • Output levels • Animal diseases - epidemiology, control measures applied • Pests • Nutrition • Input levels (availability and prices) • Prices (costs of production, trends and trade figures) • Marketing: outlets and constraints • Human population (census, structure and distribution) • Livestock ownership • Household incomes and sources • Educational status • Carrying capacities/stocking rates
Socio-cultural data	• Baseline data about communities • Perceptions and priorities
Farming systems and environmental data	• Land type, tenure system, administration, use • Farming systems and size • Natural resource inventory and capability/potential • Environmental degradation


Identify Policy Goal/ Purpose
Specify anticipated results
Specify strategy options of preliminary interest
Collect Additional Data
Screen strategy options by criteria
Sociological
Technical
Identify Constraints/Resources Linkages and Conflicts
Data adequate for Screening?
Analyze Data, Modify Options if Necessary and Select Priority Activities
Rank/Prioritize Selections
Low Priority Activities
High PriorityActivities
Monitor Strategy Components


Political /Policy
Socio-cultural
Outputs
Outputs
Fuel
Farm Household
Construction
Outputs
Outputs
Climatic
Crop Products
Resource Base
Animal Products
Land
Labour
Capital
Management
Environmental

The conservation of indigenous animal genetic resources: constraints, future outlook and policy requirements

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Introduction

Domestication of farm animal species initiated some 12,000 years ago when people began maintaining animals for work power, food, fibre, and other agricultural uses. Goats, then sheep, were the first species to be domesticated, followed by cattle and pigs, completed about 4 000 years later. Horses followed about 6 400 years ago, in central Eurasia. Chickens were domesticated about 5 000 years ago in south-east Asia and buffalo 1 000 years later in India and south west Asia. Today about 40 mammalian and avian species have been domesticated and are all important for food and agriculture. Common species include sheep, goats, cattle, horses, pigs, buffalo, chickens and ducks, and further species such as yaks, camels, donkeys, elephants, reindeer, rabbits, turkeys and rodents have also been domesticated or are in the process of domestication. However, the majority of the world's livestock production of food and agriculture is derived from 14 species which comprise some 5 000 breeds.

Approximately 1.96 billion people, 40 per cent of the world population, depend on livestock directly to meet part or all of their daily needs. An estimated 12 per cent of all people depend almost entirely on products obtained from ruminant livestock - cattle, yaks, sheep and goats. Livestock process forage and crop residues which are inedible to humans, into nutritionally important food products. Approximately 40 per cent of the total land available in developing countries can be used only for some form of livestock forage production. Animals account for 19 per cent of the world's food directly. They also provide draught power and fertilizer for crop production, bringing their overall contribution up to 25 per cent, and thus are essential components in achieving sustainable food security. In addition, livestock serves as a very important cash reserve in many of the mixed farming and pastoral systems, thereby providing an important form of risk reduction. In total, animals meet an estimated 30 per cent of the value of human requirements for food and agriculture.

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Development of domestic animal diversity

Since the start of domestication the farm animal species have been subjected to a range c selection pressures. The great diversity of production environments, or agro-ecosystems, i which animals have evolved has resulted in a wide variety of well adapted species, enablin humans to now utilize this broad range of environments for food and agriculture productio: Some species are better suited to the high altitudes, such as the yak and llama, while other such as camels, have adapted to arid desert conditions. In addition to this important diversit between species, there are distinctive differences among breeds within species which wer formed as humans took samples of species to new production environments. These sample became different breeds as they slowly adapted to the new production environment and t changing habits of the new local human community. Hair sheep show high ability to produc milk and meat in tropical environments, while wool sheep are found mainly in temperate zone: In cattle the *bos indicus* breeds are better adapted to hot and humid climates, while the *bo taurus* breeds show high milk production and growth rates under temperate conditions. Som *bos taurus* breeds have developed tolerance to Trypanosomosis and are established in Wes Africa. This differentiation of animal species into unique breed gene pools has been possibl because of the nature of genetic variation, genetic differences between individual animal permitting the development of new breeds as some animals in each generation leave mor progeny in the next and as the sampling processes operate in gene segregation and gamete an embryo formation. Cunningham (1992) considers that the domestication processes and th subsequent human directed selection, where breeds have been further developed for differen production traits and for a different and large array of products to meet needs of particula human communities and satisfy market demands, have not only greatly enlarged the genepoc of each species, but also greatly increased the genetic diversity contained in it. Hall and Ruan (1993) considered that in the Old World the number of breeds are correlated with huma population and land area, implying that in the past conditions favouring growth in huma population also favoured the diversification of breeds. The same authors state that periphera and remote countries have the highest ratio of breeds per million people, implying tha remoteness can also promote diversification (see also Darwin. 1864).

The development of this broad range of species and the variety of breeds with very differen characteristics have resulted in a domestic animal gene pool of great diversity. Genetic diversity is the variation found between species, between breeds within species, and betwee animals within breeds. It is these Animal Genetic Resources (AnGR) that we seek to manag better to achieve food security in both the short and longer term. AnGR will then include al species, breeds and strains that are of economic, scientific and cultural interest to agriculture now and in the future. However, to introduce sound AnGR management concepts we hav elected to deal with the breed[1] level of diversity within each important species. Of course in th wise use of breeds we are also catering for the within breed, between animal diversity.

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[1] Breed: A rigorous technical definition of this term is not possible for within a species there is expected to be a genetic continuum, with the only developed reproductive isolation being that imposed by geography and human activity. To also harmonize with the Convention on Biological Diversity providing for national sovereignty of genetic resources, breed is accepted by FAO as a cultural rather than a technical term, i.e. to emphasize ownership. Further, it is used collectively to encompass varieties, strains, research lines and landraces. In some developing regions population clines of a farm animal species exist within and across countries and phenotypic delineation based on observable characteristics becomes more difficult. Hence, the country and the local communities decide whether a particular population deserves unique recognition, based upon their cultural perspective. The Global Strategy

Rege (1996) reviewed the indigenous domestic ruminant genetic resources for Africa, estimating that at least 150, 125, 90 and 40 'breeds' or strains of cattle, sheep, goats and dromedary camels are present in Africa, representing 18, 15, 28 and 80 percent respectively of the global total for the four species. The results of a global survey by FAO, based on a questionnaire which was sent to all countries, provided the basic information for the breeds databank in the Domestic Animal Diversity Information System (DAD-IS 1996), and for the second edition of the World Watch List for Domestic Animal Diversity (WWL-DAD2). The results for Africa are summarized in Table 1. According to these figures, and surprisingly, only 8.3 percent of the mammalian breeds of Africa are at risk, the number of breeding males and females having fallen below a safe threshold, compared with over 30 percent being at risk in all other regions of the world. The African figure is likely to be a gross underestimation, for the following reasons:

1. Very incomplete or no information for some species was received from some countries.

2. No basic population data were provide by African countries for 61 percent of the breeds listed in the FAO Breeds Databank

Table 1: **Mammalian breeds at risk in the African region, by species**

Species	Listed in WWL-DAD	With Population data	Breeds[1] and Strains	Maintained - at risk	Not Maintained - at risk
Buffalo	2	1		0	0
Cattle	120	84	150	0	9
Goat	34	19	90	0	1
Sheep	73	47	125	0	3
Pig	13	6		0	0
Ass	6	2		0	0
Horse	31	8		0	1
Dromedary	12	12	40	0	1
Total	291	179	405	0	15

[1] according to Rege (1996)

(adapted from FAO, 1995)

A further explanation may also be that African indigenous AnGR have not been classified by countries into distinct breeds but have been grouped on the basis of archaeological, anthropological historical and phenotypical evidence and geographical location. This has lead, in some cases, to phenotypically different types having the same name, although some phenotypically similar types have been given different names (Rege 1996). Hopefully, the lack of information on 61 percent of the animal breeds of Africa is only a reflection of the general lack of data on the indigenous AnGR in some countries and not a consequence of these breeds being already extinct. Whatever the real situation, it can be safely speculated that a considerable number of these breeds should currently be on the endangered or critical list.

Based on current information for 3882 breeds in the Global Databank, developing countries possess 80 percent of the world's AnGR. Indigenous breeds produce, reproduce and live long

important asset since over time they have developed high adaptive fitness to the loc environments, now recognized as extremely valuable to further development. Furthermor some of these adaptation characteristics may be of importance, now and in the future to othe communities, characteristics such as

- resistance or tolerance to diseases, including entero- and ectoparasites;
- tolerance to poor feed resources and to fluctuations in the availability of feed and water;
- tolerance to extremes of temperature, humidity and other climatic factors;
- adapted to low levels of management;
- compared to introduced exotic breeds, they are characterized by high lifetime productivit (output per unit of input) for particular combinations of inputs, products and produc qualities.

These breeds frequently exhibit low absolute production figures whilst productivity itself ca be very high when the environment, the level of input, and time are properly accounted fo This, together with their particular adaptation characteristics and, commonly, the substanti between-animal diversity for production traits within these breeds, emphasizes the importanc of utilizing these breeds when forming the foundation for animal genetic development in th particular production environments. This now forms a fundamental policy issue for Africa sustainable livestock development. **Rapid, sustainable development of agro-ecosystems ca only be realized if based on locally adapted animal genetic resources.**

Reasons for loss of animal genetic resources

In developed countries advances in technology have lead to substantial increases in agricultura production in some production systems. The basis for this success was the possibility t develop and apply these technologies, and to access many diverse breeding population harbouring desired genes or gene combinations. This was further amplified by the possibility t access germplasm world-wide and the development and easy movement of highly selecte breeds. What was successful on the one hand was deleterious on the other, since improvemen programmes this century have only concentrated on a few breeds in each species, using hig levels of inputs, and also just one or two traits with the improvement activity been carried ou in comparatively benign environments. Proliferation was amplified through application o reproductive technologies, mainly artificial insemination. Other modern biotechnologies, suc as embryo transfer and cloning once it becomes more efficient, may further aggravate th problem if adequate precautions are not taken. The result to date is that a large number o breeds and strains which were highly adapted to very specific environmental and feedin conditions are now endangered, or extinct.

For the developing world, there are two primary factors responsible for diminishing anima genetic diversity:

- the introduction of exotic germplasm whereby exotic or other, often non-adapted, breed have been introduced followed by rapid spread through indiscriminate crossbreeding, wit the result that some indigenous breeds or landraces have been lost or displaced, and man more currently at risk of extinction (FAO 1995). Beside the fact that the introduction o exotic breeds to developing country environments commonly resulted in complete failures, it is also appropriate to note that the comparison between crossbreds and indigenous breeds,

such as reproductive fitness, longevity and necessary level of input, which are important economic factors, were not appropriately taken into account. **Nevertheless, the fundamental policy issues here are not crossbreeding but concern decisions to import and to manage imports through planned, objective evaluation.**
- changes in breeders preference to other breeds because of short-term changing socio-economics and to meet changing market requirements.

Other reasons for loss or extinction of breeds could be disasters such as drought, diseases, wars and other forms of political instability.

The importance of livestock and animal diversity

From 1960 to 1990 the world's human population increased from 3.1 to 5.4 billion, or 75 percent. The population in the developing countries' increased by 97 percent from 2.097 billion to 4.138 billion (FAO, 1992). The world population is projected to increase from 5.4 billion in 1990 to about 7.2 billion in the year 2010. This increase will occur primarily in the developing countries. In addition, 50 percent of the population will be living in cities as opposed to about 30 percent at present. This demographic growth and increased urbanisation combined with increased purchasing power will have major impacts on food consumption and consequently on its production and marketing. It has become obvious that in developing countries:

- new land for agriculture is becoming limited;
- all available production environments must continue to be used, but in a sustainable way;
- market and demand driven, more intensive (sometimes landless), peri-urban production systems will develop, particularly involving the monogastric animal species but also the ruminants, to supply urban centres with fresh meat, milk and eggs;
- in sub-humid and semi-arid areas integration of cropping and livestock activities will increase with pastoral activities being pushed into more marginal and fragile areas;
- many low to medium input, high stress production environments will remain in each region of the world at least for the main part of the 21st century; and
- production and productivity must continue to be increased in the developing world, whilst productivity gains must continue to be realized in developed countries.

Livestock and livestock development are essential factors in guaranteeing 'Food for All', in realizing the Commitments of the World Food Summit Plan of Action(1996). **Developing and developed countries are now in the process of clarifying approaches to meeting their commitment made in Rome in November 1996.**

To respond to the necessary development of all farming systems and because future needs cannot be reliably predicted, the range of genetic diversity in each livestock species must be maintained to enable rapid sustainable genetic development and adequate response to future changing production conditions and to changing demand for products and product qualities. The small number of commercial breeds suited to high input production do not offer an adequate genetic reservoir for the future. Moreover, many of these commercial breeds are not compatible with productions systems in the developing world where land, capital, feed and water resources are limited. This contrasts with indigenous livestock breeds, which often possess valuable traits such as disease resistance, high fertility, good maternal qualities, unique

product qualities, longevity and adaptation to harsh conditions and poor quality feed, a desirable qualities for low-input, sustainable agriculture and achievement of food security.

Whether the interest is in improving productivity and manipulating product quality (as it is f many developed country environments), or in improving production and productivity (mo developing country production environments), achieving **sustainable intensification** requir attention to both genetic adaptive fitness and performance of the AnGR.

While genetic change in production traits[2] of livestock can be comparatively rapid, genet change in the adaptation complex[3] to suit a particular agro-ecosystem is a slow process and m require many generations to achieve. Hence, and at difference to past approaches to t development of breeds of livestock, genetic development must utilize breeds which are alread highly adapted to the production environment, rather than base agro-ecosystem developme on exotic genetic material which has been improved under very different environment conditions. **Thus improving adaptation through selection within an introduced breed c combination of breeds will generally be much more difficult and time consuming tha improving production in an existing adapted breed.**

In summing up, biodiversity and a large diversity in AnGR are essential to maintaining an sustainably increasing livestock production and productivity, and as an insurance to meet th challenges of the future, summarized by Frankham (1994) and Strauss (1995)as:

- sustain and increase food production;
- maximise the productivity of land;
- achieve sustainable agriculture; and
- meet the known and unforeseen future needs of agriculture;

Through:

- allowing to select for desirable economic characters;
- responding to changes in consumer preferences;
- coping with changes in the production environment; and
- as a source of novel functions.

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[2] Production traits: Those characteristics identifiable and generally measurable at the individual animal level which contribute directly to quantity produced, and which are generally poorly associated with population fitness - even milk production is not closely associated with fitness once sufficient milk is produced by females to ensure survival of their replacement offspring. The vast majori of production traits of all farm animal species are quantitatively inherited, i.e. influenced by tens of genes with the final expression in an individual animal also being the outcome of all environmental influences post conception.

[3] Adaptation Complex: The second primary group of quantitative inherited traits of importance to the Global Strategy are thos associated with the adaptation complex i.e. the traits of importance to the fitness of the breed over time in the particular productio environment. Hence, the adaptation complex, by definition, must also be important to a breeds ability to be sustained in th

The decline in genetic diversity resulting from extinction of livestock breeds and strains is a problem world wide, especially in Africa (Rege 1996). The general importance of biodiversity for the future of humankind, its sustainable use and conservation are fully recognized as expressed in the United Nations Conference on Environment and Development (UNCED) which underscored the need to sustain and develop our resource base for future generations. This meeting resulted in the UN Convention on Biological Diversity (CBD, UNEP 1992) which represents an international consensus on the importance of the animal, plant and microbial species as well as on the different ecosystems to the integrity and sustainability of the biosphere and of human society. The Convention recognizes the need for all nations to participate in the effort to conserve biological diversity and simultaneously confirms the sovereignty of individual nations over their unique biological resources. Furthermore, the CBD contains provisions that would provide all nations with access to the financial and technological resources for conserving biological diversity while allowing them to share the benefits to be derived from its sustainable use (Strauss 1994). Already 167 countries have ratified the CBD, and are beginning to interpret the meaning of this international law for biological diversity coming under their sovereignty, including of course the important agricultural sector.

This CBD, as international law, encourages nations to undertake the necessary policy steps in order to meet the Articles of the Convention of which several have particular relevance in sustainably using and conserving farm animal genetic resources, of both the mammalian and avian species. Some of the policy implications for countries to consider are given below and are based on the document by Strauss (1994):

National Strategies and Action Plans

Article 6 of the CBD calls upon Nations to develop national strategies, plans or programmes or to adapt existing ones for the conservation and sustainable use of biological diversity into sectoral, and cross-sectoral plans, programmes and policies. For most countries this will require a in-depth inventory and assessment of the livestock sector to be able to develop this Strategy on which to base decisions. This will include identification, enumeration, characterization of species and breeds together with a close evaluation of the prevailing production environments to evaluate production and productivity of the different breeds adequately. It will also include the development and implementation of specific plans for improving those breeds currently widely used by farmers and for conserving those unique breeds which are at present of little farmer interest. The primary guidelines for the development of these action plans for AnGR have been drafted by FAO (1996) and work has begun on drafting more detailed secondary guidelines.

Utilization and Conservation

Article 7 of the CBD gives clear preference to *in-situ* conservation, maintenance and development of breeds in their natural habitat in which they have evolved and to which they are adapted. Enhancing and making conservation sustainable could be achieved when further developing the breed and giving it a more positive position within the prevailing production

system. This can done by designing and implementing active breed development strategie highlighting the breed's competitiveness and, where relevant, by identifying or developir market niches for special products. Sound utilization policy is central to the effective ar efficient management of Animal Genetic Resources. (Notter 1994). Wise use is the be conservation policy. Finally, the rapid, sustainable development of agro-ecosystems can only b realized if based on locally adapted animal genetic resources.

Ex-situ conservation is considered in Article 8 of the CBD. In practice, this can take the fon of either small populations in an environment different to the one in which they have evolve or of cryo-storage of semen, embryos or other biological material. This should apply whe there is no possibility for *in situ* conservation. Storage of semen and embryos complementar to *in-situ* conservation is strongly advocated for breeds at risk, as added insurance and t accommodate possible international requests for access.

Ownership and Access

The CBD recognizes and affirms nations' sovereign rights over their genetic resources an their authority to determine access to them (Article 15). This article also calls for equitabl sharing of benefits derived from this resource. Most often AnGR are owned by farmers an other private persons who will have to respond to a national policy. This requires countries t develop a policy to enable them to exercise their rights when national genetic resources ar being accessed and utilized by outside parties. It is important to note that these provisio applies only to those resources that have been transferred after entry into force of the CBD (2 December 1993) although many countries are urging that sovereign rights should also b applied to materials that was transferred before this date (Strauss 1994). The problems c access and benefit sharing are extremely complex and will have to be seen in the context c international trade agreements and international property rights. No final recommendations ar available or can be made since positions are very controversial and the internationa organisations involved will need to be guided by their member states.

Training, capacity building and technology transfer

Articles 16, 17 and 18 deal specifically with the needs for research, training and capacit building. The necessity of international funding and the assistance of developed countries i recognized in order to implement the activities required by the CBD. The research topics var from:

- practical methods for the sustainable development of breeds of each species and productio environments;
- development of standardized methodologies for systematic sampling and characterization;
- economic importance and assessment of the impact of genetic conservation;
- biotechnology to better conserve and develop existing resources;
- genetic distancing by molecular assaying to assess diversity of breeds within each species for more efficient conservation; and
- methods for *in-situ* and *ex-situ* conservation.

The developed countries are called upon to closely collaborate with institutions in the developing world and to share knowledge and benefits from this research.

Article 18 of the CBD calls specifically for international technical and scientific collaboration in order to strengthen national capabilities by means of human resources development and institution building.

Sustainable conservation programmes can only be executed if the necessary human resources are available and the appropriate infrastructure is in place. The political will and adequate financing are essential to achieve this.

Conclusions

The challenge for the future is to meet the requirements of an ever growing world population. Biodiversity is of key importance to the maintenance of food production as well as for the genetic improvement of domestic animals and plants. This agro-biodiversity is of key importance to food security.

The animal genepool which has developed since domestication is under threat due to three main causes:

i) failure to develop, implement and support sound management strategies for the AnGR of each primary production environment;
ii) the introduction, poor evaluation and widespread indiscriminate use of breeds developed for high input, benign production environments; and
iii) the lack of emphasis on and sustainable development of locally adapted breeds.

Achieving and sustaining food security is a national responsibility and can only be realized with well planned and executed development of each agro-ecosystem. For the vast majority of a region's agro-ecosystems, sustainable development of adapted AnGR must form an integral component of this production system development. High input AnGR are only productive and likely to be sustainable in high input benign production environments.

Breeds are being lost on a national basis and conserving domestic animal diversity, although it is a global concern, is a national responsibility. The global concern will result in international collaboration and in financial and technical assistance to countries to undertake the necessary surveying and conservation action.

Developing countries, particularly sub-Saharan Africa, possess an enormous wealth in genetic diversity, especially with regard to adaptive traits for medium to low input, stressful production environments. The challenge is how to conserve and develop this wealth for the benefit of the countries themselves in order to achieve sustainable intensification of production and productivity of livestock, how to make this wealth available and accessible to the rest of the world under the third CBD objective of fair and equitable sharing of the benefits realized from the use of such resources.

Countries are required to establish or reorientate existing institutional structures and develop appropriate national policies to meet these challenges and to implement the regulations of the

CBD. The implementation of some of the necessary activities will require external funding an hence it will be necessary to.

1. Identify short, medium and long-term national and regional needs from and opportunities i the livestock sector for each of a region's primary production environments.
2. Develop appropriate national and regional plans for the conservation and sustainab utilization of AnGR of each species. This will include:- identification and characterization o indigenous AnGR and their production environments;- development of breeding strategie and implementation and maintenance of the resulting livestock improvement programmes. decisions on the breeds at risk to be conserved, and on conservation strategies and th sustainable implementation of these strategies;- establishing sound policy for th importation, characterization and utilization of exotic AnGR.
3. Strengthening national research organizations and their collaboration with researc institutions in developed countries to reduce the technology gap.
4. Establish; in collaboration with other countries in a region and sharing the same resource policies for exercising country sovereign rights over its animal genetic resources.

FAO offers its assistance to countries in the context of the Global Strategy for th Management of Farm AnGR(outline of the Strategy in Annex 1) through existing Regiona Organizations (such as SADC, UEOMA, CILSS, CORAF. ASARECA) and in clos collaboration with OAU/IBAR and ILRI.

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FAO Global Strategy for the Management of Farm Animal Genetic Resources

The Governing Body of both FAO and the CBD have supported the framework for the country-based Global Strategy for the Management of Farm Animal Genetic Resources, and called for its further development.

The Global Strategy framework provides for a practical mechanism and set of key actions by countries that aim, in particular, at:

- developing and making better use of AnGR adapted to the world's major medium-input and low-input production environments, so as to sustainably intensify their agricultural systems; and
- overcoming the serious threat of genetic erosion in the remaining 5,000 or so breed resources of the fourteen main farm animal species; preliminary survey results show that about 30 percent of these resources are currently at high risk of loss.

The Global Strategy framework contains four basic components:

- A global, country-based structure with three elements: (i) focal points and networks, (ii) donors and other stakeholders, and (iii) the Domestic Animal Diversity Information System (DAD-IS).

- A technical activities programme with six elements: (i) characterization; (ii) *in situ* utilization and conservation; (iii) *in situ* and *ex situ* conservation; (iv) the development of guidelines and action plans; (v) the development of communications and information systems, and relevant training; and (vi) co-ordination.

- Expert cadres to guide development of the strategy, and maximise the cost-effectiveness of country participation.

- An inter-governmental mechanism whereby governments can directly guide international policy development, within the Commission on Genetic Resources for Food and Agriculture.

The components of the Global Strategy are inter-dependent and, in order to be cost-effective, maintain momentum and achieve long-term success, must be implemented concurrently. Once the basic guidelines and framework are in place, activities need to be developed in a coherent manner, as the necessary human and financial resources become available. FAO will lead, co-ordinate, facilitate and report globally and the Global Focus for the Strategy will be partially funded by FAO. However, the implementation of the Strategy is based on the collaboration of all stakeholders, beginning with countries, through the Initiative for Domestic Animal Diversity (iDAD).

This programme, which began in 1995, has already achieved the following:

- The technical rationale on which the framework for the Global Strategy is based : evaluated and endorsed by an Informal Panel of Experts, representing a broad range disciplines.

- The basic structure at country level is being established: National Focal Point Institutions, well as National Coordinators for Farm Animal Genetic Resources, are being identified governments in 73 countries in Africa, Asia, the Americas and Europe, although most . not yet fully active.

  A pilot regional focus has been introduced in Asia, funded by the Government of Japan. mid-term evaluation mission reported favourably on this pilot regional focus and stress the need for local and regional co-ordination and assistance to countries, to allow them make the substantial efforts required for the effective management of animal gene resources. Preparations are under way to initiate Regional Focuses for the Americ Europe and the Near East. For Africa these will be based on existing regional organizatic and are being developed in collaboration with OAU/IBAR, ILRI and the sub-regio organizations SADC (Southern African Development Community) for Southern Africa, a jointly with UEOMA, CILSS and CORAF for Western Africa. Preliminary discussions we held with ASARECA for East and Central Africa.

- The Domestic Animal Diversity Information System (DAD-IS) was designed to implemented in four stages, and the first of these stages has been developed, tested a partially implemented on the Internet. DAD-IS now provides an advanced, country-secu communications and information tool, which is flexible, and able to cover all areas of AnG management, as a "virtual structure" for the implementation of the Global Strategy. The are currently about 1,000 regular users in 90 countries, but there is not yet adequate day-t day global focus support to assist users and fully enable the System. DAD-IS offe countries an advanced, data-secure information system which accommodates all areas good management of AnGR ready for use and without the substantial development cost financial and human resources. DAD-IS is found on the Internet at world wide web si http://www.fao.org/dad-is/ and in 1998 it will also be available on CD-ROM to tho without low cost, rapid web access.

- The first steps have been taken towards developing mechanisms for stakehold consultation, whereby a broad range of stakeholders involved in AnGR may contribu actively to the development of the Global Strategy. An informal Ad Hoc Meeting of Dono and Other Stakeholders resolved to support the Global Strategy, and to "mainstream" it discussions with countries and in their collaborative livestock activities. They also agreed c the need to meet regularly to exchange information on progress.

- Development of an Early Warning System has been initiated, through global surveys c twenty-eight species of farm animals, and the development of the Global Databank fo Animal Genetic Resources. The World Watch List for Domestic Animal Diversity wa published in English and French, and Spanish.

- Four of nine planned project identification missions have taken place. Their aim is to bett understand which activities, if implemented, would accelerate the improvement of AnG

- Primary country-level guidelines for developing and implementing sound action plans for each farm animal species, and the range of primary agro-ecosystems incorporating livestock, are under development.

- A comprehensive communications strategy has been prepared, which focuses on the target audiences' information needs: it exploits all major communication opportunities, and aims at maximum cost-effectiveness. Key elements are: DAD-IS, the World Watch List on Domestic Animal Diversity, the Animal Genetics Resources Information Bulletin, a stakeholders' newsletter, and a briefing kit.

Involvement in the Initiative for Domestic Animal Diversity (iDAD)

How to countries and regions become involved in iDAD and so begin to develop and implement a country strategy for the management of farm animal genetic resources, capitalizing most on the Global Strategy? This is a step-wise process:

1. The first step is the development of a regional or sub-regional approach, with the assistance of FAO.
2. Countries identify, following invitation by FAO, National Focal Points, comprising a National Co-ordinating Institution well linked to Government, and a National technical Co-ordinator, to co-ordinate the development and effective operation of the AnGR management network for the country.
3. A Regional (Sub-regional) Focal Point is implemented to assist countries to operationalize the management effort.

Further projects at the sub-regional and country level are formulated, supported and implemented to give the process momentum.

HUMAN RESOURCES NEEDS IN THE DEVELOPMENT OF THE LIVESTOCK SECTOR

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1.0 INTRODUCTION

The central problem facing Africa is how to achieve food self - sufficiency. In spite of this problem, agriculture remains the main stay of the economies of the countries in the continent.

In most of Sub-Saharan Africa, technological and industrial development is limited. In this region, about 70 percent of the people live in the rural areas and the majority of them are engaged in agriculture. In fact agricultural sector employs about 70 - 80 percent of the total labour force in each country.

Agriculture means farming both crops and livestock. This agriculture must be improved urgently in order to feed the rapidly growing human population. The available statistics show that currently, the rate of population growth in Africa is approximately 3 percent per annum, which is higher than that of food production, which is about 2 percent. Recent studies have indicated that in order to achieve food security in Africa, the rate of increase in food production should be 4 per cent. The deficit in food production rate is causing malnutrition, diseases and unnecessary suffering. Indeed the 1992 Winrock International study has projected that the human population in Sub-Sahara Africa will increase by 800 million to 1.3 billion by the year 2025 and that an estimated 19 million tons of meat and 43 million tons of milk will be required annually to feed the continent's population.

2.0 THE IMPORTANCE OF LIVESTOCK IN AGRICULTURE IN AFRICA

Livestock play an important role in the social and economic life of the people of Sub-Saharan Africa. Some studies have shown that agriculture contributed approximately 32 per cent of the gross domestic product (GDP) in the African region as a whole. Livestock products, that is, meat, milk, eggs, wool, hides and skins contributed 25 percent of the Agricultural Domestic Product. This

figure does not include two other important contributions of livestock. These are traction and manure. According to the then International Livestock Centre for Africa (ILCA), if these factors are included in the calculation, then the contribution of livestock to the agricultural domestic product is much higher, about 35 percent.

The value of livestock manure in replenishing soil fertility, by restoring some nutrients and organic matter is recognized by most African farmers and livestock owners. It should however be pointed out that livestock does not actually produce organic matter or nutrients, it merely acts as a vehicle for the transfer of these components. In some areas, manure plays a vital role as fuel and as building material.

Draught animals (cattle, horses, donkeys and camels) perform some very important tasks for man in the region. Animal traction is particularly important in increasing the agricultural output of small holdings by providing power for ploughing, seeding with drills, hauling, harvesting and on-farm transport.

Many of the pastoralists in the arid and semi-arid areas of Africa derive their entire livelihood from livestock. In many rural areas, the sale of livestock and their products often constitutes the only source of cash income, which both enables the people to purchase various inputs necessary to increase the crop yields and contributes towards government revenue.

Perhaps the most significant contribution which is made by livestock to mankind is the provision of the high quality protein to the human diet which, in Sub-Saharan Africa, still consists mainly of cereals and root crops. The per capita consumption of animal protein in Africa is lower than in most regions of the world. In some cases the animal protein consumed in Africa is insufficient to meet the minimum requirement for normal human growth and healthy

mental development.

There is therefore a need for veterinarians, livestock scientists and policy makers to strive to overcome constraints in order to achieve sufficient levels of livestock productivity in Africa.

3.0 LIVESTOCK PRODUCTION IN EAST & SOUTHERN AFRICA

What has been said about the importance of livestock in the Sub-Saharan Africa in general is even more true for the Eastern and Southern African region in particular. This region contains about 70 and 52 per cent of the total cattle and small ruminants respectively in Africa. This livestock is owned by small and large scale farmers with the former owning a larger proportion of the cattle and small ruminants.

Although the livestock statistics for this region are high (see Table 1), the overall animal productivity is low because of a number of constraints, the major one of which is often disease. Other constraints include nutrition, low genetic potential, poor management systems and inappropriate policies. In some cases there are no polices in place. One way of addressing these constraints is to have appropriately trained cadres of personnel running the livestock sector. The overall objective of having appropriately trained cadres of personnel in the sector would be to deliver efficient livestock services to the clients.

4.0 DELIVERY OF LIVESTOCK SERVICES

Livestock Services consist of two components; animal health and animal production services. The veterinary services encompass the control of major epidemic diseases, clinical services, public health, control of import and export products and extension. The production services encompass breeding and nutrition programmes, production systems and extension. For a long time, these services in the region, except for South Africa and Zimbabwe, were entirely provided by the public sector, the government. Initially the services

provided by the public sector were adequately financed and efficient. Later there was a progressive deterioration in the quality of the services. The deterioration was caused mainly by organizational weakness and increasingly limited financial resources allocated to the services.

5.0 PERSONNEL FOR LIVESTOCK SERVICES

The tradition in the region has been for Livestock Services (Animal Production and health) to be delivered under the National Veterinary Services (NVS) establishment. Under this arrangement all the personnel delivering the livestock services operated under one directorate.

Generally speaking the personnel delivering the services are of two types, the professionals and the non-professionals. Among the professionals are the specialized veterinarians or animal scientists and ordinary veterinarians or animal scientists. For the non-professionals, there are the Animal Husbandry officers (Diploma holders), the veterinary assistants (certificate holders) vaccinators, Community Animal Health workers (CAHWS) and, in some cases, the farmers themselves who have had some basic training.

5.1 Professional staff

Looking at the existing establishments, the veterinarians far outnumber the animal scientists. This is related to the demand for the two categories of personnel. The demand for the veterinarians is much higher than the demand for animal scientists.

The number of veterinarians for some of the countries in the region is given in Table 2. Table 3 gives the number of each of the three important livestock species, that is, cattle, small ruminants and camels, per veterinarian for the countries listed. Although there are large variations in the ratios of veterinarians to the livestock from one country to the other, the general observation is that these ratios are quite high except for Botswana and

Ethiopia. However, one has to keep in mind that these veterinarians are not all working in the field. Also most of the veterinarians are employed by the public sector and the majority of them are deployed in urban centres. This makes it difficult for the remote, low potential areas to access adequate veterinary services through the NVS system. One of the main the problems faced by the livestock sector is not inadequate numbers of the professional personnel to do the work. The problem is the quality of trained staff (lacking in certain key skills), low utilization by the public sector as well as problems of low motivation because of low incentives provided, and low financial resources allocated to the sector.

6. TRAINING OF PERSONNEL FOR VETERINARY SERVICES

Hitherto, there has not been a systematic policy in the countries in the region for the training of personnel, at all levels, including postgraduate, for the livestock sector. There has not been a linkage between training and needs in the livestock sector. In other words training has not been demand driven. What has been happening is that people went in the training institutions to get qualifications as veterinarians, animal scientists or para-professionals etc without the governments' plan. In most of the countries in the region all the university graduates and para-professionals had the automatic right of employments in government. The governments have not been able to keep the funding of livestock services in line with the increases in staff numbers. This has meant that a large proportion of available funds are used on staff costs and less on operation costs.

6.1 Veterinarians: undergraduate training

The traditional programme for the professional veterinary degree extends over a five year period for candidates admitted into the university after six years at high school. The courses taught under the present curriculum have put emphasis on animal health (Therapeutic, curative and preventive medicine and

surgery), with less emphasis on livestock production courses. The programme has also tended to be very much on the academic side, covering the subject matter in depth. Generally the training programme under the present curriculum in the region covers more "science" of veterinary medicine with less emphasis on the "practice" of veterinary medicine. There are also unnecessarily too many veterinary faculties in the region. It would appear that some of them were established to satisfy national pride rather than serve specific needs. For example the veterinary faculty in Zimbabwe was established to serve the SADC countries except South Africa and Tanzania. There are now other faculties in Angola, Mozambique and Zambia as well.

6.2 Animal scientists: undergraduate training:

The majority of the animal scientists do a degree programme in agriculture and take the animal science option in their final one or two years. The degree course takes 3 or 4 years depending on individual university faculties. The training programme covers both theoretical and practical training. The products of this training programme appear to be well suited for the extension services.

6.3 Postgraduate training

Formal postgraduate training (M.Sc and Ph.D degrees) is still much underdeveloped in most of the countries in the Faculties of Agriculture and Veterinary Medicine in the region. Training at postgraduate level allows more specialisation in disciplines and sub disciplines. The purpose of training at the M.Sc level is to produce people to work in research positions in government departments, research institutions, training institutions and some private firms. Training Ph.D level prepares the candidates for teaching at universities, leadership positions in government, positions in research establishments and some private institutions.

Many of veterinarians and animal scientists wishing to carry out postgraduate studies have had to leave their home countries for specialised training abroad. They gain their qualifications, mainly Ph.D degrees, by studying problems which have limited significance to their own countries. Thus while this is an important training exercise it is not target oriented.

A number of post graduate training programmes at Msc. and Ph.D levels have been carried out in the universities in the region. However the output, especially at the Ph.D. level, does not meet the demand in most of the countries in the region. Some countries have found it necessary to acquire the services of expatriate staff to make up the shortfall. There is need to train the manpower at the highest level which the livestock sector will need to meet its challenges.

6.4 Para-professionals

In the present context, the term is used in broad terms to include the Animal Husbandry officers (AHOs) Assistant Agricultural officers, Agricultural Assistants,
(VAs) Laboratory Assistants, meat inspectors and animal nurses etc.
People who successfully undergo formal training for a minimum of three years come out as Animal Husbandry Officers or Assistant Agricultural Officers. The rest of the cadres undergo two years of formal training. The numbers of personnel in
these cadres in the region are abundant.

6.5 Auxiliary personnel

These are people who receive short and/or in-service training. They include stock inspectors, vaccinators, inseminators and Community Animal Health Workers (CAHWs).

Community animal health workers are particularly important in low potential and pastoral areas of developing countries. The training they receive is given by experienced veterinary or animal health personnel and is extremely applied and practical.

7.0 Rationalization of delivery of veterinary services:

In the recent past countries throughout the world have started to implement structural adjustment to refocus public services and improve efficiency. It has already been pointed out above that agriculture and livestock are important to the national economy in the countries in the region. The delivery of veterinary services has been a particularly important component of the structural adjustment process. There have been some initiatives to rationalize the delivery of the veterinary services. This has necessitated a division between those services that remain under the responsibility of the public sector (the government) and those that can be better handled by the private sector (Private Veterinarians, Pharmaceutical companies for drug distribution).

The criteria for assigning functions to the responsibility of one or the other of the two bodies normally are: economic consideration, technical judgement by the government veterinary authorities and the prevailing socio-cultural conditions within the country.

7.1 Services under the responsibility of the public sector

The services that remain under the responsibility of the public sector are: assuring the health of the national herd including disease surveillance, compliance monitoring, quarantine, quality control of drugs and vaccine, planning for emergencies and reporting to international bodies and neighbouring countries, ensuring food safety, import and export inspection and certification according to international standards, setting regulations and most importantly formulation of livestock development policy.

7.2 Services under the responsibility of the private sector

The major services undertaken by this sector are: clinical diagnosis, treatment, vaccination, production and distribution of drugs and vaccines, artificial insemination, management of herd health and production programmes and marketing livestock and products.

7.3 Services that are shared by both sectors

These could be; clinical diagnosis and disease reporting, compulsory testing, ticks and tsetse control, food hygiene and inspection, continuing education and training, diagnostic support, animal welfare, notifiable disease control, disease emergency response, zoonosis control, research and advise on extension.

It should be recognized that the initial focus of the private sector targets areas of high and medium potential because of the greater likelihood of success. The long term objective would be to extend this sector to the low potential areas. In the short term, however, the private sector has to take care of the high potential areas.

8.0 OPERATIONAL EFFECTIVENESS:

For the veterinary services to operate effectively, even under the two sectors, they must be part of the broad national development programme. This programme could, among other things, assess the needs for human resource development in

the short, medium and long term and design training schemes accordingly.

9.0 Training of human resources for livestock development

In order to have a national development programme for human resources particularly for the livestock sector, there must be a national training policy. Under this policy there must be an appraisal of the existing cadres of personnel and identification of where there are short falls in numbers and most

importantly, in the requisite skills.

For the short term, that is up to 5 years, emphasis should be on the retraining of the existing professional staff. There should be in particular, inservice training geared at equipping the personnel with a mix of skills to make some of them confident enough to move into the private sector. In the medium term and long term the policy should be geared towards regulating the university intake for the professional training. Already a country like Kenya has an annual output of about 70 veterinarians, most of whom can not find employment. Several other countries are in this category. The curriculum content should also be modified to fit the changing circumstances. There should be emphasis on practical training more than has been the case hitherto. Opportunities should be made available for those who wish to narrow their field of operation to undergo internship in their chosen field after their professional degree programme. Elements of business management should be included in the training programme. This would help those who opt for the private sector to run their practices on business principles.

It should be noted that animal health is a component of livestock production systems, and most of the livestock production in the region is in small holder crop-livestock farming system. There should be orientation in training programmes to equip the personnel with appropriate skills to operate in these farming systems.

The training should be broad enough to embrace all the disciplines relevant to the livestock sector, such as, socio-economics, livestock economics, marketing, range ecology and of course the traditional disciplines for animal health and production.

9.1 Research training:

The development of appropriate technologies is dependent on strong research

programmes. Moreover the quality of research out put depends on the quality of the researchers which, in a way, is a reflection of the training they received. Most of the personnel involved in the research will have had some post graduate training. We are all aware that research training is quite expensive. There should be a strategy in the region of sharing facilities for training manpower at this level. Efforts should be made to train the personnel locally as the research undertaken during and after the training will be demand driven. Emphasis should be on the applied research for the purpose of fulfilling specific needs. There should be some flexibility to allow those who wish to pursue academic careers at the universities or other institutions not to be restricted to applied research.

9.2 Para-professionals

These support rather than offer alternative services to those offered by the professionals. Experience has shown that the para-professional personnel are more dependable when it comes to delivering veterinary services in marginal, low potential areas than the public or private sector veterinarians. While planning for

the development of the human resources for the livestock sector, their role must be fully recognised. They should therefore have a niche in any training programme. Most importantly there should be vigorous in-service training schemes in order to broaden or upgrade their skills as they play an important supportive role to the professionals.

9.3 AUXILIARIES AND LIVESTOCK OWNERS

Community based delivery of animal health services has developed in a response to a very real need for improved livestock production in remote, marginalised pastoral communities. Prior to their training, the veterinary auxiliaries should be selected by the communities which they have to serve. Experience has shown that auxiliaries hand picked by the NVS prior to their

training tend not to fare well in their communities. Reasonably educated cadres also have high expectations subsequent to their training. They expect promotion opportunities to be made available for them to advance.

The tasks permitted to various cadres of the auxiliary staff must be clearly defined by the National Veterinary services. The course content and the duration of the training for these people must also be standardized nationally. Training must be appropriate, not only in subject matter, but also in the way it is presented. Community animal health workers cannot be expected to have the kind of expertise or skill of a highly trained veterinarian. Also the limitations of their training and abilities must be recognised. Nonetheless, community animal health workers are likely to be the only available source of animal health advice and assistance and their role is essential.

Livestock owners, too have a role to play in animal health but this role is not always fully recognized. Whether they are trained or not, they will always treat their animals, even using prescribable drugs. The National Veterinary Services should therefore put in place programmes for training livestock owners as CAHWs to carry out interventions like vaccinations or administration of non-prescribable drugs.

10.0 NEW INFORMATION TECHNOLOGIES

10.1 Opportunities

The new technologies are nearly all linked to the "information technology revolution." The new and accessible developments are Email, Internet access, digital cameras and CD ROM. These could assist with distant learning, mass media, vocational training, public education and electronic conferences on specific issues of interest.

Email is the simplest and allows rapid, cheap international communication of information. The information is in a form of printed words, pictures, video clips and voice. This technology puts scientists, researchers, policy makers, implementers and trainers in touch with one another. It is particularly important in that it enables people who are developing training packages to get access to new ideas and information. It also makes it possible for electronic conferences to be held, and this cuts out the usual expenses pertaining to conferences, most notably travel, accommodation and subsistence costs.

E-mail can easily be used for distant learning and mass media. For example information bulletins can be sent out world wide at the flick of a switch. These bulletins could then be printed and distributed. Further, students can access information and have their work commented on by distant instructors.

The Internet allows a user access to a huge library of information on almost any subject. This library is called the "world wide web". To access the internet, one needs the same equipment as for the Email, that is, a computer, a modem and a telephone line. The difference between the two is in costs. On the average, the monthly costs for the internet could be 3 - 4 times more than that of Email, depending on the frequency of its use.

The Internet allows scientists and trainers to search for the information they need. It contains the latest technical papers and information from universities, research institutions and publications. It also allows establishment of networks of individuals sharing information, experiences and commenting on the same specialised subject. For example, there are specialised "web sites" which allow anyone to enter, get information and also make comments.

Digital cameras are cameras which, instead of using film, use computers' memory to store their pictures. This makes it possible for pictures to be loaded straight from the camera into a computer and from there into training manuals, reports etc. The pictures and video clips can even be sent by Email.

Compact discs (CD) are capable of holding up to 600 megabytes of computer information. This allows for a huge amount of information to be placed on a single disc. Most computers are now sold with a CD drive. This allows any school, centre or institution with a computer to get interactive learning tools and information. CDs can be produced almost on any subject.

FAO has recently produced a series of CDs which contain training and information on epidemic livestock diseases, such as rinderpest. The CD explains all that is known about the disease from its causative virus, genetic structure to how to carry out an ELISA test to diagnose the disease, pictures of typical rinderpest cases and current occurrence of the disease. The advantage of the CD is that they are not expensive, costing around United States Dollars 30 - 50.

The other technology which is not so new is the satellite TV. This is quite a useful tool for mass dissemination of information on any subject, livestock included.

10.2 Implications

In order for one to use any of these technologies, one must have access to electricity and of course the resources to purchase the requisite equipment: computer and its accessories, T.V. set, computer camera etc,. This obviously disadvantages the rural-based personnel who have not access to electricity supply and in some cases cannot afford to purchase the basic requisite equipment. For these people the traditional mass media, that is radio and television (for those who have access to it) and the visual materials like flip charts posters etc., are still useful tools for training. Even where electricity and requisite infrastructure are available, ability to access to Internet etc. could be a problem.

10.3 Suggestions

There should be national (public and private) effort to provide the necessary infrastructure that provide easy access to software, networks spare parts etc.

11 CONCLUSION

In order to avail requisite personnel for improved and sustainable livestock productivity there must be an appropriate national policy in place. Under such a policy the training must be target oriented.

Countries in the region have made attempts to train personnel for the livestock sector at all levels. However the existing manpower in terms of quality does not meet the critical mass required for sustainable livestock productivity. Moreover training is done largely on disciplinary basis, yet a great number of problems in the livestock sector are related to small holder farmers. Training should therefore be interdisciplinary in order to address these problems. Emphasis should be on animal production systems which are appropriate to the country.

In the past nearly all graduates were employed by government. This is no longer possible. There is now a move to privatise at least clinical services. To be a successful private practitioner the veterinarian has to be equipped with reasonable knowledge of business management. Business management should therefore be included in the undergraduate curriculum.

Postgraduate training should be target oriented and should as much as possible be done locally in order to address local pertinent problems. Also postgraduate training is expensive. Countries should try to share the available facilities in order to keep training costs low. The new information technologies available make it possible for scientists in the region to communicate easily and share their experiences. This should make it possible to collaborate and thus share the limited resources available.

TABLE 1: ANIMAL POPULATION IN THE EAST & SOUTHERN AFRICAN COOUNTRIES (IN 000'S).

	CATTLE	SMALL RMTS	CAMEL	HORSES	POULTRY
1. Angola	3280	1825	-	1	6
2. Botswana	2800	2625	-	34	2
3. Burundi	380	1200	-	-	4
4. Comoros	50	143	-	-	-
5. Djibouti	190	977	62	-	-
6. Eritrea	3410	3000			
7. Ethiopia	29450	38400	1000	2750	54
8. Kenya	11000	12800	810	2	25
9. Lesotho	650	2675	-	123	1
10. Madagascar	10309	2040	-	-	36
11. Malawi	980	1086	-	-	9
12. Mauritius	34	102	-	-	3
13. Mozambique	1250	503	-	-	23
14. Namibia	1890	4260	-	59	2
15. Reunion	25	34	-	-	9
16. Rwanda	465	1170	-	-	1
17. Seychelles	2	5	-	-	0
18. Somalia	5200	26000	6200	1	3
19. South Africa	12632	35600	-	230	43
20. Sudan	21800	39400	2950	24	37
21. Swaziland	646	450	-	1	1
22. Tanzania	15600	13637	-	-	28
23. Uganda	5200	5400	-	-	23
24. Zaire	1650	5105	-	-	35
25. Zambia	3300	689			22
26. Zimbabwe	5500	3300		3700	
27. Egypt	4545	6592	133	10	55960

Source: FAO, OIE, WHO, Animal Health Year Book, FAO Rome, 1995.

RMTS = Small Ruminants

TABLE 2: NUMBER OF VETERINARIANS.

		VET.SERVICES	PRIVATE	OTHERS	TOTAL
1.	Angola	89	6	9	104
2.	Botswana	33	3	3	39
3.	Burundi	-	-	-	-
4.	Comoros	-	-	-	-
5.	Djibouti	-	-	-	-
6.	Eritrea	21	1	0	22
7.	Ethiopia	443	21	77	541
8.	Kenya	1245	154	60	1459
9.	Lesotho	-	-	-	-
10.	Madagascar	82	91	97	270
11.	Malawi	37	2	6	45
12.	Mauritius	28	7	11	46
13.	Mozambique	49	0	0	49
14.	Namibia	25	14	5	44
15.	Re Union	3	30	2	35
16.	Rwanda	-	-	-	-
17.	Seyschelles	4	0	0	4
18.	Somalia	-	-	-	-
19.	South Africa	523	1418	215	2156
20.	Sudan	2050	975	663	3688
21.	Swaziland	14	5	2	21
22.	Tanzania	260	55	150	465
23.	Uganda	427	26	140	557
24.	Zaire	-	-	-	-
25.	Zambia	98	41	9	148
26.	Zimbabwe	115	60	59	234
27.	Egypt	18744	5000	2000	29244

Source: FAO, OIE, WHO Animal Health Year Book, FAO Rome, 1995.

Table 3: NUMBER OF CATTLE, SMALL RUMINANT AND CAMELS PER VETERINARIAN.

	CATTLE	SMALL RUMINANTS	CAMELS
1. ANGOLA	31538	17548	-
2. BOTSWANA	71794.8	67307.6	-
3. BURUNDI	-		
4. COMOROS	-		
5. DJIBOUTI	-		
6. ERITREA	-		
7. ETHIOPIA	54436	70979.6	1848
8. KENYA	7539	8773	555
9. LESOTHO	-		
10. MADAGASCAR	38181	7555.5	-
11. MALAWI	21777.7	24133	-
12. MAURITIUS	739	2217	-
13. MOZAMBIQUE	25510	10265	-
14. NAMIBIA	42954.5	96818	-
15. REUNION	714	971	-
16. RWANDA	-		
17. SEYCHELLES	500	1250	-
18. SOMALIA	-		
19. SOUTH AFRICA	5858.9	16512	-
20. SUDAN	5911	10683	799.8
21. SWAZILAND	30761.9	21428.5	-
22. TANZANIA	28765.5	29326.8	
23. UGANDA	9335.7	9694.7	
24. ZAIRE	-	-	
25. ZAMBIA	22297	4655	
26. ZIMBABWE	23504	1402	
27. EGYPT	155	255	0.3

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SEMINAR ON LIVESTOCK DEVELOPMENT POLICIES IN EASTERN AND SOUTHERN AFRICA

28TH JULY TO 1ST AUGUST, 1997

A Keynote Address by
Prof. M L Kyomo - Technical Advisor, Cattle Breeding Project
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GLOBAL AND AFRICAN TRENDS IN LIVESTOCK SECTOR: OPPORTUNITIES AND CHALLENGES TO ITS DEVELOPMENT

BY M L KYOMO*

Introduction

In the Vision for Food, Agriculture and Environment for the year 2020 by the International Food Policy Research Institute (IFPRI), 1995, there is a statement which is worth pondering on. This states as follows:

> "Although hunger, malnutrition and environmental degradation are rampant in developing world, and although the world population will grow by an unprecedented 90 million people a year in the next quarter century, many people have developed a dangerous sense of complacency about the current and future food, agriculture and environment situation".

This complacency led IFPRI to launch an initiative on a 2020 Vision for Food, Agriculture and Environment. It involved developing an action plan for eradicating hunger and malnutrition while protecting the environment. The Vision is defined as:

> "A world where every person has access to sufficient food to sustain a healthy and productive life, where malnutrition is absent, and where food originates from efficient, effective and low cost food systems that are compatible with sustainable use of natural resources".

Similarly, FAO in 1996 organised a Food Summit whose theme was "Food for All". The aim was to seek commitment to a policy statement and a plan of action to eradicate poverty.

Agriculture dominates the economies in the developing countries and more so, of most countries in Sub-Saharan Africa where currently, about 70 percent of the people live in rural areas (Winrock, 1992). For this region as a whole, agriculture contributed 32 percent of GDP in 1988. Output of livestock commodities - meat, milk, eggs, hides, skins and wool - accounted for 25 percent of agricultural domestic products. The Winrock study (1992) observed that if non monetised contributions of traction and manure by livestock were included, the livestock contribution to agricultural domestic product would rise to 50 percent, bringing the livestock component of agricultural domestic product to 35 percent.

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Agriculture also employs 60-80 percent of total labour force and accounts for 26 percent of the total foreign exchange earnings in countries where mining is important and 60 percent where mining is not a major industry. Therefore, agriculture will continue to be the major driving force in the economic development of most of Sub-Saharan member states. This is also FAO's view for most developing countries.

Up until the early 1970s, Africa used to produce adequate food for its human population and massive food importations were unheard of. From the late 1970s up to the present, African countries import large quantities of food annually. Winrock International (1992) warned that if the growth of livestock production would continue to be 2.6 percent for meat and 3.2 percent for milk per annum, as it did between 1962 and 1987, African countries would face massive deficits in meat and milk by 2025. It pointed out that already, 11 percent of the milk on average was imported. After examining the potential for livestock development in Sub-Saharan Africa, Winrock International (1992) concluded that the growth rate of 4 percent per annum as recommended by FAO and the World Bank can be achieved. In 1980, the Organisation of African Unity (OAU) lamented in the preamble to the Lagos Plan of Action that unfulfilled promises of global development strategies were more sharply felt in Africa than in other continents of the world. Many factors contributed to this state of affairs. One of these factors was the under-investment in agriculture. The Global Coalition for Africa has observed that if agriculture is the main stay of most economies in Sub-Saharan Africa, then the annual budget allocations to it should rise from 9 percent to 27 percent.

Having recognised the importance of agriculture in the economies of Eastern and Southern Africa, the Ministers of Agriculture met in Harare-Zimbabwe in April 1994, to prepare a framework for action to be considered by Summit under the auspices of Global Coalition for Africa (GCA). The heads of State of countries in this region met in June 1994 to receive among other things, a report from the Ministers of Agriculture which highlighted what needed to be done to make agriculture the engine of economic development. The report recommended the following:

- agriculture be put on top of the political agenda;
- public investment for agriculture be increased;
- development of comprehensive and implementable agricultural policies which encompass the key prime movers of agricultural development i.e technology, human capital, physical and biological infrastructure, effective institutions and an enabling political and economic environment.

The investment and policy recommendations were to be developed as a package and be sustained for over a period of twenty to thirty years. The

Ministers also reaffirmed the commitment to regional cooperation in areas of mutual benefit to strengthen national efforts. They also identified areas of immediate priority concern to the region and these included food security, water resource development and irrigation, and human resource development. In the area of agricultural research, the Ministers recommended that the existing regional institutions be revisited in order to enhance their capacity to provide technical guidance and leadership. Another very important area was the need to create a Regional Agricultural Policy Network to enhance indigenous capacity for policy formulation and analysis. This network would, among other things, assist in the convening on a regular basis of the Conference of Ministers of Agriculture to review the progress in the implementation of the agricultural policies and strategies. The country reports at the Workshop will no doubt report on how far each of the member states had gone to implement some for the above recommendations.

This paper aims at bringing to the fore, the importance of livestock in the economies and agricultural production systems of countries world-wide, constraints and potential for its development particularly in Eastern and Southern Africa. Policy issues that need to be tackled from both a sectoral and cross-sectional view point in order to spur its development, will also be covered.

The anti-livestock Lobby

Recently, there has been a rising tide of conjecture against domesticated animals and fowl to provide goods and services in ways which have been accepted in the past (McDowell, 1991). The concerns have been expressed as follows:

- The eating of red meat and dairy products which contain poly-saturated fats is a health hazard.
- Ruminant especially cattle livestock produce a lot of methane gas and therefore, contribute substantially to global warming.
- Livestock contribute to deforestation, overgrazing and desertification.
- Livestock compete with humans for cereal grains and protein sources.
- There is pollution from concentrations of intensive livestock production enterprises.
- Livestock compete with humans for carbohydrate and protein sources.
- Livestock compete for land use with crop production.
- Livestock development is said to favour the richer segments of society - both producers and consumers - rather than the most vulnerable.

These concerns occur because of the inability to identify appropriate technologies and define strategies for livestock development applicable to individual agro-ecological zones and agricultural production systems. For

example, several technologies developed in industrialised countries have been used in developing countries without modification. Even animal germplasm from developed countries have been imported into agro-ecological zones of developing countries where they were not suited.

Global Population Trends

According to FAO (1992), both human and livestock populations have increased substantially during the past decades (Table 1). It will be observed from this table that between 1960 and 1990, the total human population has increased by 75 percent (97% increase in developing countries and 28 percent increase in industrialised world). All categories of livestock have also increased but the monogastric animals have increased more substantially than ruminants. The ruminant livestock have increased at half the rate of human population. The poultry and pigs have increased three to four times in developing countries than in developed countries.

According to IFPRI (1995), the world population is expected to increase from 5.4 billion to 8.0 billion by the year 2020. The increase will be mainly in developing countries. This increase, with the resulting increase in pressure on land and changes in composition of the livestock population will have a major effect on both available natural resources and future demand for commodities, and this will consequently determine the type of livestock feeding and production systems to be adopted.

In Sub-Saharan Africa, it is anticipated that between now and 2025, there will be an enormous demographic and social changes (Winrock International, 1992). Population growth, urbanisation and income change will stimulate the intensification of agricultural systems and profoundly alter the prospects for sustainable economic development. The driving force for change will be a near tripling of human population (Table 3). This growth will be accompanied by a dramatic migration of people from rural to urban areas (Table 3) and this will in turn create new patterns of food production, marketing and consumption.

The World Bank (1989) has warned that because of the fast growing population, the sub-Saharan economies must expand 4 to 5 percent per annum if they are to achieve food security, provide jobs and register a modest improvement in living standards. With a population growing at 2.8 percent a year, a 4 to 5 percent economic growth implies significant increases in per capita income. Because agriculture is such a large component of economic component of GDP of most countries in sub-Saharan Africa, it will be greatly affected by the state of the economies and at the same time, it is a major determinant of the economic welfare of the countries in the region. The reduced per capita GDP during the 1980s resulted in

lower per capita incomes (Table 5). The potential to reverse this trend exists if governments, private sector, non governmental organisations and international development agencies can play their role in solving constraints in resource management, feed resources availability, animal health, using the right genotype and socio-economic factors.

Table 1: Population statistics - 1960 and 1990

	Humans		Large Ruminants		Small Ruminants		Pigs		Poultry	
	1960	1990	1960	1990	1960	1990	1960	1990	1960	1990
					(Millions)					
World	2,074	5,389	1,035	1,434	1,365	1,808	406	856	3,922	10,770
Developed Countries	977	1,251	343	404	573	591	235	341	2,274	4,465
Developing Countries	2,097	4,138	692	1,029	792	1,217	171	515	1,648	6,305
Increase in developing Countries %)		+97		+48		+53		+200		+280

Source: FAO AGROSTAT, 1992. Quoted by Sansoucy, 1995

Increased urbanisation will lead to an increased demand for food and this will create markets for produce and encourage commercialisation of agriculture. As farming moves from subsistence toward a commercial mode, greater specialisation in production, transportation and marketing will occur, making the process more efficient. FAO (1986) has observed that there is a tendency for urban population in Africa to have larger incomes than do rural people. People with more incomes tend to purchase higher quality foods including fresh fruits and vegetables, meat, eggs and dairy products. Therefore, the demand for foods of animal origin will rise with urbanisation.

Winrock International (1992) has predicted that the pattern of rapid population increase in sub-Saharan Africa will lead to intensification of agriculture. Intensification involves use of more labour, improved technology such as genetic stocks and traction, and more inputs such as fertiliser and chemicals in order to gain more output from the land. Despite migration to the cities, rural population will also grow at about 2.2 percent per year.

Winrock International (1992) has quoted studies which show that livestock are an important component of the process of intensification. Livestock enter into the farming system when population pressure expands the use of land to grow crops and reduce fallow and pasture to the point that farmers seek substitutes to maintain fertility. As an initial response in climates suitable to livestock, farmers paddock animals on cropland or otherwise collect and use manure. As population pressures increase further, farmers resort to more intensive technologies including heavier application of manure and fertiliser in order to increase production. Finally, hand labour is replaced

by animal traction and mechanisation, which have become more economic because of the high intensity of land use that has been achieved. A further step compels farmers to grow legumes and forages specifically to enhance the productivity of their livestock enterprises which in turn increases soil fertility and crop yeilds. The conclusion is that population pressures cause animal agriculture systems to become more intensified and mixed crop-livestock systems become more efficient than specialised systems of crop and livestock production.

Table 2. Sub-Saharan Africa Human and Livestock Population, 1988 (in selected countries in East and Southern Africa)*

Country	Human Population x1,000	Cattle x1,000	Sheep x1,000	Goat x1,000	Pigs x1,000	Chickens x1,000
Angola	8,690	3,400	265	975	480	6
Botswana	1,190	2,350	220	1,100	9	1
Burundi	5,190	340	350	750	80	4
Djibouti	490	70	414	500	-----	-----
Ethiopia	46,090	31,000	23,400	17,500	19	57
Kenya	22,700	9,800	7,300	8,500	102	23
Lesotho	1,740	525	1,440	1,030	72	1
Madagascar	11,310	10,600	611	1,080	1,400	21
Malawi	8,900	1,000	210	950	210	8
Mozambique	13,980	1,360	119	375	160	21
Namibia	1,310	2,050	6,400	2,500	48	1
Rwanda	6,790	660	360	1,200	92	1
Somalia	8,510	5,000	13,500	20,000	10	3
Sudan	23,930	22,500	18,500	13,500	-----	29
Swaziland	770	650	35	320	19	1
Tanzania	24,790	13,500	4,700	6,600	184	30
Uganda	16,350	3,900	1,740	2,800	440	15
Zambia	7,870	2,684	80	420	180	15
Zimbabwe	9,580	5,700	580	1,650	190	10
Total	220,180	117,089	80,224	81,750	3,695	247
Africa Total	591,440	162,463	126,668	147,382	11,096	631
%age of Africa Total	37.22	72.07	63.33	55.47	33.30	39.14

** Source: FAO quoted by Winrock International, 1992*

Table 3: Population projections for sub-Saharan Africa, 1990-2025

Year	Population (Millions)	Annual growth rate (% 5-year period
1990	498	-----
1995	580	3.1
2000	676	3.1
2005	784	3.0
2010	902	2.8
2015	1,028	2.6
2020	1,159	2.4
2025	1,294	2.2

Source: Winrock International, 1992

Table 4: Urban populations as a percent of total, sub-Saharan Africa, 1960 to 2025

Year	Urban (%)
1960	11.8
1965	13.7
1970	15.9
1975	18.8
1980	22.0
1985	22.4
1990	29.0
2000	36.3
2010	43.5
2025	54.2

Source: Winrock International, 1992

Table 5: Gross national income per capita, Sub-Saharan Africa (in 1980 USDollars)

Year	Sub-Saharan Africa	Excluding Nigeria and South Africa
1968	420	400
1970	490	410
1975	540	380
1980	570	380
1985	480	350
1986	470	350
1987	450	340
1988	440	340

Source: Winrock International, 1992

Table 6: Population, land availability and output in developing countries

	Sub-Saharan Africa	Asia	Latin America	West Asia & North Asia	All
		(Millions)			
Population	501	2,470	448	316	4,005
		(ha per caput)			
Cultivated Land	0.35	0.18	0.43	0.29	0.24
Grazing Land	1.28	0.17	1.27	0.84	0.49
		(US$ per caput)			
Value of Crops	83.7	89.2	144.8	64.8	92.9
Value of livestock	19.5	25.7	78.1	39.9	31.9

Source: FAO AGROSTAT, 1993. Quoted by Sansoucy, 1995

Contribution of Livestock to Food Security

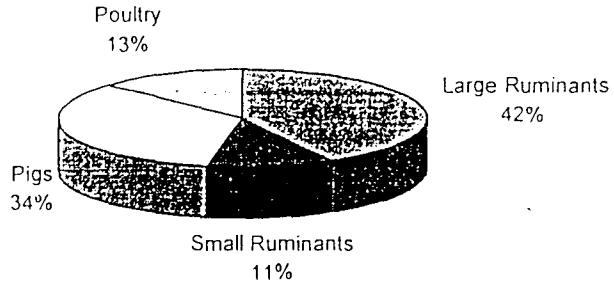
Trends in livestock food supply in developing countries

Livestock are important contributors to total food production. This contribution seems to increase at a higher rate than that of crops. Table 7

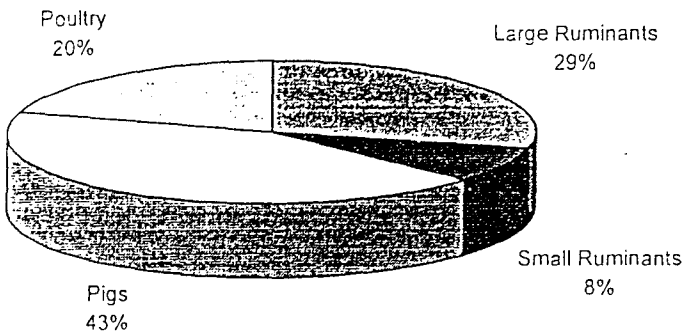
shows that the recent increases in livestock products appear to be even more spectacular than those achieved for cereals from the green revolution. Most notably, egg production has increased 233 percent over the last two decades, compared to 127 percent for meat production, 78 percent for cereals, 113 percent for fish. By the year 2020, demand for livestock products will increase by 75 percent, while for food grains, it will be 55 percent. This is because income determines the protein intake of people particularly in urban areas. Of the different animal species, meat production from monogastric animals may produce 2.4 times more meat than ruminants, provided that feed is available and affordable (see Figure 1). Consumption of animal products per caput is low compared with developed countries (Table 8). This shows that there is potential for increasing consumption and hence production of animal products in developing countries. The per caput nutrient supply in developing countries compared to developed countries shows that animal products are primarily a source of protein and essential amino acids but when they are a major constituent of the human diet, they also contribute a significant proportion of total calories (Figure 2). In developed countries, 60 percent of dietary protein supply is derived from animal products compared to 22 percent in developing countries. In the latter countries where diets are composed of a small number of staple foods, animal products are of a great importance in preventing malnutrition as they have a better concentration of essential amino acids than vegetables. Consumption of animal fat can be unnecessary in developed countries while in developing ones where there is deficiency of calorie in-take, they are very useful as sources of calories.

Livestock help to alleviate seasonal food availability in many different ways. For example, liquid milk whose production is seasonal, can be processed during periods of surplus into by-products such as clarified butter, cards, milk powder, cheese et cetera, and be used throughout the year. Again, animals, particularly livestock are slaughtered as the need arises to even household food needs. Meat, like milk can be processed into various products such as dried, salted, cured or smoked meat and be used when other food sources are scarce.

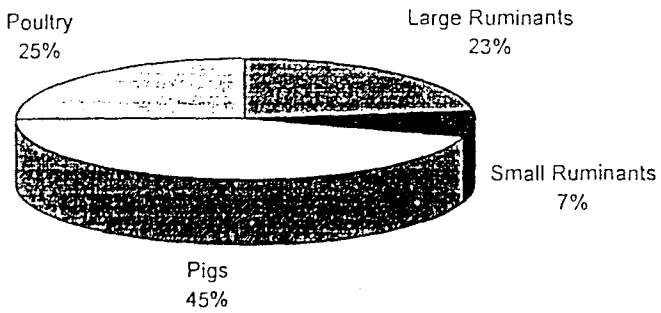
1970 - 28.5 Million tonnes



1990 - 64.8 million tonnes



2010 - 143 million tonnes



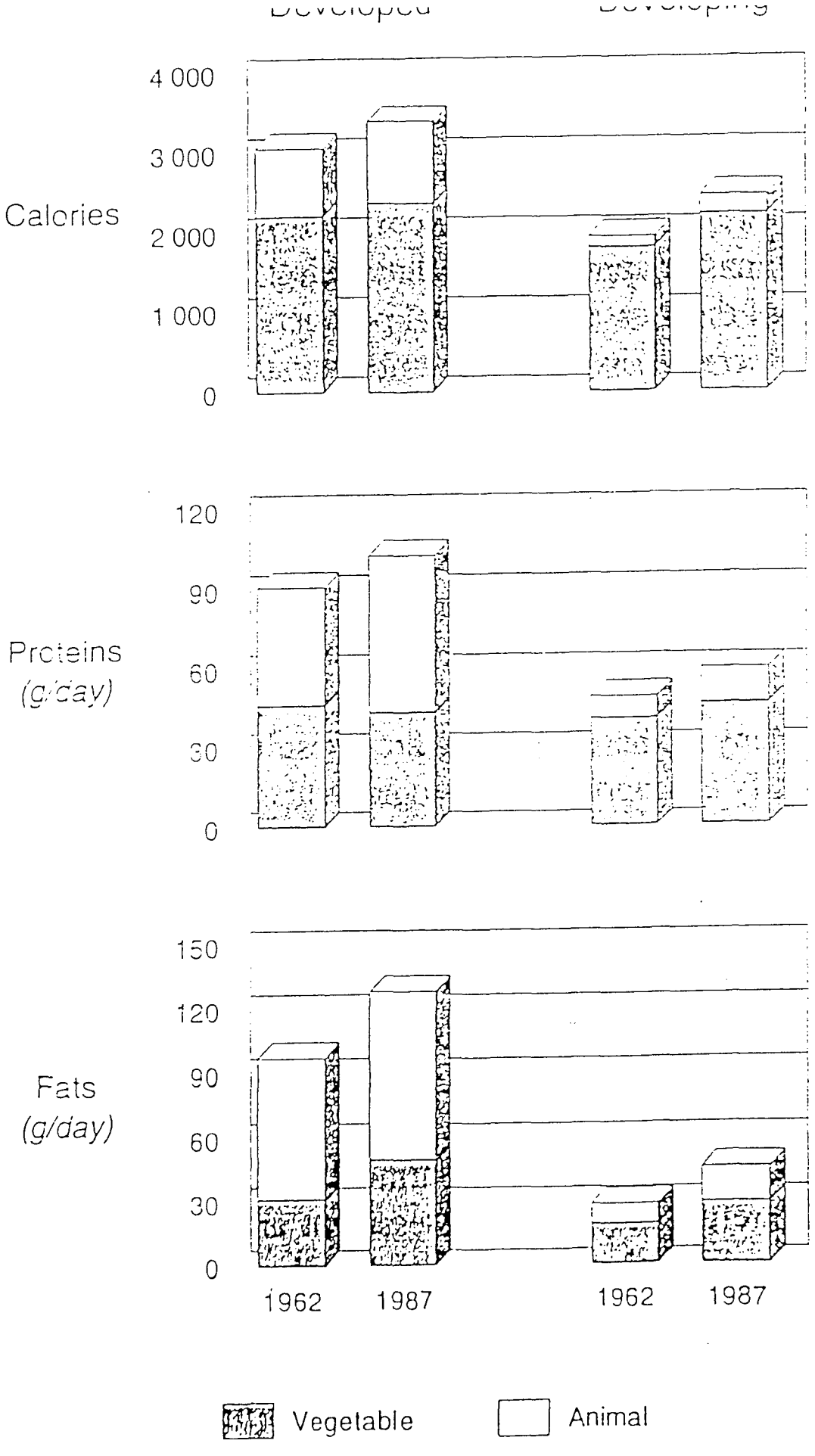

Developed
Developing
Calories
4 000
3 000
2 000
1 000
0
Proteins
(g/day)
120
90
60
30
0
Fats
(g/day)
150
120
90
60
30
0
1962
1987
1962
1987
Vegetable
Animal

Table 7: Trends and projections in food production in developing countries

	Production (Million tonnes)			Growth rate (%)	
Product	1969/71	1988/90	2010	1970-1990	1990-2010
Wheat	67	132	205	3.8	2.1
Rice	177	303	459	3.0	2.0
Milk	78.0	147.3	247.6	3.5	2.5
Meat	28.5	64.8	143.0	4.6	3.8
Eggs	4.6	15.3			
Fish	16.4	35.1			

Source: Sansoucy, 1995

Table 8: Per caput consumption of meat, milk and fish in 1990

Region	Meat	Milk	Fish
World	32.9	75.0	13.1
Developed	81.6	200.0	26.8
Developing	17.7	36.6	8.8
Africa	11.4	27.5	8.0
Latin America	41.1	93.9	8.6
Near East	19.6	60.7	4.4
Far East	15.1	27.0	9.4

Source: Sansoucy, 1995

Livestock can also be used as a source of income. Many resource poor farmers derive incomes from livestock and use them for purchasing food, other household needs as well as agricultural inputs such as fertilisers, pesticides, weedcides and others. At national level, livestock food products represent 27 percent of the total agricultural output (Table 9 and 10). This subsector has potential of higher growth rates and has higher total value than crops (Table 11). In addition, livestock activities such as dairying, have the advantage of providing incomes to farmers regularly. the programme of Operation Flood in India works through cooperatives which pay farmers delivering milk to collection chambers on a daily basis. This means subsistence farmers received regular incomes. Draught animal power, animal for transport and for pumping water are sources of incomes to farmers owning these animals.

Table 9: Major commodity groups in total gross agricultural production in 93 developing countries

Commodity group	Share of total value (%)	Annual growth rates of Production (%)			
		1961-1970	1970-1980	1980-1990	1990-2010
Cereals	30	4.1	3.0	2.8	2.0
Roots, tubers, plantains & pulses	9	2.5	1.5	1.6	1.7
Other food crops	27	3.1	3.5	3.7	2.8
Non food crops	7	2.7	1.3	3.1	2.2
Livestock	27	3.9	3.8	4.6	3.4
Total	100	3.5	3.0	3.4	2.6

Source: Sansoucy, 1995

Livestock also provide increased income stability to farm or household, acting as a cash buffer as well as deterrent against inflation. In mixed farming systems, livestock reduce the risks associated with crop production. They also represent liquid assets that can be realised at any time, adding further stability to production system.

Livestock acts as a generator of employment. There are several livestock activities such as dairying, poultry or pig farming which are labour intensive involving men and women in production, processing and marketing. Sansoucy (1995) has reported that labour accounts for 40 percent of the total costs in smallholder production systems (Table 12).

Table 10: Value of Agriculture and Livestock Products in some Eastern and Southern African countries in sub-Saharan Africa, 1988

Country	Value (US$millions)		Livestock share of Agric. (Output (%)
	Agric.	Livestock	
Sudan	3,261	1,901	58
Ethiopia	3,243	1,299	40
Kenya	2,202	826	38
Tanzania	2,837	642	23
Somalia	709	514	72
Madagascar	1,765	72	27
Uganda	2,840	404	14
Zimbabwe	1,137	260	23
Namibia	300	245	82
Angola	632	201	32
Zambia	527	169	32
Mozambique	796	160	20
Botswana	121	107	88
Malawi	831	98	12
Rwanda	645	70	11
Lesotho	95	66	70
Swaziland	193	47	24
Burundi	739	42	6
Mauritius	182	24	13
Total	23,055	7,547	327

Source: Winrock International, 1992

Table 11: Estimated value of food commodities (1990-1992 average)

Commodity	World	Developed Countries	Developing Countries
Wheat	77,325	49,893	27,432
Rice	102,547	7,606	94,941
Fish*	223,381	111,531	111,850
Total meat and milk	619,106	404,160	214,946
Milk	218,153	158,119	60,034
Meat	400,953	246,041	154,912
- bovine meat	120,726	86,353	34,373
- ovine meat	17,010	7,250	9,760
- pig meat	193,603	108,062	85,541
- poultry meat	69,614	44,376	25,238

Source: Sansoucy, 1995

Table 12: Staff requirements for meat processing/marketing operations

Staff requirements for 30 animals (persons/day)	Slaughtering	Meat marketing	Further processing
Cattle	20	4	>80
Pigs	10	2	>30
Small ruminants	3	1	

Source: Sansoucy, 1995

Livestock as a supplier of production inputs for sustainable agricultural development

They are a source of energy. the estimated number of animals being used for draught power is 400 million. About 52 percent of the cultivated land in developing countries is farmed using only draught power and 26 percent using only hand tools (Gifford, 1992 quoted by Sansoucy, 1995), compared with tractors, animal power is a renewable energy source with most of the implements made locally. Tractors on the other hand, 90 percent of these and their implements are made in industrialised countries and have to be imported by developing countries. Therefore, draught animal power does not drain foreign reserves. FAO (1987) estimated that dependency on draught animal power and human power will decline slightly by the year 2000.

In many countries, cowdung is used as fuel for cooking thus reducing expenditures on fuel - wood or fossil fuels. In India alone, 300 million tonnes of dung are used for fuel every year (Sansoucy, 1995). It is also used for plastering houses and ashes can be used as fertiliser.
Animal manure is also used for biogas production. Kumar and Biswas (1982) have reported that the best manure for this purpose comes from (in descending order) pigs, cattle, horses, camels and poultry. On-farm biogas production reduces the work load of women by eliminating wood collection or fuel purchasing. It is person-friendly because of its convenience and increased hygiene, and it provides a number of services such as lighting, warm water and heating. It can also be used to drive machinery such as water pumps.

Livestock can be a source of fertiliser. Nutrient recycling can be an essential component of any sustainable farming system. The integration of livestock with crops allow for efficient nutrient recycling. One tonne of cowdung contains 8kg N_2 4kg P_2O_5 and 16kg K_2O (Ange, 1994 quoted by Sansoucy, 1995). The chemical composition of manure varies, however, according to the animal species (poultry manure appears to be more efficient fertiliser than cow manure) and also the nature of their diet. The cultivation of legume

fodder and trees, for example, in alley farming systems, also contribute to the enrichment of soils through nitrogen fixation. Soy bean in the humid tropics can supply 40kg of nitrogen per hectare.

Livestock can help in weed control. Sheep, for example, are used in some countries to reduce undergrowth in forests and thereby reduce the risk of fire during summer or dry season. In Kenya and Tanzania, cattle have been used to graze in coconut and cashewnut plantations and the benefits have been to the animals, the crops through dung deposits and to the owners through the elimination of labour for weeding.

In rural areas, credit, banking and insurance are virtually non existent. In these areas, livestock play an important role as a means of saving and capital investment, and they often provide a substantially higher return than alternative investments. A combination of large and small livestock that can be sold to meet petty cash requirements to cover seasonal consumption deficits or to finance large expenditures represent a valuable asset for the farmer.

Other products and functions

Hides and Skins

The overall yield of hides and skins in relation to overall weight of the slaughtered animal is approximately 6.5 percent for cattle and 10 percent for small ruminants (Sansoucy, 1995). World production of hides and skins increased between the 1960s and the 1980s with bovine hides reaching 1.8 million tonnes (55 percent increase) and sheep and goat skins up to 220,000 tonnes (5 percent increase). During the same period production in developing countries, fell: bovine hides by **50** percent (down to 47,000 tonnes) and sheep and goats' skins by **25** percent (down to 68,000 tonnes). Since the slaughter of cattle, sheep and goats did not decline it means these products were not fully utilised. FAO has introduced better flaying techniques to increase hide and skin quality. Since the world price for cattle hides has varied between $1.5 and $2 per kilogram over the last ten years should be an adequate incentive for producing high quality raw hides and skins.

Social and Cultural functions

Livestock keeping has considerable social and cultural significance. These have been the main reasons for keeping animals in many societies. It is difficult to attach monetary value to many of these roles.

Livestock wastes such as poultry manure can be recycled by feeding to cattle. Pig and poultry manure can be used to generate algae for fish. Marginal lands and crop residues can be utilised by livestock.

Non food attributes of livestock as a factor of sustainable agriculture

Increasing animal production saves foreign exchange. The cost of importing animal feeds into developing countries is estimated at between US$10 and 15 billion per year (Figure 3). Although developing countries also export, this export is in terms of oil seed cakes. Being a source of by-pass protein, the cakes could be put to better use locally to improve production of national herds which in turn would reduce the imports of animal products.

The trade of meat products is better balanced (Figure 4). These figures, however, mask the fact that only few countries are high producing. There is still substantial potential for increasing local products to save foreign exchange from import substitution and to increase rural incomes.

The situation regarding the importation of dairy products into developing countries is critical. Imports have dramastically increased during the past three decades while exports have been negligible (Figure 5). The prospects for increasing dairy production has been more favourable following reduction of subsidies in industrialised countries and realistic foreign exchange rates.

Constraints and Opportunities to Increased Livestock Production and Productivity in Sub-Saharan Africa

Winrock International (1992) has identified constraints to, and opportunity for raising cattle, small ruminants, poultry and pigs in five major agro-ecological zones in Africa. Technical constraints include feed supply, animal health, genotype and livestock management.
In most agro-ecological zones and production systems, livestock owners fail to feed animals adequately throughout the year. In some areas, the quantities of feeds are in short supply during certain parts of the year such as during the dry season. In other cases, the feeds are available but are of poor quality. In both areas, livestock, therefore, fail to obtain adequate and balanced nutrients. In cases where crop residues and agro-industrial by-products are available, these are either exported, wasted or are very expensive. Sometimes, infrastructure for transporting, processing and marketing feed stuffs is underdeveloped. If animal production has to grow at four percent per annum as recommended by the World Bank (1989), feed availability at affordable costs will have to be developed.

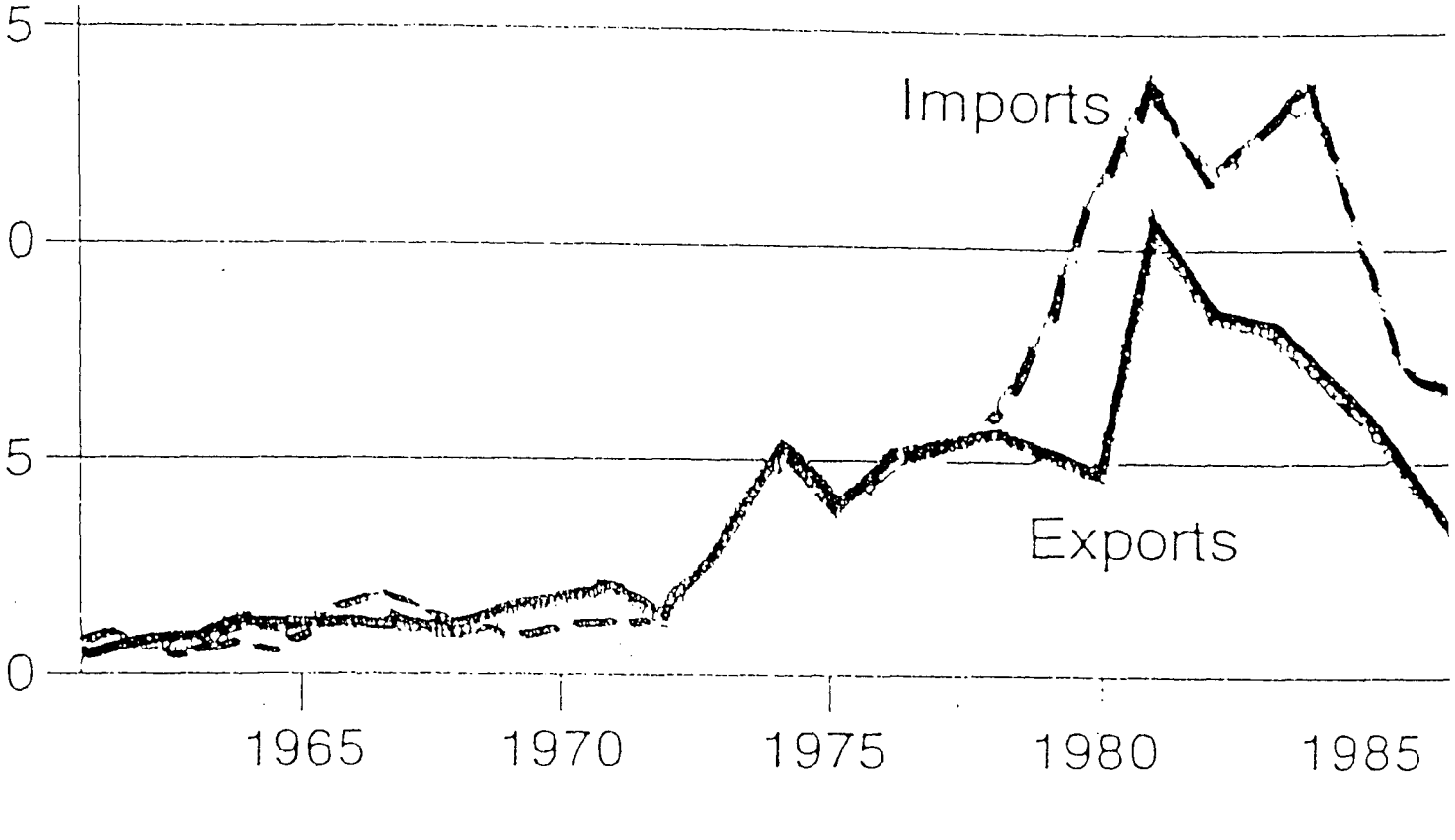


FIGURE 3: Value of Feed Grain Imports and Exports in Developing Countries, 1961 to 1989
SOURCE: Sansoucy, 1995

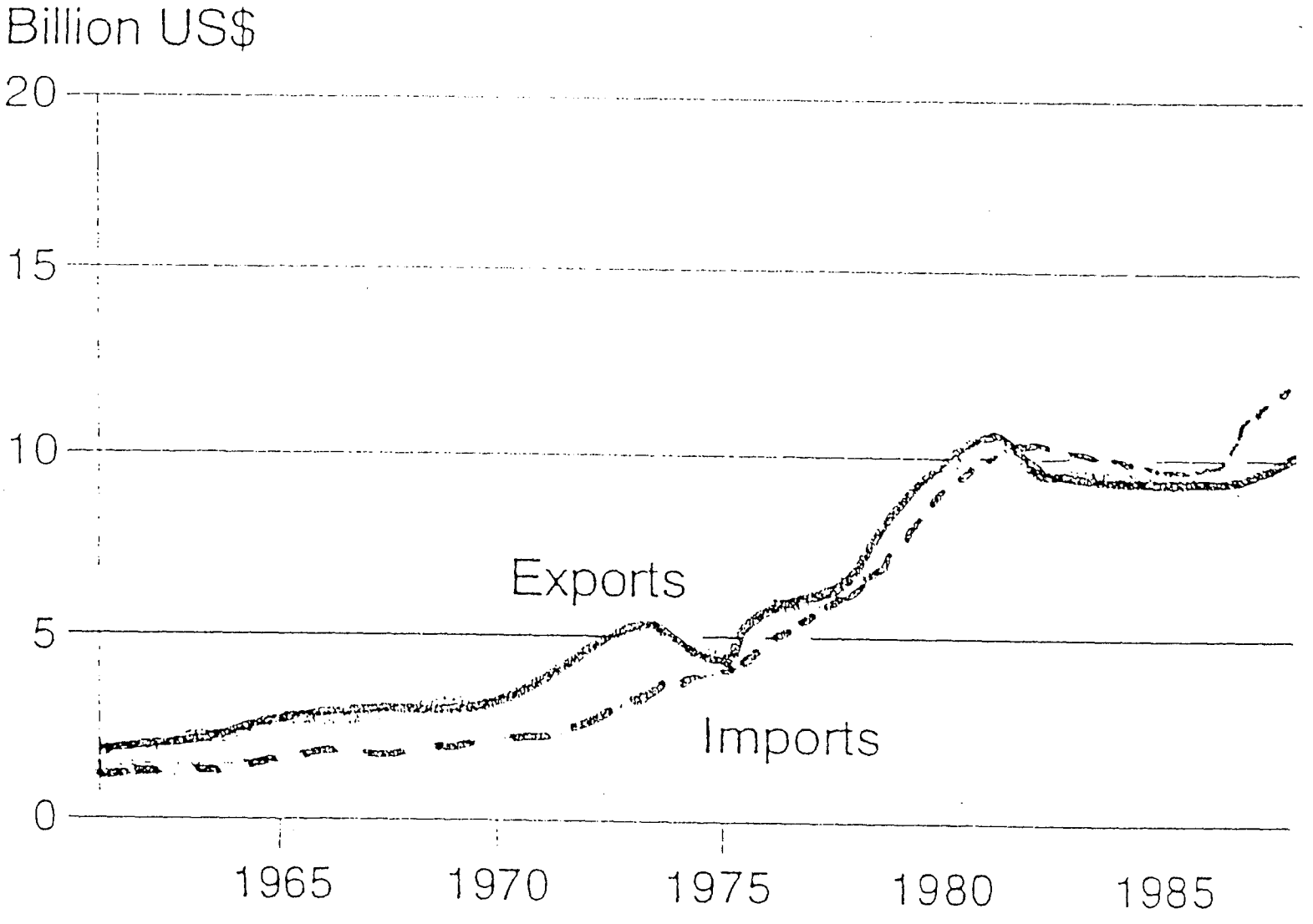


FIGURE 4: Value of Meat Imports and Exports in Developing Countries, 1961 to 1989
SOURCE: Sansoucy, 1995

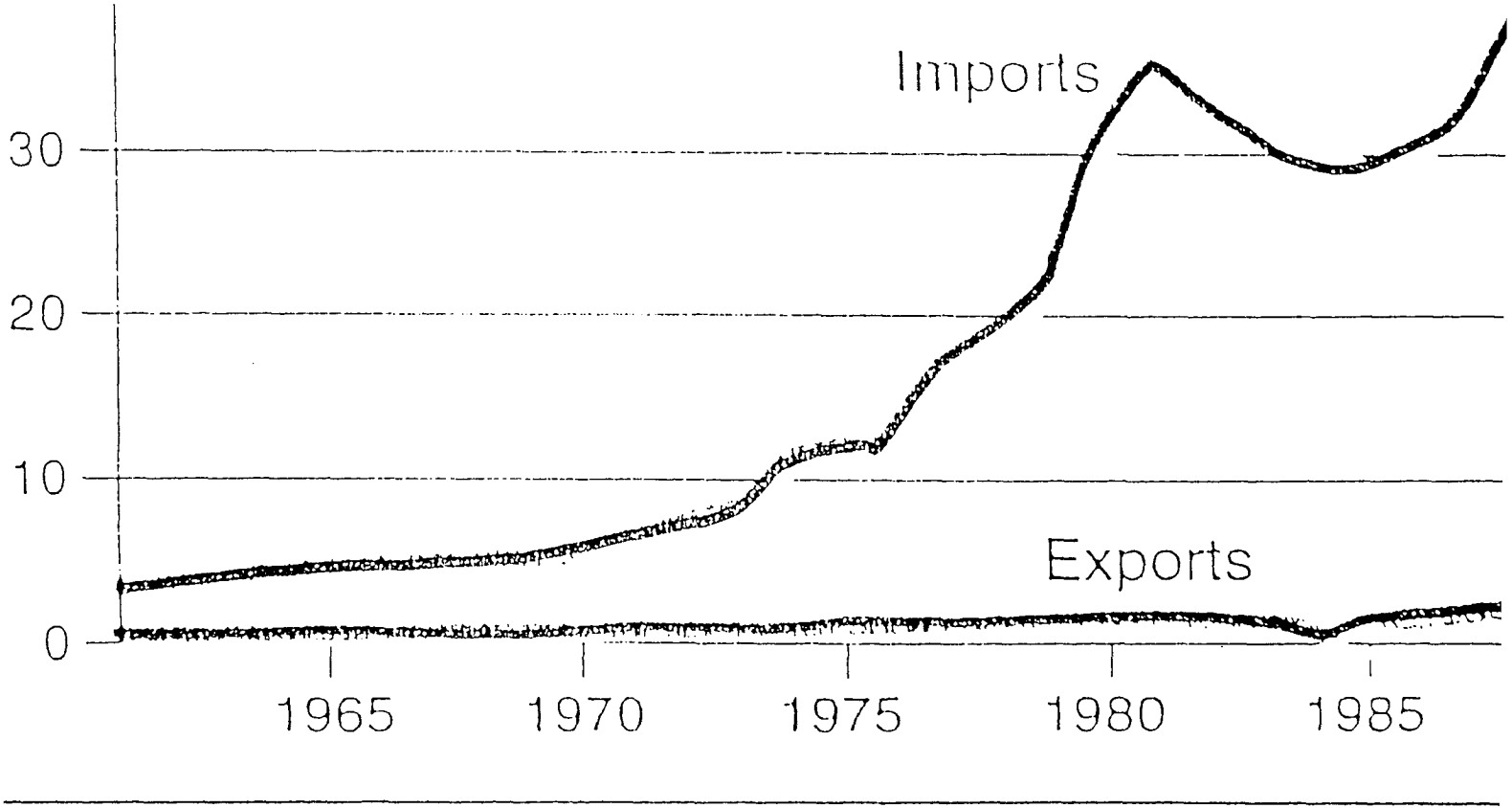


FIGURE 5: Value of Dairy Imports and Exports in Developing Countries, 1961 to 1985
SOURCE: Sansoucy, 1995

Animal diseases reduce the productivity of livestock in all agro-ecological zones in sub-Saharan Africa. The first category of diseases are the epidemic infectious diseases such as Rinderpest, Contagious Bovine Pleuropneumonia, peste des petits ruminants and contagious caprine pleuropneumonia threaten the whole region and cause high mortalities and severe economic loss. Although vaccines have been developed and they can be controlled, sometimes to costs of purchase and of administering them are very high.

In some cases, especially in Eastern and Southern Africa, wildlife remains the reservoirs of these diseases and in the process of conserving them, they become sources of infection. Parasitic and viral diseases which are mainly vector transmitted, also cause severe economic losses. Vaccines and chemotherapeutic agents are being developed for some but this development is still in its infancy. The control of ticks and insect vectors with pesticides is expensive and sometimes these drugs are not available making the sustainability of control difficult to achieve. The list of diseases under this category includes trypanosomiasis, theileriosis, anaplasmosis, babesiosis, dermatophilosis, African swine fever, bovine ephemeral disease, blue tongue, cowdriosis, Nairobi sheep disease and Rift Valley fever. There is a third category of diseases whose severity increase with intensification of livestock production systems. These are both infectious and non infectious and they include soil-bourne bacterial diseases such as anthrax, infectious reproductive tract diseases such brucellosis, causals of diarrhoea and pneumonia in new born, mastitis, sheep and goat pox, Newcastle disease, internal parasites and mineral deficiencies. Control measures of these diseases have been developed. However, they become severe because of underfeeding, use of unadapted genotypes and because of poor management.

It has been observed (Winrock International, 1992) that one of the most important factors holding back sustainable control of livestock diseases in sub-Saharan Africa is the inability of many countries to maintain effective disease surveillance and control. There is also lack of effective diagnostic capacity including functional veterinary services. The veterinary service which hitherto, has been provided by governments has proved to be ineffective and unsustainable. At present, privatisation of some veterinary services is being introduced.

The need for effective animal health delivery services in order to reduce disease constraints in animal agriculture remains very important. The economic consequences of animal disease in sub-Saharan Africa has been estimated at US$4 billion per year through direct losses due to mortality and slow growth, low fertility and decreased output resulting from morbidity.

Genotype

Poor animal genotypes fail to produce adequately even in environments where feeds are available, animal diseases can be controlled and where management can be improved. Many countries in sub-Saharan Africa have not given priority to identifying production traits among their indigenous farm animals and establishing sustainable animal improvement programmes. These are well adapted to the agro-ecological zones in which they are found. They are disease resistant, heat tolerant and are able to utilise low quality feeds. The countries have instead resorted to importing exotic breeds of livestock. The impact of these Importations on increased food commodity production has not been high. Another approach has been to indiscriminately crossbreed the indigenous farm animal with exotic ones. The result is that the indigenous breeds or breed types are disappearing fast. The biodiversity convention that was adopted by United Nations member states in 1992 is encouraging member states to conserve and use in sustainable manner, the indigenous genotypes. There is need for member countries in sub-Saharan Africa to implement the conservation, improvement and sustainable utilization of indigenous farm animals.

Farming systems and animal management

Steinfeld and Mack (1995) have observed that agricultural planners have had difficulties in understanding the complexity of livestock production systems and how these systems function. They have rightly stated that this has been primarily a problem of quantification and comprehension. The consequence has been that the potential development opportunities are ignored, particularly the potential for using livestock as a catalyst to drive agricultural development. Winrock International (1992) has observed that as intensification of livestock production systems proceed, knowledge on how to profitably incorporate new technologies into farm level production strategies will become more important.

Resource Management

To feed the growing human population, more land will need to be devoted to the cultivation of food and cash crops, and this being a finite resource, there will be a reduction in its availability for pasture and fodder. On the other hand, the increased food and cash crops will make available more crop residues and agro-industrial by-products, many of which represent a very valuable animal feed resources. However, there is need to increase the efficiency of resource utilisation for sustained production. Degradation of

natural resources through deforestation and cultivation on steep slopes and wetlands leading to the drying up of rivers, siltation and reduction of breeding grounds for fish stocks.

The lesson here is that a careful assessment and analysis of the production environment is required in order to come up with livestock development strategies that will lead to better use of local resources, contribute more effectively to food security, improve the living standards of poor farmers and ensure sustainable development of animal agriculture. Sansoucy (1995) has identified the determining factors of this overall strategy as being as follows:

- political support for fair commodity prices and proposed strategies;
- better definition of the target recipients' needs;
- increased efficiency of use and management of natural resources;
- linking of production and post-production components to efficient infrastructure, services and marketing schemes;
- more appropriate policies for the use of common land and rangelands;
- improved capacity and commitment of national and international agricultural centres and non governmental organisations to implement strategies that contribute to development of livestock production within specific agro-ecosystems/eco-regions.

The same author has observed that in livestock production, the overriding considerations are availability and efficient use of local natural resources. A successful livestock development strategy requires the formulation of resource management plans that complement the wider economic, ecological and sociological objectives. Particular attention needs to be given to land use systems and to the natural resources required for improved livestock production. The strategy will also need to consider the social, cultural, political and institutional elements that affect the management of natural resources. On the policy side, issues relating to land use, common property, legislation, price policies, subsidies, levies, national priorities for livestock development and research capacity have to be addressed. Again, the implementation of action programmes requires both technical and institutional support and, equally important, government commitment.

Adequacy of Available Land Resources

The fast growing human population in sub-Saharan Africa while cultivable land is declining, means that increased agricultural production of four percent per annum will have to come from intensification of production from the already cultivated land. Winrock International (1992) has pointed out that the use of fertiliser use in sub-Saharan Africa in 1992 was only 12kg/ha

compared to 60kg/ha in South Asia. If sub-Saharan Africa has to feed its fast growing population, the same report commends increased use of fertilisers, improved seeds, chemicals and development of a commercial feed industry to support increased livestock production.

Policy Constraints

Winrock International (1992) has observed that the livestock sector has probably suffered more than the crop sector from inappropriate government policies.

These have appeared in forms of favouring the urban consumers at the expense of rural producers, excessive regulation, unfair public sector competition with private producers, malfunctioning institutional settings that have limited producers' access to inputs and lack of application of appropriate technologies. The policy of supplying urban consumers (governments' principal political bases) with cheap milk and meat and low payments to farmers have discouraged the growth of local livestock industries.

Other constraints under this subject have included over-valued exchange rates which have encouraged imports of livestock products and discouraged local production and exports. Another factor has been the limited availability of foreign exchange for the purchase of veterinary drugs, feed additives and other essential inputs. The subsidy of livestock imports by donors have also discouraged local production. The direct price controls have harmed local livestock production. They often did not benefit the targeted poor urban consumers.

The direct government involvement in livestock production during the 1960s and 1970s, when government was seen as the engine of development and was believed to be able to supply goods cheaper than the private sector affected the sustainable development of the livestock sector. Monopolistic public sector behaviour led to running of parastatal livestock farms which could not be sustained. There was in addition, excess regulation and overtaxing of livestock owners and these affected livestock development. The provision of free or subsidised animal health services has retarded the development of private veterinary services.

There have been government and traditional institutions that have been slow in adapting to rapidly changing economic and social conditions as population density increased and financial resources declined. For example, the land ownership and management systems of livestock have not changed to cater

for increased livestock and human populations. Communal land ownership for example, has led to overgrazing and mixing of livestock thus making it difficult for disease control and genetic improvement. Supply of services by government have been hampered by increasing staff numbers thus paying salaries at the expense of running costs.

Opportunities to correct policy-related problems, however, are beginning to appear in several countries (Winrock International, 1992). Structural adjustment aimed at a balancing the budget and in long term increasing efficiency of production are being implemented. Calls for privatisation of production activities is being encouraged by international and regional institutions and most governments are accepting them.

Institutional constraints include poor extension systems of transferring technology to farmers and assessing new knowledge from research centres and transferring it to farmers. Similarly, government veterinary services have been inadequate in disease surveillance, vaccine production, epidemic disease control and farm level curative and preventative services and public health. In most countries, all the services except those that are of benefit to the public should be privatised. Farmers should be encouraged to form producer organisations so that they may influence policy, research extension or training that directly affect their welfare. Lack of farmer empowerment is a constraint to development and it can be solved by encouraging them to form producer organisations.

Livestock Production Systems and their potential for development.

The livestock production systems that exist in Eastern and Southern Africa include mixed crop-livestock, pastoral-agro-pastoral, intensive commercial and livestock-wildlife systems. Several variants of each of these systems exist depending on input usage, proximity to market outlets, potential for commercialisation and the species of livestock being used.

In the case of crop-livestock mixed systems, opportunities exist for intensification using appropriate improved technologies depending on agro-ecological zone more than production inputs. Technological packages have to be developed through farming systems research. These will include improved varieties of food and feed crops, forages, legumes, tree crops, improved indigenous and exotic species of livestock management systems.

There will be need also, to develop more effective technology transfer methodologies. The veterinary services to support crop-livestock systems will be more effective if they are based on private enterprises and if

supporting infrastructure such as vaccine production, diagnostic laboratories, markets for drugs, transportation and others are made available (Winrock International,1992). Improved roads could facilitate the delivery of cheap and efficient artificial insemination service using room temperature or frozen semen. Above all, the government policies should change and become more supportive to agriculture through provision of an enabling environment for free markets, conducive price policies and land tenure system.

The pastoral and agro-pastoral systems can be made more productive if systems of management of water and land could be made favourable for livestock production enterprises. There is need to initiate land use rights for livestock keepers. Efficient methods of animal disease delivery system is also needed. The use of private veterinary services and auxiliaries could be very beneficial. There is need for the farmers' advisory service to monitor the abundance or scarcity of feeds on the rangelands and warn livestock keepers to promptly take steps to mitigate the potential impact of drought.

The intensive commercial systems involving dairy cattle, pigs and poultry are developing as demand for meat, milk and eggs expands. These are normally found in the peri-urban areas. To encourage their development further, feed supply, infrastructure such as roads, good policies and credit are some of the factors which need to be developed. The strategy should be to encourage the production of cheap and ample feeds in the form of feed grains, root crops and oilseeds that are supplied by commercial feed industry. Ranching based on natural and improved pastures is undertaken in all agro-ecological zones. However, in some zones, their existence will decline as the owners will switch to more intensive mixed crop-livestock farming systems.

The wildlife and integrated wildlife - livestock systems are important production systems in Eastern and Southern Africa. Although, they have been popular in the past, their profitability is being questioned, mainly due to lack of markets for game meat. The tendency now, is to have separate ranches for ruminant livestock and for wildlife. For the latter, profitability comes from marketing hunting rights, tourism and meat. There is great potential in exploiting game ranching and integrated wildlife-livestock systems in arid and semi-arid rangelands and the experiences gained in some countries in Eastern and Southern Africa should be used to develop this production system further, and extend it to other parts of sub-Saharan Africa.

A look at the development of the livestock sector - A case of Uganda

Despite the positive contributions and despite the recommendations from various FAO studies and others on how the livestock industries could drive

agricultural economic development, still many countries in Eastern and Southern Africa do not have comprehensive programmes to develop their livestock. Many formal livestock projects in most developing countries have failed to meet their objectives with the result that donors are becoming more reluctant to support such developments (Steinfeld and Mack, 1995). Understanding the complexity of livestock production systems, production factors and processes that affect animal production can be a prerequisite for livestock development.

Uganda has been one of the countries that is attempting to reverse the downward trend in livestock production and low contribution to socio-economic development. Endowed with a good climate for crop and livestock production and a large livestock resource of 5.1 million cattle, 5.7 million goats, 0.97 million sheep, 1.37 million pigs and 21.40 million poultry (compared with a human population of 18.68 million in 1996), the Uganda's policy makers have been alarmed by the fact that per caputa availability of livestock products is still very low (15.2 litres of milk, 3.6kg of meat) compared with FAO recommendations of 200 litres of milk and 50kg of meat.

To spur socio-economic development, the Government of Uganda realised that it had to develop a macro-economic strategy designed to lay a basis for creating an independent, integrated and a self-sustaining economy. This strategy aims at ensuring sustainable development by focussing on the mobilisation of resources for investment. It also aims at lowering the rate of inflation, encouraging private investors in most sectors of the economy, divestifying exports, having realistic foreign exchange rates, removing trade bureaucracy, ending market monopolies and reforming and simplifying taxation.

In 1991, the government with the support of the Danish International Development Assistance (DANIDA), commissioned a study to come up with a Master Plan to develop the Dairy Sector. This Master Plan was completed in 1992. It provided for a set of policy reform proposals as well as an investment plan with profiles of proposed projects. One of the projects was concerned with dairy cattle breeding development. It identified the following outputs:

- Development of a National Dairy Cattle Breeding Policy.
- Improve marketing communication system for supply of breeding stock.
- Improved delivery of government and private Artificial Insemination services.

- Lay foundation for privatisation of Artificial Insemination service.
- Train farmers in heat detection so that they may reduce number of inseminations per conception and reduce average interval between calvings.
- Train farmers on values of forming Farmers' Livestock Breeding Associations and Breed Societies so that they may participate in livestock improvement.
- Introduce a farmer friendly Herd Recording system for farm management and livestock selection purposes.
- Train staff in modern livestock breeding technologies.

The National Cattle Breeding Policy Document has been prepared. Recently, it was expanded and renamed the ***National Animal Breeding Policy*** after strategies for the improvement of other farm animals were included. ***The broad policy objective of the National Animal Breeding Policy is to "attain a sustainable increase in the productivity of Farm Animals to ensure national food security and socio-economic development while conserving the natural resource endowment".*** The primary aim of the national programme for animal genetic improvement is to provide guidelines to farmers, investors, researchers, extension workers and civic leaders on various suitable breeds for various agro-ecological zones and production systems; alternative breeding programmes; import and export and trade in genetic materials; ***breeding and management systems for conservation and sustainable use of indigenous genetic resources*** and the use of modern breeding technologies in the country.

Priority areas for research and development have been identified and the legal and institutional framework (including sources of funding for the breeding programme) required for implementation of the policy, ***within the privatisation, liberalisation and decentralised democratic principles adopted by the government have been articulated. An Action Plan for the implementation of the policy*** has also been prepared. It identifies start-up activities such as sensitisation of all stakeholders on need for animal breeding policy for a sustainable increase in productivity of farm animals, importance of forming animal breeders' associations and breed societies, usefulness of herd recording, legal, institutional and policy reforms needed, corrective measures to be taken, capacity building and stakeholder facilitation mechanisms required and a profile of projects for which investment is needed.

In addition, ***an Animal Breeding Bill*** has been prepared to provide for the legal framework for implementing the policy and to provide for regulation and control, marketing, import and export and quality assurance of animal genetic

materials and to provide guidelines on appropriate breeding strategies for various situations and to various stakeholders.

The conducive government policy of providing an enabling environment for the private sector to operate while ensuring a basic standard of living for all by providing essential services which are not available to everybody through the market, and trying to maximise the effectiveness of government by improving productivity and accountability of the public sector is paying dividends. Already, the economy is growing at 8 percent per annum. Milk production is estimated at 570 million litres per annum in 1996 compared to 400 litres in 1990.

Conclusions

The World Bank and FAO have recommended that agricultural production including livestock production must grow at four percent per annum if it has to provide adequate nutrition to the human population which is growing at 2.8 percent per annum in all regions of sub-Saharan Africa. Feed availability to livestock and at affordable costs will be crucial factors in determining whether the target in animal production is reached. Improvement in the control of livestock diseases has also a high potential for increasing livestock production. Maintaining effective disease surveillance and control by having effective diagnostic capacities, together with adequate vaccine production or supply facilities and functional veterinary services will be of great importance in reducing disease constraints to animal agriculture in the region. In this regard, the privatisation of veterinary services which has started in most countries should be speeded up and care should be taken to see that while this is being implemented, the provision of services to livestock producers is not disrupted. Animal breeding policies to guide investors, even small scale livestock producers in commercial livestock production enterprises should be formulated. The genetic improvement of traits of economic importance in indigenous breeds of livestock should be given high priority. These breeds or breed types exist in large numbers in most countries in the region, and a small increment in productivity per animal per annum will lead to a collectively large volume of products in the country or region. Policy constraints which have hampered the development of the livestock sector in most countries in the region are being removed in some countries. In others, resistance to reversing the policies still exists. Removing subsidies, privatisation of livestock enterprises including most services for which farmers can pay should be undertaken. The governments should concentrate on improving infrastructure which can lead to improved marketing of livestock, setting regulations, standards and public health issues. Livestock research and extension have also been very weak in most countries in the region. Public involvement in supporting research and extension is an equity issue.

Therefore, efforts must be made to ensure that effective research and extension systems are in place and that they are responding to producers' needs. Governments in the region have in the past contributed funds for running research and extension programmes without involving producers. If the latter are organised in "specialist" producer groups, such as livestock breeding associations or breed societies, they will be able to meet some of the costs. The energy to drive the livestock production system toward ever higher levels of productivity is best provided by incentives to farmers awarded by the market functioning in a policy environment supportive of agriculture (FAO, 1986 and World Bank 1989 quoted by Winrock International, 1992)".

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MARKETS: MARKETING LIVESTOCK AND ANIMAL PRODUCTION IN SOUTHERN AFRICA [1]

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1.0 INTRODUCTION:

In SADC region, agriculture contributes 20% to GDP and of this, 38% comes from livestock. Like the rest of Africa, agriculture is the biggest industry in SADC countries employing 60-80% of the rural people. Livestock management is predominately extensive in most of SADC countries, and livestock depends mostly on natural range.

As a region, SADC is endowed with livestock resources comprising 41 million cattle, 37 million sheep, 22 million goats, 4 million pigs, 149 million poultry and 2 million equines. Other farm animals found in the region include water buffaloes, farmed ostriches and deers. Inspite of the large livestock resources in the region, SADC is a net importer of animal and animal products, and trade among SADC countries remains very low. Against this background, however, some SADC countries have acceptable animal disease control infrastructure and produce surplus beef and other livestock products for export. The majority of the countries in SADC produce only to fulfil their domestic markets.

2.0. *Marketing Situation in Southern Africa*

Market situations in Southern Africa differ from one country to another and from one commodity to the other. The underlining factors are the economic situation in each country and the animal disease situation prevailing thereof.

2.1. *Beef and Live Cattle*

Botswana, Namibia, Swaziland and Zimbabwe produce surplus beef for export to the European Union and South Africa, where beef markets are available. These countries also have acceptable animal disease control infrastructure for management of diseases which are obstacles to trade. For the most part, these countries are unable to fulfil the European beef quotas.

Regional markets available are in South Africa, Mozambique and Angola. Processed beef has other markets besides those mentioned above.

Live animal cross-border trade (formal or informal) exists between Angola and

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[1] This paper only gives general picture of livestock markets in the SADC region because it was written one night without references and proper study.

Namibia and Zambia, also between Tanzania to Malawi and Zambia, Namibia to South Africa.

2.2 *Breeding Stock and Genetic Materials*

Significant breeding stock trade exists between South Africa and its neighbours and also between Zimbabwe, Malawi and Mozambique. Many SADC countries import breeding animals, especially dairy animals and genetic materials outside the region.

2.3 *Pork Production*

Only South Africa and Zimbabwe are self sufficient in pork production. These countries also produce surplus pork for export to the region although deficits still remain. In fact many SADC countries including South Africa import pork from European and other overseas countries.

2.4 *Poultry Production*

Again South Africa and Zimbabwe are the only two SADC countries producing surplus poultry and poultry products for export to the region. Poultry production is an emerging business in many SADC countries and many small scale farmers are involved in the business albeit difficulties in acquiring feeds. This is one of the most promising industry in the region and many SADC governments have incentives for poultry production, including egg production.

2.5 *Milk and other Dairy Products*

Again South Africa and Zimbabwe are self-sufficient in milk production. All other SADC countries have deficits in milk production and depends on imports of UVF milk from European and other parts of the world. As regards milk products, almost all SADC countries import significant amounts of these products.

Dairy farming is also an emerging business in SADC countries and large numbers of breeding animals are imported into the region. Artificial insemmination programmes are also practised in the region to compliment deficits in breeding animals. Several donor assisted small dairy development projects are being implemented in the region. In many SADC countries, lack of milk marketing infrastructure is the biggest obstacle in the development of this industry.

2.6 *Wildlife Farming*

This is an emerging business in several SADC countries, but remains largely an

elite business for the rich. An investment in this industry is necessary to widely publicise it to rural ommunities.

2.7 Hides and Skins

In many SADC countries, hides and skins are sold as sun dried in countries where no formal slaughter takes place. Marketing of hides and skins is hampered by lack of proper slaughter facilities and hides marketing infrastructures. In fact hides and skins are some of the most wasted commodities in the region and are of very poor qualities due to lack of proper management.

3.0 CONSTRAINTS TO LIVESTOCK MARKETING IN SADC REGION

a) Animal Diseases - Presence of major animal diseases in many SADC countries render their animal and animal products unavailable for marketing. At least two countries with large livestock populations in the region have major diseases as well.

b) Lack of market information - information on available commodities, quantities available, and location is not easily available.

c) Lack of marketing infrastructures - In many SADC countries, livestock marketing is not organised.

d) Price manipulations and interferences

e) Trade tariffs

f) Dumping of cheap livestock commodities from overseas

4.0 SUGGESTED SOLUTIONS TO MARKETING CONSTRAINTS

Livestock market problems can be resolved by dealing with constraints. Many of these constraints can be solved by applying a regional approach. Changing national policies to recognise livestock industry as an important industry to rural development and food security. More involvement should be put in animal diseases, livestock development and marketing infrastructure.

5.0 PROSPECTS FOR THE FUTURE

SADC region has plenty of livestock resources with well organised beef

marketing system. With investment in animal health, SADC can become self-sufficient in animal and animal products. While reasonable markets exists in the region and beyond, studies on livestock markets can open new opportunities.

6.0 CONCLUSION

Investment in animal diseases will open new opportunities for SADC countries with plenty of livestock resources and as yet are not exporting. A regional study on markets will open new opportunities for the region.

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Interactions between land-use policies, livestock farming systems and environment management

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Abstract

The human population is increasing, the proportion of people living in urban areas in East and Southern Africa is increasing, generating an increasing demand for livestock products. Earlier attempts at policy interventions to increase the offtake of livestock products were not always successful and some had a negative impact on the environment. However, increasing collaboration between animal and social scientists in recent years has led to a better understanding of the rationale underlying traditional grazing and mixed crop/livestock systems, which can make a significant contribution to the policy debate. The analysis undertaken highlights issues for consideration in extensive, mixed and intensive livestock systems, recognising that the effects of agro-ecological zones and the economic environment will also modify the policies prior to implementation. For intensive systems, environmental controls are essential in the longer-term and technical options to minimise adverse effects already exist. It is also recognised that the general trend to globalisation means that livestock policies should be integrated into national agricultural strategies and these need to take account of international trade agreements.

Introduction

Traditional livestock farmers generally have a sound appreciation of the implications of the interactions between farming and land-use within their local environment. However, increased pressures on land-use and increasing demand for livestock products mean that traditional husbandry methods will need to be modified, if future demand is to be met. Attempts to implement technologies for more intensive production from the developed, temperate world have often been unsuccessful due to a failure to appreciate the complexity of systems developed over centuries by pastoralists and sedentary farmers, not the least of which are the patterns of access to, and use of, land resources. Better understanding of these issues must be incorporated into livestock development planning to increase productivity in the future, without long-term damage to the natural resources which support livestock systems.

The authors recognise that livestock development and land-use policy will only be effective in the context of a favourable, wider policy environment including aspects of macro-economic policy, pricing and trade policy, environment policy and infrastructure and services development. These issues are touched on briefly in this paper but we have been asked to concentrate on issues relating to land-use policy, defined here as including land-use planning and management as well as land tenure issues. A diverse range of important questions are thus raised, including Common Property Resource (CPR) tenure and management; questions of shared or multiple-use of land resources across sectors such as livestock and wildlife; issues of demarcation (registration) of land; the importance of off-farm land resources to sustain mixed farming systems; and land-use planning for co-ordinated development of urban and peri-urban production systems with appropriate

environmental protection. The challenge is how to develop the right mix of policies to promote the desired balance of increased agricultural production, sustainable resource use, environmental protection, and equitable development. Similar concerns were raised following FAO World Food Summit in 1996 and hence this seminar.

This paper aims to highlight key issues which could inform the debate on appropriate policies to foster the development of livestock production in the region, recognising that policy requirements and priorities differ between livestock systems and agro-ecological zones. It will do this by reviewing recent trends in livestock systems and land use, by highlighting lessons which can be learnt from past successes and failures of land-use policies, and by considering their impact on the environment, as a prelude to identifying key policy options.

Trends in livestock production systems and land-use

In the recently published, multi-donor funded Livestock and the Environment study (de Haan, Steinfeld and Blackburn (1997), and Sere and Steinfeld 1996) livestock production systems were broadly defined as land-based systems (grazing and mixed farming systems) and landless systems. Grazing systems were defined by Sere and Steinfeld (1996) as 'solely livestock systems in which > 10% of the dry matter (DM) fed to animals is farm produced and in which annual average stocking rates are <10 Livestock Units (LU) per ha of agricultural land'. In keeping with the objectives of this paper, these will be referred to as 'Extensive land-use systems'. Mixed farming systems were defined by Sere and Steinfeld (1996) as 'systems in which >10% of the DM fed to animals comes from crop by-products, stubble or > 10% of the total value of production comes from non-livestock farming activities'. Sere and Steinfeld's third category was termed landless systems, in which <10% of the DM fed to animals is farm produced and in which the average annual stocking rates are >10 LU/ha agricultural land'. These systems will be referred to here as 'Intensive land-use systems'. This categorisation of systems is particularly appropriate when discussing land-use issues since, although they are varied in nature and occur across the many different agro-ecological zones of the South and East African region, some of the land-use implications, environmental impacts and policy issues are common within each group.

Recent trends within these systems in response to changing internal and external environments are summarised below.

Extensive land-use systems

The nature of grazing systems (and land-use requirements) varies greatly between agro-ecological zones from the extensive 'disequilibrial' systems of arid areas to the more stable 'equilibrial' systems of the sub-humid, humid and temperate highland zones. Across these zones, the systems encompass pastoralism in arid areas to agro-pastoralism and ranching in semi-arid and more humid areas. They are largely based on natural rangelands and pastures, though with some improved, more managed, pastures in more stable environments.

The major land-use issues and trends in these systems concern the tenure and

in multiple use of rangelands, and the difficulties of ranching development. Pastoralism and traditional range tenure and management systems are under pressure from a variety of sources. Human and livestock populations continue to grow, though more slowly than in other zones and production systems. At the same time, competition with encroaching agricultural settlement (often taking key niche resources), policies for settlement of pastoralists, trends to privatisation (*de jure* or de *facto*) of range resources for individually owned herds (eg by private water development or ranch development), and increasing competition with wildlife and demarcation of habitat reserves in some areas have led to the gradual reduction of land available for transhumance systems.

These trends tend to have restricted movement and flexibility in pastoral management, and to have increased year-round grazing pressures. Changes have also occurred in the species mix of livestock held by pastoralists (such as the increased holdings of camels and goats in N Kenya and goats in several Southern African countries). Consequent changes in range conditions have undoubtedly occurred, though whether they constitute degradation is still open to debate in some cases (Abel and Blaikie 1989, de Querioz 1993, Dougill and Cox 1995, Perkins and Thomas 1993, and de Haan et al 1997). There are also concerns that such pressures have led to increased sensitivity of pastoral systems to drought, with larger impacts of drought on livestock and livelihoods. The same pressures, together with other local political developments, have led to some weakening of traditional pastoral institutions, with trends towards more open access systems with less customary control and management (Niamir, 1991, Vedeld 1992).

Grazing systems in more humid areas are under similar pressures but here the main trends are for competition with agricultural land development in populated areas, and for competition and/or integration with wildlife and other uses of rangelands. Bush encroachment in increasingly intensively grazed areas is a common phenomenon in many parts of semi-arid to sub-humid Africa (Caesar 1992, Dougill and Cox 1995). Development in these areas is also restricted by tsetse and tick-borne disease. While land-use induced changes in habitats and infestations occur spontaneously in settled areas, there are many other areas where grazing animals are more exposed to disease as they are forced into the fringes of infested areas.

Mixed farming systems

Mixed farming systems are the most important agricultural systems in most of SSA, in terms of the numbers of people involved, the areas of land occupied and the total outputs of livestock products (Table 1). Small-holder systems are particularly important, being the common basis of subsistence but also with potential for intensification and commercialisation. These farms range from the very small holdings of less than 0.5 ha in more favourable sub-humid and highland areas of Rwanda, Burundi, W and C Kenya, and Kilimanjaro in Tanzania to larger more extensive systems in semi-arid and sub-humid areas. They are characterised by the more or less close integration of livestock and crops, especially for the provision of draught power and manure, and the use of crop residues for livestock feed.

Table 1 Total production of livestock products by different production systems in Sub Saharan Africa (1)

Commodity	Overall '000 MT	Extensive land-use '000MT (%)	Mixed systems '000MT (%)	Intensive land-use '000MT (%)
Beef	2242	1390 (62)	852 (38)	0
Sheep + goat meat	924	390 (42)	534 (58)	0
Milk	13227	9827(74)	3400 (26)	0
Pig meat	511	104 (20)	329 (65)	78 (15)
Poultry meat	854	214 (25)	391 (46)	249 (29)
Eggs	808	165 (20)	397 (49)	246 (30)

1. Sources: Sere and Steinfeld (1996), de Haan et al (1997)

Land-use issues and trends in these systems are driven by demographic pressures and resulting land-use change and intensification. As pressures increase, off-farm resources are converted to cropland, farm holdings decrease in size, the options for grazing livestock decline, small ruminants may replace cattle and ultimately livestock holdings may be reduced. In favourable circumstances, livestock and cropping systems may intensify based on on-farm fodder crops, as in the dairy systems with Napier grass and/or tree fodders in C and W Kenya and Malawi, and on stall-feeding systems (Ehui, Shapiro and Yapi-Gnaore, 1996).

In more extensive semi-arid systems, land-use pressure, though currently lower, is increasing rapidly with population growth and with in-migration from over-populated highlands and high potential areas (such as arid and semi-arid parts of Kenya). In such areas, agricultural land settlement means a loss of off-farm grazing and woodland resources and greater pressures on remaining resources. At the same time, problems of reduced integration and greater conflict may be emerging at the interface between pastoralists and agriculturalists (resulting in less access for visiting herds to use residue feeds and less manure for croplands). Issues of the management of CPRs are thus of particular importance.

Intensive land-use systems

These systems incorporate most urban and peri-urban livestock units, but the term 'intensive' avoids having to define what constitutes 'peri-urban'. Such high intensity land-use systems are in the ascendancy, globally, with key characteristics being distance from feed supply and usually proximity to a market for livestock products. Ellis & Sumberg (1997) reviewing food production and policy in urban areas, highlighted the impact of structural adjustment programmes on declining exchange rates, which in turn have led to increased prices of imported food and hence increased local production. Production of poultry products in intensive systems (Table 2) is thus growing faster than the increases in rates of production from mixed and extensive land-use systems (<5%/year), and on a par with growth in pigmeat production from mixed, rainfed systems.

Table 2 Current production of livestock products in Intensive land-use systems in SSA and annual growth rates (1981/83-1993/94) 1.

	Production ('000 MT)	Production (% share in SSA)	Annual growth rate(%)
Pork			9.2
&	327	24	
Poultry meat			6.7
Eggs	246	30	6.2

1. Sources: Sere and Steinfeld (1996), de Haan et al (1997)

In terms of population, urban production is more important than often realised, eg one third of households in Harare keep livestock (ENDA-ZW 1994), 17% of households in six major cities in Kenya (Lee-Smith and Memon 1994) and 5% of households in Cairo rear livestock (Khouri-Dagher 1987), while in terms of production, e.g. in Dar es Salaam, 16% of milk supplies in Dar es Salaam are produced from urban sources (Kurwijila et al 1995).

Peri-urban production systems include larger scale commercial and intensive enterprises, the latter characterised by specialisation, intensive market oriented enterprises, eg poultry, pigs, and milk and some beef feedlot systems; largely divorced from the land resources they use. Intensive pig and poultry systems are generally located near centres of consumption, since transport of concentrate feeds is cheaper than that of live animals or of refrigerated livestock products, but the situation for ruminants is different, due to the bulkier nature of their natural diet. Where demand is high and no infrastructure for the processing of milk exists, its short shelf life will result in lactating cows being kept in urban areas, while dry cows and beef cattle may be located closer to a source of forage. There are pressures to intensify in industrial systems, because of the high costs of land and the need, therefore, to extract a high return, together with the opportunities for taking advantage of economies of scale in animal housing, input supplies, feed preparation and skilled management, resulting in the development of large scale operations.

There is great scope for increased productivity (per livestock unit) and efficiency of feed use in intensive production systems. Trends for further expansion of industrial systems in SSA are now likely with the restoration of modest per capita income growth, privatisation and restructuring. One trend noted by Ellis and Sumberg (1997) is that of civil servants buying plots of urban land to produce food to compensate for the declining purchasing power of their income. Increasing population pressure and land costs in urban areas may lead to a shift from small-scale urban, to large scale peri-urban operations, but with potentially negative environmental consequences.

Lessons to be learnt from existing policies and their impacts on livestock production

The introduction of policies to try to control or facilitate these trends is not new and lessons can be learnt from studying the reasons for successes and failures in each system.

Extensive land-use systems

Within arid to semi-arid zones, understanding of the ecology, sociology and operation of pastoral systems has developed markedly in the last 15 years (Sandford 1983, Behnke, Scoones and Kerven 1993) and is leading to renewed development of policy initiatives (Behnke and Kerven 1994, de Haan et al 1997). Critical features of this understanding include renewed recognition of:

- the great variability of the climate and vegetation base in arid areas, and of the driving role of this variability in controlling stock numbers and fluctuations;
- the consequent benefits to be derived from allowing freedom of livestock movements to access key niche or patch resources, eg valley lowlands and floodplains for dry season and drought grazing, and water resources;
- the resilience of some rangelands to climate and grazing variability (depending on soil types and land forms);
- the need to reassess the scenario of the 'tragedy of the commons', recognising the nature of customary land rights and the roles of traditional pastoralist institutions and communities in control of access to, and management of, CPRs;
- the differentiation of the variable 'disequilibrial' range environments and the more stable 'equilibrial' areas where stocking densities and grazing systems have more impact on vegetation conditions and ranch-based production systems may be feasible.

Together with this reassessment has come the evaluation of the lessons of past project interventions (Gilles and de Haan 1994). For the arid and semi-arid areas it is now clear that many of the assumptions of range degradation and the need for more formalised land tenure to promote improved rangeland management were not universally valid. Inappropriate ranch development and settlement led to declining range conditions in some cases and financial failure of some developments. Tenure revisions such as nationalization of rangelands, group ranches and grazing blocks may have had some advantages in provision of services (such as water development, livestock services), but with the disadvantages of restriction of grazing movements and undermining of traditional social structures, local customary tenure and CPR management systems (Oxby 1982, Gilles and de Haan 1994, Swift and Toulmin 1993).

Similarly, destocking policies, frequently advocated but rarely successfully implemented in the past, are now seen to be unnecessary in the self-regulating circumstances of the more drought prone areas, and shown to have been based on misunderstandings of pastoralist herd production objectives which are more oriented to milk production, security (or risk limitation) and some livestock sales, rather than to beef production and high offtake rates. Many inappropriate range management interventions have also been promoted in the past. Thus, bans on burning practices, bans on livestock movement, and the imposition of rotational grazing systems (as in grazing blocks) have often had adverse rather than beneficial effects, or have not been implemented by pastoralists. More

complex rotational grazing systems have rarely justified their costs in management or fencing (even in defined communal areas such as in Zimbabwe, Cousins 1992).

Other policy trends impacting on livestock production in extensive land-use systems include the increasing recognition of the multiple roles and potential alternative (non-livestock) outputs of rangelands. Thus, wider environmental interests such as the preservation of wildlife and habitat biodiversity, the exploitation of veld products, and the interests of indigenous and minority populations have come to the fore. Livestock production can co-exist with many of these interests; many private ranch systems in semi-arid areas of Zimbabwe, Botswana and S Africa include wildlife harvesting and game viewing, with both economic and ecological benefits where wildlife resources are adequate (see Arntzen 1994 and Kreuter and Workman 1994 for Botswana and Zimbabwe respectively), and community-based wildlife management has been successfully introduced in communal areas (Arntzen 1994), though with a number of CPR issues still to be resolved (Murombedzi 1991). Pressures for such multiple use and wider access to resources will grow and will need to be accommodated in future planning and management.

Mixed farming systems

The main land-use policies impacting on livestock production in mixed farming systems concern the protection and management of off-farm resources (including CPRs), the continued demarcation of agricultural land and the impacts of traditional land tenure systems in encouraging subdivision and fragmentation of holdings. In tsetse affected sub-humid areas, additional impacts of tsetse control and land settlement policies have been noted. However, livestock production in mixed farming systems is particularly dependent on a range of other general economic and sectoral policies affecting markets, product prices, input costs and supplies and other factors influencing agricultural development.

Under adverse policy conditions a spiral of degradation of resources and productivity can occur due to human population increase, subdivision and fragmentation of land holdings, loss of grazing land, reduction of livestock holdings, reduced soil fertility, increased intensity of cultivation and soil erosion (such as has happened in parts of Rwanda, de Haan et al 1997). Under favourable conditions, especially with market access and input supplies, mixed systems including livestock can generate cash surpluses to invest in soil and water conservation and inputs to sustain fertility and raise productivity (as in the case of Machakos in Kenya, Tiffen & Mortimore 1994). Other important contributing factors to such development may be the role of land tenure reform in providing the security and incentives for investment (though the influence of this is debated, see Harbeson 1985, Barrows and Roth 1989).

The protection and management of CPRs in mixed farming systems has received much less attention than in pastoral areas, particularly where settlement and in-migration has altered local social structures and institutions. In many of these areas, CPRs become open access unmanaged resources prone to degradation from both grazing and fuel wood collection. Improved management of these resources requires strong local institutions and clear establishment of rights within and between communities.

The most important general policy issues affecting livestock production in mixed systems have been market access for product sales, price controls and input subsidisation. Increased livestock production is often dependent on access to markets and to support services and input supplies. In mixed farming systems, the balance of support given to crops and livestock can be important; increased subsidy to inorganic fertilizer or mechanisation inputs, or price support to cash crop production, may adversely affect the value of manure and draught power contributions, and the opportunities for growing fodder crops on-farm, with impacts on longer term sustainability and the maintenance of livestock in systems (de Haan et al 1997).

Intensive land-use systems

The commercial nature of these systems and their potential to meet urban demand, makes them of particular interest to policy makers. Policies can include land-use issues such as zoning, and indeed livestock are theoretically banned in many urban centres, but this is often ignored, leading to the lack of official services and support in some cases (Waters-Bayer 1996). As urban populations become wealthier and more health conscious, the pressures may grow for the removal of livestock, at least from the most densely populated urban centres, as has happened in developed world cities. However, as discussed earlier, the increasing demand for livestock products and the decreasing availability of land will combine to provide market incentives for more intensive, peri-urban systems. For such systems, there are many lessons to be learnt from developed country systems, particularly in relation to waste disposal issues.

Land-use policies for zoning or limiting concentrations of production, and policies to control waste disposal are generally not yet well developed in SSA. There is a tendency for unplanned development in response to markets, infrastructure and economic circumstances, e.g. poor roads and no cold chains, encourages the concentration of production. The lack of legal frameworks and technical services to monitor and control waste discharges can lead to pollution and increased health risks. Many European countries now have laws relating to the disposal of manure and other pollutants such as silage effluent and fines are imposed for pollution of water courses.

In developing countries, existing policies which have a major impact on intensive systems include subsidies on imported inputs, such as equipment, breeding stock, veterinary pharmaceuticals and feed supplements, have had an impact on the economics of these systems. They are also more susceptible to international trade agreements than less intensive systems and local policies thus have to be viewed in that context (Ehui, Shapiro and Yapi-Gnaore 1996).

In the UK, the introduction of quotas on milk production led to a decreased reliance on concentrate feeds, with a move back towards extensive systems. This move is being supported by government through a change in research emphasis towards programmes to improve the efficiency of forage-based systems. In SSA, this may translate into pressures to improve the efficiency of use of available by-product feeds (eg brewers grains, food processing wastes) but it is unlikely that the demand for livestock products can be met without also increasing the use of cereals for livestock feed. Thus, national planning of livestock policies should be closely integrated into national agricultural strategies.

Environmental impacts of current policies and trends

Extensive land-use systems

Great controversy has surrounded the question of the environmental impacts of grazing systems (as noted above). Impacts are certainly site-specific, depending on a variety of local circumstances, so generalisations are dangerous. In arid and semi-arid areas, some of the trends for restricted access to grazing lands, and reduced flexibility in operation of grazing systems may have resulted in greater stocking densities and year-round grazing pressures leading to changes in range conditions. Such changes are indeed widespread, including reductions in ground vegetation cover, increased soil erosion, changes of vegetation species composition to less palatable species, the switch from perennial to annual grasses and increased bush density in some circumstances.

Much debate has focused recently on the extent to which this is reversible change; in disequilibrial areas evidence suggests that changes may be most dependent on climate and weather fluctuations and largely reversible (see de Haan et al 1997). Some changes are nevertheless costly to reverse in practice (even if only in organisation and management, such as burning regimes to control bush encroachment). Notably, though, in many of these areas overall trends for livestock populations continue to rise and there is little evidence of widespread reductions in secondary (livestock) productivity, at least as measured in local multiple product and subsistence terms (Abel and Blaikie 1989).

Some livestock development in rangelands has certainly impacted on habitats and wildlife in the past. In particular, fenced ranching, the proliferation of disease control cordon fencing in many countries of S African, and the pressures leading to demarcation and fencing of habitat and wildlife reserves have resulted in the loss of large wildlife populations, especially of migratory grazing animals (Taylor and Martin 1987) and in range degradation in restricted wildlife areas in some instances.

Debate has also focused on the definition of degradation of rangelands. While at one level the definition needs to encompass aspects of the basic potential of soils and vegetation, and in these terms perhaps little degradation has occurred, it may also need to include aspects of current utility for the output objectives and resource requirements of users. Thus bush encroachment may or may not constitute degradation depending on the mix of livestock and/or wildlife utilisation objectives. Further work is required on these definitions, and the subsequent identification of indicators of changes significant for both long-term resource potential and for feasible shorter-term management.

Mixed farming systems

The chief livestock-related environmental impacts in small-holder mixed farming systems concern soil conditions in croplands and the conditions of off-farm CPRs. Under the adverse spiral of degradation in mixed farming, as described above, impacts on soils mainly concern the reduction of organic matter and fertility, leading to other important changes in water holding capacity, pH and cation exchange capacity, and susceptibility to erosion. Erosion rates in SSA average 30-40 tonnes/ha/year and may reach 100 tonnes/ha/year on poorly managed slopes, compared with soil formation rates of 1 tonne/ha/year (Pimental et al 1995). Fertility loss generally increases as the ratio of

occurred with a ratio of 13-50 ha grazing/ha cropland compared to annual losses of over 100 kg N/ha in the Ethiopian highlands with 0.25 ha grazing/ha cropland (Williams et al 1995 cited in de Haan et al 1997).

Impacts on the remaining off-farm CPRs include some of those noted in rangelands. The generally greater year-round grazing pressures, however, and the added pressures of fuel wood collection result in greater evidence of degradation, including vegetation destruction, soil erosion and severe habitat change and impacts on wildlife.

Intensive land-use systems

There are both direct and indirect environmental impacts of industrial systems. Direct effects arise from the production of wastes: dung and urine which can lead to contamination of the surrounding soil and water courses with nitrates, phosphates and/or heavy metals, although one positive effect is that more intensive ruminant production with a higher proportion of concentrates in the diet reduces methane production. There are also potential problems of environmental health, noise, smell, disease (zoonoses and bacterial contamination of water supplies) and uncontrolled urban livestock cause additional impacts, such as damage to property, pests and disease (rats, mosquitoes etc), conflicts with other residents and road accidents or congestion from wandering livestock. In the most extreme cases in densely populated areas there may be pressures for complete bans on certain forms of production, as with pig production in Singapore.

Indirect effects or 'external' environmental impacts, arise from the production of fodder and concentrate feeds on separate land. These may result from expansion of cultivation into fragile areas (excessive cultivation of downlands in UK, soil erosion in USA, soil erosion and fertility loss from hillside cultivation of feed cassava in Thailand - see Hendy et al 1995); excessive intensification and application of inputs (pesticides, inorganic fertilizers, impacts on biodiversity of plants, insects, birds and other wildlife), landscape and amenity changes, removal of habitats (eg woodlands, hedges), as has happened in W Europe, USA and rapidly developing countries (eg Brazil and Mexico). However, environmental impacts can be greatly reduced by low-input agricultural methods with little restriction of yields, and appropriate land-use and environmental protection policies.

Future policy issues and approaches

This section highlights key issues which merit consideration by policy makers, building on the review and analysis in the preceding sections. A very brief checklist is presented in Table 3.

Extensive land-use systems

The recognition that arid rangelands are more resilient against grazing pressures than previously thought, should lead to greater emphasis being placed on questions of access to resources, the provision of necessary support services, drought contingency planning, and livelihood security of pastoralists, than previously. Planning of World Bank range livestock projects is increasingly incorporating these priorities following earlier project failures (see analysis of Gilles and de Haan 1994 and commentaries by Vedeld, Sihm, Bourn and Herlocker 1994).

The management of access to resources is still a critical and complex issue, however, with the need to recognise the importance of a wide variety of customary rights traditionally held or shared by pastoral groups (for seasonal grazing areas, drought emergency access, rights of transit, access to key niche resources). These rights need to be supported rather than undermined by legal tenure regulations (eg with regard to cropland development, or privatisation of rangelands or water resources). Rights need to be vested in groups of range users with the flexibility to accommodate and build on local customary management practices but combining sensitive technical support for further development. Pastoral Associations are seen as potentially useful institutions for such purposes (Swift and Toulmin 1992; Behnke 1994; Gilles and de Haan 1994), though they should be genuinely inclusive of all users and have sufficient authority over resources and management.

Table 3 Summary of key policy issues for each type of livestock system

Extensive land-use systems
- control of access and management of resources;
- integrated lad-use planning;
- support for pastoralist institutional development;
- technical support, e.g. resource monitoring;
- infrastructure support, e.g. access to water;
- marketing services responsive to climatic variation.

Mixed systems
- access to and management of off-farm resources;
- tenure reform, with incentives for investment in sustainable land resources;
- technical support, e.g. alternative feed sources;
- consistent pricing and input subsidisation policies;
- disease control, e.g.tsetse.

Intensive land-use systems
- land-use planning/zoning;
- environmental controls and incentives;
- technical support, e.g. information on efficient use of feeds;
- pricing and input subsidisation policies taking account of international agreements;
- inter-sectoral planning of land use, e.g. with respect to by-product availability;
- disease control and public health protection.

Given the complexity of the many overlapping and site-specific local rights, statutory tenure arrangements may be too rigid and too rapidly outdated to be feasible; rather governments might set the framework for procedural law to establish institutions, methods and fora for agreeing rights and settling conflicts (see Shanmugaratnan et al 1992, Bonfiglioli and Watson 1993 and Vedeld et al 1994). Issues of access and management may need to be discussed at the levels of associations sharing seasonal resources, amongst groups of associations sharing more broadly accessed resources (eg niche or drought refuge grazing), and within the context of wider district land tenure

for more settled agro-pastoralists in semi-arid conditions such as in Zimbabwe (Cousins 1992) and Botswana (Abel and Blaikie 1989).

At the technical level there is a need to provide better support to pastoralists' institutions. Planning and extension services must improve their understanding of the operation of local grazing systems, including recognition of seasonal and niche resources, requirements for movement, and the condition and trend of resources (using monitoring methods as discussed below). Improved provision of range services such as water supplies and fencing (eg for disease control or protection of cropping) should be planned within the context of this land-use understanding, and with full participation of pastoralist communities. Range management interventions should first involve issues of access, as noted above, secondly support to seasonal grazing systems, traditional deferred grazing practices and drought reserves, and subsequently approaches to solving agreed local problems such as bush encroachment or other forms of degradation. Marketing services may need to be more oriented to supporting the periodic emergency removal of animals from the ranges, and restocking (including provision of draught power in agro-pastoral areas), as well as recognising the importance of commercial beef marketing where this is appropriate. Other elements of drought contingency planning need to be developed and more institutionalised. Veterinary and other livestock extension services still need to be made more accessible and relevant to the needs of herders (with issues of cost recovery, privatisation, and paravet training and support).

Land-use planning for pastoral zones should be co-ordinated with other policy areas to be effective, in particular with agricultural settlement and land demarcation policy, especially in the fringes of the pastoral areas and for the development of settled agriculture and irrigation in lowlands and valleys within pastoral zones. Land development policy in arid and semi-arid areas also increasingly needs to explicitly include other interests, including those of minority indigenous groups and the poor, the opportunities for multiple uses of land (eg for veld products and non-timber woodland products), better integration of livestock and wildlife management where feasible, and the incorporation of wider environmental objectives in planning and management (conservation of resources, biodiversity and amenity etc).

Finally, better understanding of resource conditions and trends, especially the nature and extent of change or 'degradation' of resources is required. An important contribution to this is the development of resource monitoring methods, with better understanding of range ecology, the definitions and indicators of degradation (from the perception of different range users), improving technical options for remote sensing and GIS-based methods, and with opportunities to include indigenous community knowledge through Rapid Rural Appraisal and similar sociological survey methods.

Policy priorities change in grazing systems in the more stable 'equilibrial' conditions of the sub-humid and humid zones. Key questions here are whether changes in current land-use are desirable; ranching systems are generally aimed at beef production rather than the mixed outputs of partly subsistence-based systems, and are required to be commercial because of the necessary investment and running costs. Issues of the alienation of traditional land-users, the privatisation of resources and impacts on habitats and wildlife

of multiple product systems should not be underestimated (Behnke 1985) and many of these areas may eventually be accessible to mixed farming development.

In areas of limited current exploitation, both the options for and constraints on development may be greater. Options for commercial ranch development may exist where markets for beef (or other ranched animal products) are available, and where the costs of ranch development and operation are not too high. Land allocation by government agencies for such purposes, by private sale or lease, should be accompanied by sound district scale land-use planning to determine appropriate locations for such development (including provision of services such as water supplies and market facilities) and by realistic assessments of land capability, vegetation productivity, stocking rates and livestock productivity to determine feasible scales of operation (as approached by the Government of Botswana in the World Bank financed National Land Management and Livestock Project and GOB/FAO in their programme of Land Use Planning for Sustainable Agricultural Development, Powell 1994).

Constraints to such development include infrastructural, service and financial constraints, especially in less densely populated areas, but also problems of disease, especially tsetse borne trypanosomosis. Tsetse infestation has implications also for the development of mixed farming systems as discussed below. Options for local control of tsetse are now much greater then they were, with improved target, trap and pour-on technologies, but reliance on these methods for large-scale ranching development is still risky. In humid Central and West Africa the use of trypanotolerant cattle is still the preferred option for this type of development.

Mixed systems

These systems have great potential for intensification as well as possibly the greatest risks of resource degradation if poorly managed under pressure. However, given their integrated multi-component nature, mixed farming systems particularly require a mix of policy responses to promote sustainable increased productivity.

From the standpoint of livestock development, the key land-use policy issues in these systems are the access to and management of off-farm resources, the question of the size of land holdings, and the options for improving feed supplies. The recognition of the role of off-farm resources for grazing and tree fodder (as well as many other products supporting mixed farming households) is a prerequisite to better incorporation of questions of rights of access and the development of agreed local CPR management regimes in local land-use planning and tenure reform. The development of local CPR management institutions may be an important component of such planning. The chief threat to these resources is in continued settlement and opening of croplands, with subsequent demarcation and registration, a process which is clearly inevitable in many areas. However, the requirements for off-farm resources differ markedly between agro-ecological zones and may change as mixed farming systems intensify so that flexibility and local understanding of land-resource needs will be required in land planning and tenure revision programmes.

In higher potential areas with high population densities, as off-farm resources are virtually

restricted, in some cases to the point where it is no longer possible. In these circumstances there may be land-use policy and incentive options to consolidate fragmented land holdings, to restrict sub-division of holdings, or to identify opportunities for special protection of off-farm resource reserves. Tenure reform, individualisation and registration of cropland ownership are often seen as necessary for encouraging long-term investment and improvement of land productivity, though as Barrows and Roth (1989) note, this is not always sufficient, depending on factors affecting the land user's perception of tenure security as well as questions of access to credit, input supplies and services.

The development of livestock production in mixed systems generally requires the overall intensification of these systems to improve crop productivity, to introduce fodder crops, and to invest in the conservation and improvement of resource conditions (especially soil conservation and fertility). At the same time, the better integration of livestock in these systems often provides a key to this intensification through opportunities for more efficient resource and nutrient cycling and cash earnings for investment (see McIntire et al 1992, de Haan et al 1997). A package of policies is thus required to support these systems, including consistent economic, pricing and input subsidisation policies (such as reduced subsidisation of fertilizer costs), infrastructure and service development policies (roads, markets, product processing services, input supply, education, extension and credit), and appropriate agricultural development and technology introduction.

The questions of tsetse control and associated land settlement may be particularly relevant in sub-humid to humid zones suitable for mixed farming systems. The lessons of earlier tsetse control operations in such zones are that, in the first place, without pressure for occupation and utilisation of land (including permanent habitat alteration), tsetse control may not be sustainable. Where land-pressures exist, a range of land evaluation and settlement planning inputs may be required to promote equitable and sustainable land development alongside tsetse control (see Hendy 1988 and Barrett 1991). Given the potential impacts of control on land-use change in these circumstances, environmental impact assessments are increasingly required to predict such changes and to build in safeguards for habitat and biodiversity protection where necessary. These needs are recognised in the current regional tsetse control programmes in Southern Africa and the proposed programme for East Africa.

Intensive land-use systems

Sumberg's 1996 review of the literature on peri-urban systems, combined with Case Studies in Tanzania, led to a conclusion that ther is little justification for sectoral policies specifically directed at urban/peri-urban systems. A range of policies are needed to encourage intensification in general, without the adverse environmental impacts that have been noted in developed world agriculture. Land-use policies for zoning the location of intensive systems may be useful in certain circumstances, both for rational planning of development and for environmental and public health objectives. Thus, co-ordinated planning of feed manufacturing facilities, development of common waste disposal facilities and market services may be advantageous. Most countries have local planning regulations regarding the siting, scale and protections required for construction of large-scale production units, at least in urban and peri-urban zones. Zoning is also important

1993 for other aspects of development of urban agriculture in E and S Africa). For smaller-scale production, the frequent high degree of uncertainty could be reduced by putting in place appropriate frameworks for access to public land and protection against eviction from private land.

The main instruments of policy directed at the intensive systems themselves in the developed countries have included firstly controls on discharges of wastes (or limitations of the Biological Oxygen Demand (BOD) in discharged wastes, leading to complete bans on surface water discharges of wastes). Subsequently progressive controls on the density of stocking on agricultural land (now 2 cows or 170kg N/ha/year manure equivalent in the EU for example). Further controls on methods of storage of manure (must be covered) and distribution (not to be spread in autumn or winter) have been introduced in some countries, together with limits on maximum fertilizer nutrient applications (from both inorganic and organic sources) and taxes on excess P production per ha of farmland (in the EU). In some countries (eg USA), farms are required to produce and implement nutrient management plans and licences may be required to operate industrial scale enterprises.

The aims of these policies are to distribute production to where the concentrated wastes and nutrients of intensive systems may be easily absorbed in surrounding land-based agriculture, and to 'internalize' the costs of environmental impacts under the 'polluter pays' principle. Increased costs may ultimately be passed to consumers, but experience from the EU suggests that with a more balanced spread of production and better integration of landless and land-based production systems there can be 'win-win' situations in which environmental impacts are reduced and costs to consumers are not great. Further, there may be increased incentives to encourage production from more remote grazing-based systems (at least for milk and red meat production).

Policies on product pricing, input supply and subsidy, market services, transport and infrastructure (roads, water supplies, markets) need to be co-ordinated to encourage expansion of production in locations where there may be a comparative advantage, for example in proximity to large scale cereal and oilseed processing facilities, or close to other feed sources and large urban market centres. Regulatory policies relating to the quality of animal feeds could both improve the productivity of such systems and decrease the negative impact of excessive waste production. Unrealistic policies for self-sufficiency may need to be questioned and opportunities for intra-regional trade in livestock products expanded. Import subsidies on concentrate feeds and other inputs should be examined carefully to avoid excessive support to intensive production, leading to inefficient use of feeds and discouragement of production and marketing from the rural sector. Opportunities for recycling of wastes may also be developed, especially utilization of poultry manure for ruminant feeding and production of compost products for soil improvement and nutrients.

Conclusions

In conclusion, there are many lessons to be learnt from the past. One is the benefit of understanding the rationale underlying traditional systems through research partnerships

of production system, but one generic issue is continuity of access to land, although solutions are likely to be site specific. Environmental control is particularly important for sustainability of intensive systems and relevant technical solutions have been identified, particularly in Europe. In the modern world, livestock policies should be integrated into national agricultural planning strategies, which in turn need to take into account international trade agreements. The problems are complex, but the trend towards partnerships should yield significant results.

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The Mechanisms for Regional Coordination and Policies for Livestock Research and Development in the SADC Region[1]

by

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The Heads of State and Government of nine countries in Southern Africa decided on April 1980 to launch the South African Development Coordination Conference (SADCC)to pursue policies aimed at economic liberation and the integrated development of their National economies. The SADCC member states, at that time, comprised Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. Namibia, which gained independence in 1990 joined the organization the same year.

Based on the experience and successes of SADCC, therefore in 1992 the Heads of State and Government again committed themselves and their governments to the establishment of a Southern African Development Community (SADC) to achieve the ideals of cooperation, and to serve as a vehicle for the development and integration of the region. Two more countries have joined the community recently namely South Africa (1994) and Mauritius (1995). The membership now stands at twelve countries.

At the onset the Heads of State identified areas of collaboration which included the productive sectors of food, agriculture, natural resources, energy, industry and trade mining and tourism; and the service sectors of human resource development, transport and communication. They were cautious to make sure that all member states participate in the development, and management of projects and programmes while avoiding the creation of unnecessary bureaucracies (Kyomo 1992, Anandajayasekeram and Nkwanyana 1993). Thus a decentralised structure was adopted for implementation of the various sectoral activities and member states were assigned responsibilities shown on Figure 1. This regional approach is designed to complement, support and enhance national activities rather than replace them. The Paper therefore outlines the mechanisms put in place for coordination of the regional research activities in the Food, Agriculture and Natural Resources sector, regional initiatives and identifies key areas, for which policies for research and development in livestock should be revised or formulated.

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The Food Agriculture and Natural Resources (FANR) Sector

The Southern African Centre for Cooperation in Agricultural and Natural Resources and Training (SACCAR) is an organization under the umbrella of the FANR sector of SADC. The overall goal of the SADC FANR Sector is to achieve a significant increase in per capita agricultural output so as to enhance national food security and to improve the welfare of the citizens of SADC member states.

In order to achieve this goal, the FANR policy has the following specific objectives:

- increase agricultural production and productivity and ensure food security at the household, national and regional levels.
- ensure the efficient and sustainable utilization, effective management and conservation of natural resources.
- incorporate environmental consideration in all policies and programmes and to integrate the sustainable utilization of natural resources with development needs.
- generate domestic savings and foreign exchange to finance a gradual structural transformation of the regions agriculture dependent economies.
- improve the living conditions of rural population in Member States through increased and employment derived from the efficient and sustainable utilization of agricultural and natural resources.
- ensure the recognition of the value of national resources so that they contribute optimally to the welfare and development of all the people of the region (SADC 1992).
- The subsectors of FANR were allocated as follows to Member States:
- Botswana - Research and Training
Livestock Production and Animal Disease Control
- Lesotho - Environment and Land Management
- Malawi - Forestry
Wildlife
Inland Fisheries
- Namibia - Marine Fisheries and Resources
- Zimbabwe - Food Security
Overall Coordination of the FANR Sector

The Southern African Centre for Cooperation in Agricultural and Natural Resources Research and Training (SACCAR")

The Government of Botswana was given the mandate by SADC to coordinate the Sector of Research and training in the region. Coordination and cooperation, it was decided, was to be achieved through a medium of a Coordinating Centre. Accordingly in 1984 the Southern African Centre for Cooperation in Agricultural research (SACCAR) was established as a SADC Unit to provide the organizational basis for regional cooperation and to provide technical support for National Agricultural Research Systems (NARS).

The mandate of SACCAR has expanded overtime from an original focus on coordination of regional research in food crops to coordination of research in Agriculture and Natural Resources and the Coordination of advanced professional training in agriculture. In addition SACCAR is also charged with the responsibility of implementing and institutionalizing impact assessment at both National and regional level.

SACCAR is specifically entrusted with the responsibility of coordinating and promoting research initiatives in crops, livestock, forestry, wildlife and fisheries (inland and marine) and also higher level professional training in agriculture and Natural resources.

Objectives of SACCAR:

The objectives of SACCAR are:

- provision and dissemination of available and appropriate technology among and between SADC countries.

- Coordination and implementation of studies on research policies, priorities and constraints common to all Member States and initiation of collaborative research projects to overcome them.

- facilitating the exchange of information among the NARS

- promotion of the development of human resources necessary to man the agricultural research institutions.

- to promote coordination of SADC agricultural research activities.

To implement these objectives, SACCAR has both service and coordination functions.

The service function of SACCAR include:

- Serving as Secretariat of its Board

- Serving as a depository for the agricultural development plans of member states

- Maintaining an inventory of National and regional research systems

- Sponsoring regional studies

- Publication of a Newsletter and support of the printing and publication of the Zimbabwe Journal of Agricultural Research a SACCAR designated regional journal.

- Initiation, organizing and sponsoring of workshops.

SACCAR has to provide these services at all times.

The other major function the Centre is involved in is the coordination of the regional collaborative research projects in the FANR Sector. SACCAR has a facilitating role, in this function, that involves assuming responsibility to the Government of Botswana and to the SADC Council of Ministers for overseeing the various regional research and training programmes in the subsector. It also coordinates relations with donor agencies and with the various IARCs and other bodies responsible to SACCAR for executing the regional programmes.

Due to limited capacity of the NARS in terms of manpower and resources a Networking mode of collaboration was considered to be most logical and feasible approach to deal with regional research issues. The membership of individual NARS to SADC and SACCAR is mandatory, but participation of a NARS in any given research Network is to a large extent voluntary. The types of Networks coordinated by SACCAR in the SADC region are collaborative research and training Networks (See table 1). Collaborative research Networks involve joint inter-country and inter-institutional, planning, implementation, monitoring and evaluation of research on problems of mutual concern.

Regional Coordination and its Mechanism

When SACCAR was created it was anticipated that it would play a facilitating and supporting role, rather than having direct responsibility of managing and implementing activities. Coordinating of activities of institutions working in the region was considered as one of its primary function:

Coordination was defined at FANR Research Coordinating Consultative Workshop in Harare, Zimbabwe 10th May, 1993 as:

- taking a leading role in facilitating and catalyzing interaction to achieve mutually agreeable decisions and programmes;

- harmonizing priority setting and inter-sectoral vertical and horizontal research integration;

- advising on how such research shall be conducted;

- Centralizing the coordination of review and approval of research proposals;

- disseminating research results to all sectors; and

- establishing and maintaining a database on research and disseminating such information for sharing with all relevant institutions in the region.

The overall coordination implies aspects of administrative, managerial and technical coordination. This also implies accountability of SACCAR to the NARS and donors.

The FANR Research Coordination Consultative Workshop also endorsed the existing Board of SACCAR and Sectoral Technical Committees as the appropriate mechanisms for carrying out this mandate. The workshop also agreed to have all sectors represented in the Board of SACCAR.

- The Board of SACCAR

The Board of SACCAR provides the broader guidelines and priorities and approves plan of action.

Composition:

Directors of Agricultural Research	-	12
Representative of Inland Fisheries Section	-	1
Representative of Marine Fisheries Sector	-	1
Representative of Wildlife Sector	-	1
Representative of Forestry Sector	-	1
Representative of Livestock Sector	-	1
Representative of Environment and Land Management	-	1
Representative of Food Security Sector	-	1
Dean's Committee	-	1
Director of SACCAR (Ex-Officio)	-	1
Total		21 Members

- The Deans Committee

This committee assists in setting priority areas and in the guidance and monitoring of training activities in the region.

Composition:

One dean from each member state
SACCAR
Donor(s)

- The Project/Network Steering Committees

These committees perform the function of identifying priority activities and overseeing management and implementation of research projects/networks.

Composition:

National coordinators of that commodity (One from each member state)
Donor representative(s)
SACCAR
Executing Agency

- The Executing Agencies

They are responsible for the actual implementation of the projects. They are answerable to the Board through SACCAR as well as NARS and donors.

- NARS Manager

They play a dual role. As members of the Board they assist in providing the broader guidelines and priorities for the region. In addition they are directly responsible for the day to day management of the regionally executed projects located in their own countries.

- Regional Research Workshops

- These are used as a vehicle for identifying priority research themes for regional cooperation.

1. **The SADC Livestock Production and Animal Disease Control Sector**.

SADC recognizes the importance of the Livestock industry in the region. Livestock production is one of the major components of the agricultural economy of SADC member states and goes well beyond direct food production (meat, milk and eggs). Sales of livestock and their products provide direct cash income to farmers. Livestock are the living bank for many farmers and have a critical role to play in the agricultural intensification process through provision social and cultural functions (dowry, healing).

In view of this recognition, the Southern African Development Community (SADC) established the Livestock Sector coordinated by the Government of Botswana. The majority of the people of the SADC member states are heavily dependent on the livestock industry for their livelihood. The livestock sector in the SADC region is faced with a number of constraints which include:

- inadequate quantity and poor supply of feed from natural grazing, feed suppliers or low quality grass in the dry season.

- insufficient utilization of crop residues and agro-industrial by-products

- unreliable supply and high cost of commercially produced feeds

- Low genetic potential of indigenous breeds
- Poor breeding control and systems
- inadequate support services to control diseases which cut across international boundaries
- Low off-take rates
- Overstocking and overgrazing
- Inadequate marketing infrastructure; and poor understanding of regional livestock marketing operations.
- Poor research, extension and farmer linkages.

To this end, the SADC regional livestock programmes and projects focus on disease control and improving livestock productivity in the region. Every government in the SADC region would like to see the production of livestock commodities (meat, milk, hides and skins, eggs and traction power) increased. however, increases in productivity in livestock depend on effective policies in:

- Animal breeding
- Nutrition
- Animal health
- Management
- Marketing

The sector has, before SACCAR's mandate was expanded, been responsible for all issues on livestock research and development in the region. However, even at the present moment all livestock research projects are initiated and validated by the Sectoral Technical Committee before they are submitted to the Board of SACCAR for endorsement and inclusion in the SACCAR Programme of action.

1. Existing Regional Research and Development Initiatives

a) A long-term strategy for research priorities on Food Agriculture and Natural Resources in the region was developed by a team of consultants commissioned by the Board of SACCAR between 1993 and 1995. The strategy was approved by the Board in May 1995.

When the Republic of South Africa and Mauritius joined SADC it was found necessary to revisit the regional priorities to take into account the needs of these two new member states. There was also a call from our stakeholders that an integrated approach should have been used in setting regional priorities. The integrated approach meant integrating agro-ecological dimensions and environmental considerations with commodities in priority setting. Therefore in 1996 another study was commissioned to address the above issues. The study has

been completed and was endorsed by the Board of SACCAR in November, 1996 and reviewed by the SACCAR stakeholders in March 1997.

Under livestock the study considered six livestock species namely beef and dairy cattle, poultry, sheep, goats and pigs. The following were identified researchable areas across agroecological zones defined as "Humid, Sub-humid and Semi-arid".

- Breed improvement for hardiness in beef and dairy cattle, sheep, goats, pigs and poultry were ranked high in the sub-humid and semi-arid agro-ecological zones. Thus there is a need to explore the value of the unexploited genetic potential of all livestock species adapted to environmental conditions in the region.

- The highest ranking in the study across agro-ecological zones was given to disease control, particularly tick-borne diseases of cattle, Newcastle respiratory diseases of poultry, and the control of ecto- and endo-parasites in small ruminants and poultry.

- Research on feeding systems with emphasis on homegrown feeds and industrial by products ranked high across agroecological zones for all livestock species except equines. Thus emphasis should be on the development of packages for drought survival feeding to carry the animals through the long dry periods.

- Rangeland improvement reinforced with forage legumes and watershed conservation ranked high in the sub-humid and semi-arid zones. Agroforestry especially for land reclamation was identified as high priority across zones.

- Due to the lack of coherent information, equines were not assessed in this study. However, with the recurrent droughts and the potential for increased commercialization of beef production, donkeys are likely to play an increasing role in the provision of draught power in smallholder production systems. Consequently, there is need to increase research and development efforts towards donkeys in the long-term.

b) Sub-Regional Project on Management of Farm Animal Genetic Resources for SADC

On February 17-21, 1997 a regional workshop on "The Management of Farm Animal Genetic Resources" was held in Gaborone which resulted in the formulation of a "Strategy for Development of Farm Animal Genetic Resources in SADC Countries". The workshop was sponsored by SADC, FAO and UNDP.

The workshop noted that there was no coordinated approach to the management and use of animal genetic resources in the region despite the recognition by individual SADC member states that animal genetic resources were important. It was also realised that some cross-boarder activity in animal genetic resources is

taking place in form of "movement of genetic" material between countries, subregional meetings and participation in regional activities, with organizations such as ILRI".

The Long term goals for the development of animal genetic measures in SADC was identified as to:

- Maintain and maximise the use of all available animal genetic resources, with special emphasis on the indigenous livestock, for the development of sustainable farming systems in the SADC region.

- Base this use on an informed understanding of the merits of the available genotypes within the prevailing production systems of the region.

- Create a sub-regional network on the management and use of farm animal genetic resources. ("Proceedings: Management of Farm Animal Genetic Resources" Workshop February 1997).

The process of taking the document through the SADC approval machinery is coordinated by the Livestock Production and Animal Disease Sector.

c) The SADC Animal Agricultural Research Network

Another important initiative in the livestock sector has been the establishment of a SADC Animal Agriculture Research Network whose objective is to:

1. To promote inter and intra regional collaborative research activities in the NARS to generate appropriate technologies.

2. To assist in capacity building in the NARS through training and information exchange.

3. To improve collaboration and strengthen linkages among stakeholders within and outside NARS.

4. Assist NARS to source funding for the research, training and information exchange activities.

The Network will have a Steering Committee with the following membership.

A member from each of the 12 member states

- ILRI

- SACCAR

- Donors

- SADC Livestock Production and Disease Coordinating Sector Coordinator.
- 2 regional eminent scientists to be nominated through SACCAR-ILRI consultation.
- Steering Committee will liaise with national livestock networks.

d) On-going Projects Coordinated by the Livestock Production and Animal Disease Sector:

i) AAA2.3: Regional Heartwater Research and Vaccine Production Project

ii) ZAM2.4: SADC Regional Training Centre for Middle-level Personnel for the Control of Tsetse and African Animal Trypanosomiasis.

iii) AAA2.5: Training in Animal Health Auxiliary Personnel in the Diagnosis of Animal Diseases.

iv) ZIM2.2:2 Regional Tsetse and Trypanosomiasis Control Project

v) BOT2.2: Regional Foot and Mouth Control Project

vi) BOT2.3: SADC Regional Training Centre for Meat Inspectors and Meat Technologists.

vii) ANG2.1: Veterinary Assistance to South West Angola.

(Livestock Production and Animal Disease Control Sector Animal Progress Report, June 1997).

SACCAR in collaboration with the Livestock Production and Animal Disease Sector and ILRI has developed a regional research project on dairy entitled "Research to Support Market-oriented Smallholder Dairying in Southern Africa". Funds are being sought to finance the project.

SUGGESTION ON POLICY REVISION OR FORMULATION

Policies are defined here as the strategies to meet the goals of government initiatives or programmes. In the SADC region, livestock sector policies play an essential role in improvement and production of livestock as they define the types of livestock (Cattle, goats, sheep, poultry and pigs) to be kept and hence set the required levels of nutrition, animal health, management, breeding and markets to produce for. Most countries in the SADC region have livestock sector policies. These policies vary in their details and applications, but tend to centre on disease control, production and marketing.

The SADC Livestock Sector has over the years formulated regional policies in the SADC region. Therefore, the SADC livestock policy objectives are:

- to improve livestock disease control with emphasis on rinderpest, Foot and Mouth Disease, Zoonotic Diseases, Animal Trypanosomiasis, Tick Borne Diseases, contagious Bovine Pleuropneumonia and New Castle Disease.

- to improve cattle and poultry production including dairy, piggery, range development and management.

- to improve livestock breeds and breeding methods with emphasis on indigenous livestock.

- to develop regional capacity to sustain livestock services.

- to develop regional manpower capacity to service the livestock sector.

- to increase utilisation of SADC's livestock and livestock products through improved intra and extra-regional trade; and

- to encourage the development and utilisation of low cost technologies in livestock disease control and animal production.

These livestock policies and constraints have been addressed through a broad based sectoral strategy which is composed of regional projects and programmes. Looking at these policies in detail, one can identify some major issues in livestock policy in the region and related research questions which are important to sound policy development. These issues are:

- Management of common property resources
- Control of livestock stocking rates
- Control of livestock diseases
- Breeding control and methods
- Pricing and marketing
- Technology Development and Transfer
- Animal Health and Production Services

These major policy issues in the SADC region are examined in the discussions which follow:

a. Management of common property resources - many of the resources on which the livestock sector in the SADC region is dependent, are held as common property. Of particular importance are communal grazing resources. In general communal grazing lands belong to the states and thus essentially belong to nobody. There is nobody who has the responsibility of managing the communal areas. There is also the issue of dual rights - where farmers who have ranches have the right to exclusively graze their cattle, sheep and goats in their ranches, and when their ranches are overgrazed, they move their livestock out of their ranches to graze on communal lands which in most SADC member states are already overgrazed. Policies on the management of communal areas have been formulated. However, in some cases they seem not to be effective or there is lack of implementation capacity.

b. Control of Livestock Stocking rates - Governments in the SADC region have frequently calculated carrying capacities of the desired stocking rates and attempted to get farmers to voluntarily limit livestock numbers. Such efforts have in most cases not been successful. We need to know what policy incentives can induce farmers to reduce the stocking rates. What types of sites are critical to livestock production and how they can be conserved. Answers to these questions are necessary for the formulation of sound policies.

c. Control of Livestock Diseases - A number of SADC member states have clear policies on control of animal diseases especially cattle. However, policies on disease control of some livestock species (pigs, poultry, sheep, goats, mules, donkeys and horse) are very weak. There is a therefore a need to strengthen some of these policies and reflect on the diseases of animals which are considered of less importance.

d. Breeding Control Methods

The majority of livestock in the region are found in the communal sectors where it is difficult to control animals and practice good breeding methods. This results in low production coefficients such as calving percentage, off-take, weight gain and indiscriminate breeding where animals drop their young ones during the dry seasons when there is limited grazing resources.

The majority of the countries in the SADC region have breeding policies on livestock. These vary in their details and tend to concentrate on the use of indigenous breeds for meat production, crossbreed's between indigenous and exotic dairy breeds or pure breeds for milk production and dual purpose breeds for meat and milk production. In poultry and pig production, the policies concentrate on the use of exotic breeds for meat and egg production aimed at commercial markets. In some SADC member states, some of these policies have met with failures.

e) Marketing and Pricing

Livestock are sold to local abattoirs, butcheries, cooperatives, individuals processing plants and to overseas markets. In general, policies for marketing large livestock are there to guarantee farmers good prices, but these policies are weak in smallstock

marketing. In some cases there are no set of standards on which producer prices are based and lack of marketing infrastructures including marketing information. Expansion of regional markets by effective marketing services, pricing and cost effective transport systems capable of moving livestock products from one part of the region to the other is needed.

f) Technology Development and Transfer

The policies of the SADC member states are to generate improved user and environmental friendly agricultural production technologies and systems and participate in the transfer of those technologies and systems at the production levels. In this context, the Agricultural Research Departments operate between the policy makers, who set the national livestock policies and the producer levels, which determine or drive the demand for improved technologies.

In some member states good technologies have already been developed and what is required is essentially transferring these technologies to the end users. If these new technologies are adopted and farmers improve their husbandry methods, substantial production increases will result. One of the policy issue which is of concern is Research - Extension linkages. In some member states there are no strong formal linkages which have been institutionalized between research, extension and farmers.

g) Animal Health and Production Services

In most of the SADC member states the delivery of animal health and production services are the responsibilities of national governments. The delivery of livestock services, especially veterinary services is very expensive and should be a shared responsibility. There is therefore a need to re-look at the current policies in order to relieve governments from being the sole providers of veterinary and animal production services. In some cases government policies specifically prevent participation of the private sector to supply and distribute certain agricultural requisites. e.g. drugs and vaccines.

SUGGESTIONS FOR IMPROVING LIVESTOCK POLICIES

1. Develop sound policies which can encourage farmers to effectively work together to manage common grazing resources by:

   - construction of drift fences

   - investing in ranches

- setting up regulations to control the use of communal grazing areas. In some countries these regulations are in place, the problem is who has to enforce them or implement them.

- seriously look at the question of dual grazing rights.

2. Introduce policy incentives to encourage farmers to reduce their stocking rates. Show the benefits of desired stocking rates to farmers through research and education, and improve marketing (prices, bonus).

3. Strengthen Livestock Disease policy to adequately cater for animals which are considered of less importance by establishing health programmes for them (poultry, pigs, donkeys, sheep, goats, mules).

4. There should be a very strong relationship between breeding policy and the type of research work to be carried. For example, where the policy is to use only indigenous breeds for meat, eggs and milk production, research in characterization of indigenous breeds to produce products to meet family needs is more appropriate than research in characterisation of exotic breeds for these products.

   - We need to clearly define policies for the different Livestock Sub-sectors in the SADC region. What breeds to use;

     (a) traditional sectors
     (b) small commercial sectors
     c) commercial sectors.

This information should then be provided to the farmers.

5. Improve or strengthen research and extension policies to enable staff to better serve the farming community.

   - There should be a good flow of information from researchers to extensionists, farmers and vice-versa.

   - There is also a need to provide timely information on:

     (a) Available technologies
     (b) Inputs availability
     (c) Sources of loans

         - Interest rates
         - Loanable amounts
         - Lenders and locations
         - Mode of payments

6. We need to train staff in policy formulation, management and livestock economists. We need to encourage strong collaborative work in research, extension and training.

7. We need to broaden our livestock policies to allow participation of the private sectors and NGO's in providing certain services drugs, vaccines and extension.

8. We also need to look at our regional steering committees with a view to reconstituting them to accommodate the needs of all our stakeholders.

These would make our livestock policies more relevant and effective in improving livestock production in the SADC region.

CONCLUSION

Despite the weaknesses enumerated above, which are by no means exhaustive/there are still opportunities to make our livestock policies effective. The private sector communities inclusive should be encouraged and enabled to take an increasing share in input supplies, market development, credit provision and policy making decisions.

We need to recognise the inter-dependent nature of agriculture, especially under the policy of food security and therefore seek full support and cooperation of the public sector, private sector, NGO's and farmers through full and unfailing representation in all relevant coordination machineries and mechanisms. This current workshop should come up with proposals for improving policies of the livestock industry in the SADC region. There is in place a good foundation for effective policies, but like anything else it has some defects. With good will on all sides and inputs from all stakeholders these defects can be patched to give us good policies our farmers deserve. We should build up and improve on what we have.

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Angola	Energy
Botswana	Livestock Production Animal Disease Control Agricultural Research
Lesotho	Environment and Land Management Water
Malawi	Inland Fisheries, Forestry and Wildlife
Mauritius	Tourism
Mozambique	Culture and Information Transport & Communications
Namibia	Marine Fisheries & Resources
South Africa	Finance and Investment
Swaziland	Human Resources Development
Tanzania	Industry and Trade
Zambia	Mining Labour & Employment
Zimbabwe	Food, Agriculture and

TABLE 1: LIST OF REGIONAL PROJECTS COORDINATED BY SACCAR - FEBRUARY 1996

PROJECT NO. AND TITLE		LOCATION AND DONORS INCLUDED	EXECUTING AGENCY	STATUS
AAA.3.1	Land and Water Management Research Programme	Botswana (Coordination)	Not identified yet.	Funding being sought.
AAA.3.2	Sorghum and Millet Improvement Programme	USAID, GTZ SADC (Zimbabwe)	ICRISAT	Under Implementation Phase III.
AAA.3.3	Grain Legume Improvement Programme			
(A)	Bean Improvement Programme	(Tanzania) - No Donor (Supported from SACCAR core budget)	MALAWI & TANZANIA NARS COORDINATE	NETWORK functioning
(b)	Groundnut Improvement Project	(MALAWI) GTZ	ICRISAT	On-going Phase IV
(c)	Cowpea Improvement Project	Mozambique - No Donor.	Not idenitified	Funding being sought Phase II.
AAA.3.5	Training in Research Management	Tanzania, USAID	SACCAR/ISNAR /ESAMI	On-going
AAA.3.6	Agroforestry Research Programme	Malawi (Coordination Office) CIDA	ICRAF	On-going
AAA.3.7	SADC Plant Genetic Resources Centre (SPGRC)	Zambia NORDIC Countries	SADC NGB	On Going
AAA.3.8	Maize and Wheat Improvement Network	Zimbabwe European Union	CIMMYT	On-going
AAA.3.9	Strengthening Faculties of Agriculture Forestry & Vet Medicine	Malawi, Tanzania, Zambia & Zimbabwe, GTZ	SACCAR Universities	On-going

PROJECT NO. AND TITLE		LOCATION AND DONORS INCLUDED	EXECUTING AGENCY	STATUS
AAA.3.10	Dairy Livestock Productivity Improvement in Large & Smallholder Farmers in Southern Africa.	Not decided.	Not identified.	Funding being sought.
AAA.3.11	Regional vegetable Research and Developed Network	TANZANIA GTZ	AVRDC	Only Training Component Under implementation . Funds being sought for research component.
AAA.3.12	Network and Drought Animal Power and Other Farm Power Equipment	-	-	
AAA.3.13	Southern African Root and Tubers Crops Research Network	Malawi (Coordination Office) USAID	IITA	On-going
AAA.3.14	Wool and Mohair	Not decided	Not identified	Project being revised to include more member states
AAA.3.15	An Aquaculture Research and Development Network in Smallholder Farms in Southern Africa.	Not decided.	Not identified	Funding being sought.

The Funds secured for the projects under implementation amounts to US$77.16 million. The total SACCAR portfolio of projects is valued at US$120-44 million.

The contribution of indigenous livestock to the economies of African countries, with particular reference to Eastern and Southern Africa*

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Indigenous livestock and African economy

Livestock are vital to the subsistence and economic development in Africa. They provide year-round flow of essential products, sustain the employment and income of millions of people and contribute draught power and manure for crop production. In the rural areas, livestock are an important source of food and cash, and hence are crucial for the purchase of consumer goods and procurement of farm inputs. Other functions of livestock include production of such non-food items as hides, skins, wool, transportation and fuel (from dung) in some communities. Livestock also convert crop residues and fibre materials of no value into protein of high quality. Very critical in some of these production systems are the asset and security functions of livestock (Jahnke et al, 1988). These refer to their role as capital investment yielding an interest, for example, in the form of milk. They represent a safe and durable form of storing wealth, especially if there is no financial system to perform this function. The role of livestock for social and cultural functions in Africa is the most difficult to quantify. These involve social exchanges of livestock within or between families or communities. Examples include dowry payments and slaughtering for traditional feasts or religious ceremonies. In addition to these roles in traditional society, livestock are a major source of revenue and export earnings for many countries.

Indigenous livestock diversity of Africa

Africa is endowed with a large diversity of farm animal genetic resources -- species, breeds, strains. The number of breeds/strains of each species found in Africa is variable: cattle 100-150; sheep 50-60; goats 45-50. The continent has a large number of breeds/strains of indigenous chickens and other poultry species, but no estimates of actual numbers are available. Africa is also home to a yet undetermined number of dromedary camel breeds/strains, mainly restricted to the arid and semi-arid areas, a substantial number of breeds/strains of indigenous pigs as well as mules, asses and horses.

Of the approximately 80 breeds of zebu cattle in Africa about 45 are considered native to eastern Africa and 5 to southern Africa. On the other hand, southern Africa with about 20 breeds/strains, is home to the majority of the sanga (zebu x African taurine composite) cattle breeds, eastern Africa has only 5 breeds/strains while west Africa has about 4 more recently developed sanga breeds (Rege et al, 1994). Most of the African taurine cattle - both Longhorns and Shorthorns -- are native to west Africa. The 7 zenga (zebu x sanga) cattle breeds documented in Africa - the Horro, Fogera, Arado, Jiddu, Alur, Nganda and Sukuma are all found in eastern Africa; indeed, the location of these breeds is restricted to Ethiopia, Eritrea, Uganda and Tanzania. Africa is also home to four composite cattle breeds -- the Bonsmara of South Africa, Rana and Renitelo of Madagascar, and the Mpwapwa of Tanzania -- all developed from crossbreeding indigenous breeds with specialized exotic breeds.

Agroecological and regional differences in livestock agriculture

Agroecological differences

Africa is a region of enormous environmental diversity. This diversity derives mainly from

primarily influenced by the number of days during the year when vegetative growth is possible. The continent can, thus, be classified in terms of rainfall and number of plant growth days into arid, semi-arid, sub-humid and humid zones (Table 1). Mean annual rainfall ranges from less than 100 mm in parts of the Sahara and Kalahari deserts and in the Horn of Africa, to over 9000 mm in the mountains of Cameroon. The coefficient of variation of annual rainfall ranges from about 15% to over 50% and is highest in the drier areas.

Africa is also very varied in terms of altitude, ranging from about 120m below sea level in the Danakil depression of Ethiopia to 5895 metres at the summit of Mount Kilimanjaro in Tanzania. The highlands are defined as those areas within the other agroecological zones where, because of altitude, mean daily temperature during the growing period is less than 20°C. About 5% of sub-Saharan Africa lies above 1500 metres above sea level and is classified as highlands or cool tropics (Table 1).

Table 1 shows that eastern and southern Africa together account for 48% of the 7.7 million km^2 land mass of sub-Saharan Africa classified as arid (i.e. less than 90 plant growth days and less than 500 mm annual rainfall), 53% of the semi-arid area, 44% of the sub-humid area, and 77% of the highlands. However, the two regions have an insignificant proportion (8%) of the humid zone.

The distribution of livestock is also closely related to environmental conditions (Table 2). The arid zone, covering about 36% of sub-Saharan Africa's surface area (Table 1) has 30% of the region's total ruminant biomass, literally all its camels, but proportionately few cattle (21%). The semi-arid zone, with 18% of the surface area, has 27% of the ruminant biomass, with all ruminant species well represented (Table 2). The sub-humid zone, with 22% of the surface area has 19% of the ruminant biomass, with cattle (23%) slightly over-represented and small ruminants under-represented. The humid zone occupies 19% of the surface area and has only 6% of the ruminant biomass, with all species except camels about equally represented. The highlands account for 5% of sub-Saharan African land area but holds 17% of the ruminant biomass, most (82%) of which consists of cattle. Indeed, 20% of the cattle biomass in sub-Saharan Africa is found in the highlands.

Differences exist in herd/flock productivity, as measured by offtake rates (Table 3) between agroecological zones. Cattle offtakes averaged 10.8% in 1995 with a figure of 10.2% for arid/semi-arid zones, a figure of 10.6% for sub-humid/humid zones and 12.5% for the highlands. Offtake rate for sheep and goats, species predominantly found in the arid and semi-arid zones, was estimated to average 28.5% in 1995 while estimates for pigs and poultry were 82.6% and 116.4%, respectively. These figures are expected to improve, but small ruminants, poultry and pigs are expected to record higher rates of growth on offtakes than cattle, reaching 50%, 48% and 100%, respectively by 2025. Thus, small ruminant offtake will almost double over the 30 year period.

Regional differences

The distribution of agroecological zones across sub-Saharan Africa is also reflected in regional distribution of livestock (Table 4). West Africa, which is predominantly (54%) arid, has only

species composition of the regional livestock population is presented in Table 5. Eastern Africa has 49% of the cattle, 38% of the sheep, 44% of the goats and 8% and 21% of pigs and chickens, respectively. Southern Africa has 22%, 17% and 13% of cattle, sheep and goats and 29% and 18% of pigs and chickens, respectively. Thus, the majority of the African ruminant population is in eastern and southern Africa, while only 37% and 39% of the pigs and chickens, respectively, are found in the two sub-regions. Central and North Africa have only a small proportion of Africa's livestock wealth.

There are also between-region differences in rates of population growth for the different species. Table 6 presents average growth rate figures for ruminants and non-ruminants for eastern and southern Africa for the period 1970-1995. Cattle population increased at a rate of 1.4% annually in eastern Africa and 0.6% in southern Africa. Corresponding values were 1.6% and -0.5% for sheep, 1.7% and 1.5% for goats, 8.0% and 2.1% for pigs and 3.4% and 3.7% for chickens. Thus, other than chickens whose population increased at a faster average rate in southern Africa and goats whose rate of population growth in eastern and southern Africa were about the same, all other species experienced faster population growth rates in eastern than in southern Africa. Indeed, the population of sheep in southern Africa was on the decline over this period.

Role of indigenous livestock breeds

Indigenous livestock as source of food

Human diets will not have the needed amounts and kinds of amino acids unless they include protein from either animal products or an unusually well designed combination of foods from plants (FAO, 1983). Livestock are a significant source of high quality protein, minerals, vitamins and micronutrients for the majority of African people. Animal products are of much greater importance to the pastoral peoples and among groups with high ratios of animals to people. The nutrition of pastoral communities depend a great deal on milk, blood and meat from their animals. Thus, although they have no access to a healthy balance of plant proteins, the wholesome nature of animal proteins compensate for this. On the other hand, in communities where there is dependency on plant proteins, one would expect the nutritional situation of the lowest income groups to be precarious because they cannot afford enough or the right kinds of vegetable sources of protein to meet body requirements. In environments where exotic breeds cannot be raised (e.g. arid areas and tsetse-infested areas), adapted indigenous stocks are the only source of animal proteins, especially for the majority of rural dwellers. Livestock also make indirect contributions to human nutrition. For example, they are the primary source of cash income that pastoralists use to buy food grains. In addition, they play an important role in food security: when crop harvests are poor, livestock can be sold to buy grain (Winrock, 1992).

The combined contribution of ruminants to the total food production from livestock in tropical Africa is almost 80%. Cattle alone account for over 50% (Jahnke, 1982). Annual contribution of ruminants to meat production is estimated at over 3.2 million tonnes, representing over 72% of total meat production. Cattle meat accounts for over 70% of total red meat production and over 50% of the total meat output in sub-Saharan Africa. Despite the low biological yields of the arid and semi-arid zones, cattle milk output from these zones represent over 40% of the total

ruminants in sub-Saharan Africa. In addition, the two zones account for over 50% of the total beef output, produced exclusively by indigenous stock. These figures have been calculated on the basis of carcass weights which, in turn, were estimated from assumed dressing percentages. It is worth noting that, in the African context, and indeed in most developing countries, the conventional concept of dressing percentage is inappropriate: almost all parts of the animal are consumed. Thus, actual meat outputs in traditional production systems are expected to be higher than these estimates.

Indigenous livestock as producers of farm energy

In addition to providing milk and meat, cattle are used in mixed farming systems for work. For example, it is estimated that approximately 10% of The Gambia's national cattle herd is draught oxen and that 60% of all agricultural households use animal traction for cultivation (Alers-Montalvo et al, 1983; Sumberg and Gilbert, 1988). Agyemang et al (1992) observed that about 30% of all male cattle slaughtered at the national abattoir in The Gambia had their noses punched, an indication that they had been used as work oxen. In Ethiopia, out of the 14 million hectares under cultivation, animal power cultivates 64% (9 million hectares). In Kenya, tractors are used to cultivate only 3.5% of land under smallholder cultivation. The remainder of the 1.3 million hectares of land under smallholder cultivation is cultivated by draught animal power and hand tools, but hand tools account for a larger proportion (upto 67%). It is difficult to quantify, in monetary terms, the contribution of cattle draught power to agricultural production in Africa. However, it is clear that use of cattle and equines, particularly donkeys in land preparation, planting, threshing and transportation lead to improved quality and timeliness of farming operations, thus increasing land under cultivation, crop yields and incomes (e.g. McIntire et al, 1992). McDowell (1977) has estimated that the availability of a draught ox to a family unit could increase agricultural output six-fold. Thus, it can be argued that the current level of crop output from mixed farming systems in most parts of Africa is, in large part, due to the use of draught power provided largely by cattle breeds found in these production systems. Available estimates indicate that 15% of farmers in sub-Saharan Africa use animal traction; the value of traction in this region was put at $2000 million in 1975 (ILCA, 1987) and this accounted for 31% of the value of sub-Saharan Africa's livestock outputs and was second only to meat. Where it is used, animal traction is the livestock product of primary concern to many smallholders to whom the timely planting of food crops is of paramount importance.

The major gains from animal traction arise from the increase in area under cultivation. Several studies have indicated that when farm operations are diversified and animals used also for off-farm labour (e.g. transport), animal traction becomes potentially more attractive (Francis, 1988; Rauch et al, 1988).

Although equines and camels are also used for work, Jahnke (1982) has estimated that 55% of work animals in tropical Africa are cattle. In some regions of Africa, cattle play an important role in off-farm transport, mainly connected to trade and marketing. In the arid zones of the continent, use of cattle to cart water for livestock watering and for human use is not uncommon. Cattle are also used to transport homesteads in nomadic livestock husbandry systems. The one (transport) function of livestock which is usually ignored or taken for granted is that these animals walk long distances to the place of sale and slaughter. In the absence of modern

Asset and security functions of indigenous livestock

One of the reasons usually given for the low live animal offtake from traditional herds is the holding of livestock as a status symbol or as a sign of wealth. Livestock owners in rural areas usually do not have access to banking facilities and, over the years, have come to rely on investment in their stock. Indeed, most of these systems are not sustainable without livestock; cattle is the predominant species. While investment in livestock carries its own risk, farmers' long-term interest in security against crop failure and currency fluctuations is served by such an investment. For example, in 1986, The Gambian currency (Dalasi) was devalued by nearly 50%. While the purchasing power of bank account holders declined, the value of cattle appreciated overnight. An analysis of income accruing from crops and livestock in a mixed farming situation in Abet of Northern Nigeria revealed that, among farm items sold, livestock and livestock products accounted for 56% in value terms (Ingawa, 1986). In addition, while sale of crops was limited to certain seasons, sale of livestock and milk was less season-dependent and therefore represented a dependable asset for emergencies. In general, livestock contribute to the stability of farm income because they can be bought following good crop performance and sold following crop failures. Thus, livestock helps to cushion farm enterprises against unstable commodity prices during unfavourable years and serve as a "currency" in which social obligations are expressed.

Since investments and farm debts in some of these production systems are nearly nil, the livestock populations held by these communities represent a net worth that is potentially and readily convertible into cash. In 1986, the contribution of cattle to changes in farm wealth or capital gains in the West African subregion was estimated at US $396 million (Niang, 1991).

Indigenous livestock facilitate utilisation of marginal lands

About 13-16 million km^2, or nearly half of the continent south of the Sahara, is desert or arid grassland and savanna where crop production is a high risk enterprise (Brown, 1971). Nearly all livestock in these zones are indigenous African breeds raised under traditional nomadic and transhumant pastoral systems based upon communal grazing. They are well adapted to the characteristically sharp annual and seasonal variations in rainfall, requiring mobility in search of forage. These land use systems make efficient utilisation of available vegetative resources of this zone and provide a reliable source of food for the population, a supply which has been possible to sustain at life support levels throughout the dry stress periods in most years (Cossins, 1983). Frequent reference to low land productivity of the pastoral range livestock production systems ignores the fact that livestock farming is the only way to support any human life at all in much of this zone. Pastoralists in these areas depend on milk rather than meat (Cossins, 1983) and cattle are the dominant species. As has been alluded to, arid and semi-arid zones together hold 51.3% of the total cattle biomass of sub-Saharan Africa (Table 2). The proportion of cattle biomass to total ruminant biomass in arid (48.3%) and semi-arid (80.6%) zones are higher than those for all other individual species (Table 2). Indeed, the low relative cattle biomass in the arid zone is due to the biomass contribution by camels almost all of which are found in this zone.

Thus, pastoral systems in sub-Saharan Africa are dominated by indigenous livestock. In dry countries such as Mauritania, Somalia and Botswana which have large livestock populations

every economically active rural person is between 7.7 and 12 (Jahnke, 1982). For the arid zone of tropical Africa as a whole, which is predominantly a pastoral land use system, the ratio is 5, compared to 100 in modern African ranching (Jahnke, 1982). If these countries organised their land use in the form of modern ranching, their pastoral population would have to be reduced by a factor of 50 (Jahnke, 1982). Thus, although labour productivity is considered low in the arid zones, the production systems have a high employment capacity. About 29 million people lived in the arid zone of sub-Saharan Africa in 1980. The estimates for 1990 and 1995 were 39.8 million and 46.4 million, respectively. Adjusting for rural-urban population trends, predictions for the human population in the arid zone in 2010 and 2025 are 51 million and 59 million, respectively. Clearly, the pastoral land use system has made it possible for these zones to support a high human population. In the absence of alternative agricultural activity, livestock provide the only opportunity for the productive use of land and labour in these zones.

Some indigenous livestock breeds have adaptations which allow them to survive and produce under very specific stresses. Tsetse-transmitted trypanosomiasis has prevented the use of many livestock breeds in large areas of Africa, nearly 10 million km^2, which comprises some of the best-watered areas of the continent — the humid and sub-humid zones. Fortunately, there are some breeds of cattle and small ruminants indigenous to Africa which are known to survive and produce in the presence of tsetse and trypanosomes. This characteristic, termed trypanotolerance, is possessed by a few cattle breeds of West Africa, namely the N'Dama and several West African Shorthorn types (e.g. Muturu and Baoule) and some breeds of sheep (e.g. Djallonke) and goats (e.g. West African Dwarf). There are also livestock populations in eastern Africa which exhibit a degree of tolerance to trypanosomiasis. These include the Orma Boran cattle of Kenya. In addition to providing meat, milk, traction, manure, etc., trypanotolerant livestock perform another critical function: they provide a means of introducing livestock agriculture into these special environments. In so doing, they free up financial resources which would otherwise be spent on chemoprophylaxis, chemotherapy or tsetse control programmes. Trypanotolerant livestock thus, generate, from these environments, additional agricultural income which would not be possible in the absence of livestock agriculture.

Overall contribution of indigenous livestock to national economies

A rough estimation of the importance of the livestock sector to the national economy is the sector's contribution to Gross Domestic Product (GDP). The share of agriculture in GDP is important in Africa. The average for the continent is 17.4% (Jahnke et al, 1988), but it is highly variable, ranging from 2.2. and 2.3% for Gabon and Cote d'Ivoire, to 35.7% for Zimbabwe, 38.7% for Chad and even 81.6 and 86.3%, respectively for Somalia and Mauritania. The contribution of livestock to agricultural GDP in the region has been estimated at 25% but this increases to 35% when traction and manure are considered (Winrock, 1992). However, these averages hide great disparities between countries, ecological zones and subregions. For example, the share of livestock to agricultural GDP varies from 5% for Ghana and Cote d'Ivoire to 82, 84 and 88% for Namibia, Mauritania and Botswana, respectively (Winrock, 1992). Table 7 summarises estimates of the contribution of the livestock sector to agricultural GDP for some eastern and southern African countries in 1988. These figures indicate that, while livestock has a larger average contribution in eastern African countries in absolute terms, livestock share of total agricultural output is higher, on average, in southern than eastern Africa. This is mainly

In general, livestock products do not contribute much to direct foreign currency earnings in African countries. The few exceptions include countries like Botswana, Swaziland, and Zimbabwe which realize net exports of meat and meat products and Kenya, Madagascar, Botswana, Namibia and Zimbabwe which record net exports of milk and milk products (Table 11). Some countries, e.g. Kenya and South Africa, also export indigenous animal germplasm (both live animals and semen). Most countries in eastern and southern Africa export hides and skins (Table 11). Although the earnings from direct exports of livestock products is small, the foreign exchange savings role of indigenous livestock through import substitution, as indicated by value of livestock output of food products, is considerable in almost all countries. It is to be noted that the highest per capita consumption of animal products outside pastoral areas occurs in urban areas. In the absence of local supply of these products, this demand would have to be met through importation. Indeed, even where indigenous breeds do not actually produce export value products, they facilitate, by providing for the local demand, export, for example, of "prime beef" from limited high-input systems thereby contributing indirectly to export earnings. In this way they also contribute to the employment of urban labour involved in processing, packing and exporting livestock products.

Comparative productivity

Ample evidence exists in the literature which indicates that, under conditions in which indigenous African livestock are predominantly kept, specialized imported breeds would be no match. Most studies done to date -- mainly under station or improved (commercial) production conditions in tropical and subtropical countries (e.g. Schutte, 1935; Bonsma, 1949; Vorster, 1962; Buck et al., 1982; Trail, 1984; Vilakati, 1990; Moyo, 1996), have shown that indigenous breeds can be as productive if not more productive than European breeds, especially if account is taken of viability and maintenance requirements as measured in terms of liveweight. Additionally, the low risk factor of adapted breeds is an important consideration where market values are unstable while costs of production continue to increase or where the probability of death from environmental stresses is high (Frisch, 1984).

Despite the universally accepted fact that indigenous African cattle produce less milk (on a per animal basis) than the European dairy cattle, the quality (butterfat and protein content) of milk from indigenous African cows is generally superior. Additionally, when adjusted for animal size, the productivity is quite considerable, even before taking into account the harshness of the production environment and the input requirements for indigenous livestock relative to those for specialized exotic breeds. Table 12 presents data on milk production characteristics of some indigenous cattle breeds. These data originate from diverse studies in different countries and should not be compared in the conventional way. The object of presenting these data is simply to indicate some quite potentially productive, locally available, breeds which should be developed for milk production. The average lactation milk yield of a Friesian cow on an average, small to medium, holding in Kenya is about 3600 kg (Rege, 1991). This is within the range of productivity figures available for the Butana (1000-5600 kg) and Kenana (700-4600 kg) of Sudan under a wide range of production environments. When account is taken of the butterfat content of Butana and Kenana milk, these figures increase to 1299-7272 and 798-5242 kg, respectively. The upper limits of these figures are not different from production figures of well-managed exotic dairy breeds in most tropical environments. Adjustments for other factors such as mature cow weight increases these figures further and emphasizes the difference

kg and producing 3600 kg of 3.6% butterfat per lactation is equivalent to 554 kg per 100 kg of body weight maintained or 2797 kg per 100 kg metabolic body weight (i.e. $WT^{0.75}$). Correcting the mode (about 2100 kg) of the Butana cow under typical production environments for butterfat, the equivalent lactation yield is 2393 kg. Adjusted for mature weight of a Butana cow of about 400 kg yields 598 kg per 100 kg body weight maintained or 2675 kg per 100 kg metabolic body weight. Such analyses indicate that Africa is endowed with some indigenous breeds which are just as productive, if not more productive, than exotic types under local production conditions. Indeed, a complete analysis would need to include differences between indigenous and exotic breeds in variable costs of feeds and other inputs, especially veterinary drugs, for which large differences exist between the adapted indigenous breeds and exotic types.

Similar calculations could be made for the other breeds on Table 12. Indeed, the data presented on Table 12 did not take into account milk consumed by the calf. Where exotic breeds are milked, calf rearing presents additional costs in milk replacers or other forms of artificial milk. On the other hand, indigenous breeds usually raise their own young and the amount of milk consumed by the young may be considerable.

Unfortunately, there are very few systematic breed evaluation studies in Africa in which indigenous and exotic breeds have been comprehensively compared under typical production conditions. Table 13 presents productivity indices calculated on the basis of calf weaning weight per unit of cow weight maintained in a beef cattle breed evaluation experiment conducted under range conditions in southern Zimbabwe (Moyo, 1996). The figures are on four sanga breeds indigenous to southern Africa (Mashona, Nkone, Tuli, and Africaner), one imported *Bos indicus* breed (the Brahman), two European (*Bos taurus*) beef breeds (Sussex and Charolais) and various crosses. Mashona, the smallest breed in the study, was consistently superior in the productivity indices considered, mainly because of the small cow weight maintained, superior calving rate and low calf mortality. Indeed, the results in Table 13 clearly show that, in general, indigenous breeds were superior to exotic breeds on the basis of the productivity indices. The only obvious exception was the Africaner which, because of its poor reproductive performance, was consistently inferior to the exotics -- including the Brahman. In expressing weight of weaner calf per unit of cow weight, the assumption being made is that the latter is directly related to cow maintenance requirements, especially feed. Whereas the relationship between body weight and requirements for maintenance is well established, the actual cost implications of this relationship in production systems where animals are entirely dependent on pasture is not clear. Nonetheless, figures in Table 13 indicate that, where feed availability is a constraint, the indigenous breeds are superior. The study (Moyo, 1996) recommended the use of indigenous breeds as dam lines in crossbreeding for beef production in similar (semi-arid) environments.

As has been pointed out, the perceived "low productivity" of zebu type cattle is obviously related to aspects of adaptation. For example, lower levels of thyroid, adrenal and ovarian activity have been cited as factors contributing to the Brahman's greater heat tolerance but lower reproductive efficiency compared to European type cattle (e.g. Howes, 1963). In addition, Howes (1963) and Hentges and Howes (1963) indicated that Brahman cows used feedstuffs and nutrients from body reserves to lactate at the expense of reproduction. Delayed estrus and subsequent lower reproductive rates were obvious results. Kincaid's (1963) report that dry

Table 14 presents productivity figures of Nguni and its crosses obtained from results of a long-term breed evaluation study in Swaziland (Vilakati, 1990). The ranking of the three purebreds (Nguni, Brahman and Simmental) attests to the superiority of the Nguni in weaner calf production on pasture. As with the Zimbabwe study, the Brahman ranked intermediate between the indigenous and the exotic *Bos taurus* beef breed. Performance of crosses indicated the extent to which the Nguni can be useful as a dam line in crossbreeding for beef production. Results indicated that crossing Brahman with Nguni yielded better performance than did crossing Simmental and Drakensberger with Nguni under these conditions. However, Nguni x Drakensberger crosses were superior to crosses with the Simmental. These data are consistent with the widely reported excellent performance of Nguni cattle on range (e.g. Scholtz and Hofmeyr, 1992). The Nguni cow is reputed as a fertile and biologically efficient beef animal under ranching conditions. It also shows early sexual maturity and ease of calving (Scholtz and Hofmeyr, 1992). Additionally, it has been reported that feed conversion ratio of the Nguni on high energy feed concentrate diet compares well with that of improved exotic breeds (Scholtz and Hofmeyr, 1992).

Zebu and sanga purebreds may not be efficient feedlot beef cattle, but they are extremely desirable in restrictive environments. In addition, the genetic utility of zebu and sanga cattle in beef production systems has been well documented. Zebu (and sanga) x *Bos taurus* crossbreds, including reciprocal crosses, exhibit heterosis in several economically important traits. Highest hybrid vigour has been reported in reproductive performance. Maternal heterosis is large for weaning weight. Preweaning and postweaning growth also exhibit significant heterosis. The success of zebu crosses has led to the formation of several zebu-based synthetic breeds. Utilization of zebu crossbreeds and/or synthetics in medium to high potential areas will continue to be important.

Utilization of indigenous animal genetic resources

Issues

In attempting to establish a livestock improvement programme for a difficult environment, there are two main approaches: One is to alter the environment, making it less rigorous. The other is to select stock which, while suitable from the point of view of production, are also likely to be the most adaptable to local biotic and abiotic, including climatic, stresses. To what extent should efforts be made to modify production environments in order to accommodate animals of the highest genetic potential as opposed to concentrating on the productivity of genotypes which withstand the rigours of the harsh environment (while neglecting scope for its amelioration)? Turner (1975) has commented on the need to balance efforts in the two areas by examining cost-benefit relationships and has pointed out that either option taken alone may not be optimum. In traditional African livestock production systems, level of animal management and nutrition cannot support the potential of the so called improved breeds. The extent to which these environments can be freed of the limitations imposed by climate, disease, parasites and nutrition is quite limited. This makes a strong case for the utilization of locally available, adapted genotypes in combination with improvements in the environment wherever feasible and economical, while also considering development of appropriate breeding programmes for further development of these breeds. Unfortunately, national governments have not given due consideration to development of indigenous livestock breeds. Indeed, there is a tendency to

As has been pointed out, Africa is endowed with a wide diversity of breeds and strains of livestock. In addition, available body of evidence indicates that there is substantial within-breed variation in most of the economically important traits. Indeed, estimates of heritability of these traits in tropical (including African) breeds in well-managed populations are often either within the range of those reported from temperate regions or higher than corresponding estimates in temperate regions. Given the fact that most populations of indigenous livestock have been subjected to only very mild selection pressures for productivity, the general trend of high heritability estimates is expected. However, Syrstad (1992) has pointed out that the few available estimates of heritability of production traits in indigenous tropical breeds have invariably been based on insufficient amount of data. Additionally, most of these studies have suffered from poor experimental design. These, plus the generally poor animal management in these situations have obviously resulted in large environmental variations. Thus, heritability estimates on the lower end of the scale have often resulted from larger-than-average phenotypic variation -- mainly from large environmental variation -- rather than from small genetic variation. Swanepoel and Lubout (1992) have concluded that the low reproductive performance of tropical cattle is largely due to environmental, mainly nutritional, stresses, and that estimates of heritability of female fertility traits in tropical Africa, while low to moderate, are higher than estimates for temperate cattle breeds.

A critical component of genetic improvement, only second in importance to "variation", is selection intensity. In traditional systems, reproductive rates are so low and mortalities so high that there is hardly any opportunity for selection. Farmers invariably have to keep all animals that survive. Absence of recording is another important constraint which makes it impossible to undertake selection on objective criteria. Selection pressure is further compromised in most cases by small herd sizes and/or uncontrolled breeding in communal grazing systems.

Choice of strategy

The present distribution of indigenous breeds in Africa is mostly a result of history, tradition and local convenience, sometimes even prejudice. There are only isolated cases where deliberate measures have been taken by governments to select and breed animals specially suited physiologically for each region or to import suitable indigenous germplasm from other countries within the continent. What kind of strategy is needed to effectively utilize Africa's indigenous livestock genetic resources? Table 15 presents a possible framework for matching genotypes with environments. In the really harsh environments, livestock are likely to be kept mainly for meat and will depend mainly on natural pastures characterized by seasonality in both quality and quantity. In addition, animal management, including disease control, is likely to remain poor. In such conditions, fertility and viability are more important than growth rate of individual animals (Syrstad, 1992). Under these circumstances, it seems logical to focus on pure indigenous stock. In relatively milder environments, attempts should be made to improve suitable indigenous populations by selection. Cooperative breeding programmes based on the principle of open nucleus breeding schemes have been proposed as ideal for genetic improvement in situations with moderate levels of management (e.g. Smith, 1988; Barker, 1992).

One important question is whether or not selection in harsh environments should include

selecting animals on the basis of performance alone not give sufficient consideration to adaptive mechanisms involved in maintaining, say heat balance? With regard to adaptation to warm climates, McDowell (1972) has suggested that primary emphasis should be put on performance because of the low correlations between heat tolerance and ability to perform. Turner (1984) reported a reasonably high and significant heritability estimate of 0.33 for rectal temperature and favourable genetic correlation (-0.86) with growth rate from birth to 18 months of age. The favourable correlations suggest that adaptability would not be compromised by placing major emphasis on selection for performance. There are, indeed, indications that selection for performance (e.g. reproduction, survival, growth, etc) in stressful environments will lead to selection for the most suitable animals (e.g. Leckey, 1960; FAO, 1968). Besides, as the number of traits in a selection programme increases, genetic progress that can be made in improving any one trait slows down, unless the traits are highly genetically correlated. Additionally, there are no satisfactory estimates of heritability of measures of adaptability in these populations. Moreover, cooperative breeding schemes, considered ideal for genetic improvement of indigenous livestock, need to be as simple as possible initially and, thus, should avoid complicated selection criteria. However, some studies have indicated that selection for adaptation, when feasible, may yield desirable results. Results reported by Burrow et al (1991) showed that selection of zebus for heat resistance did not change liveweights, carcass weights or time spent in the feedlot. The resulting animals were found to be suited to markets requiring lower levels of subcutaneous fat with high levels of marbling. Additionally, feed conversion efficiency and meat quality traits were not affected as a result of selection for heat tolerance.

Under conditions of sparse feeding or low nutritional levels, small animals obviously have an advantage over large animals (e.g. Taylor and Murray, 1988). In such situations, selecting for body weight above certain optimum levels might result in animals becoming less adapted. In addition to the lower maintenance requirement and other related adaptive attributes already alluded to, an advantage of small body size often overlooked is the resulting convenient carcass size for rapid disposal in environments with inadequate transport network and freezing facilities. In addition, there is no evidence indicating that the quality of beef from the small-sized indigenous cattle is inferior. However, with improved nutrition and general management, selection for increased growth rate or body weight may be justified (Barlow, 1984; Hetzel and Seifert, 1986).

The next question is which breeds to target for improvement. As there is a natural stratification of livestock breeds by climatic zones, there should be little difficulty in making choices. For example, Bonsma et al (1953) had earlier indicated the suitability of Africaner for the scorching (hot and dry) environments and the Nguni for the more humid or hot and wet climates of southern Africa. A good understanding of the environment in addition to knowledge of available breed resources is required to make appropriate decisions on breed choice and necessary improvement interventions.

Where opportunity exists for improving the production environment, there may be a shift towards more commercialized meat (e.g. beef) production systems and/or dairy production. In such cases, there are two options. One is to identify a suitable breed from the wide range of indigenous breeds. For example, beef operations in tsetse-free regions of Southern Africa may consider use of well-selected breeding animals from the Nguni, Africaner, Tuli or even Boran

type" cattle breeds in the sub-region. With improved management, crossbreeding -- with appropriate specialized beef breeds -- for beef production may also be considered. As has been alluded to, breeds such as Tuli, Mashona and Nguni have been shown to be suitable as dam lines in crossbreeding for beef production on range.

There seems to be a growing consensus that, in crossbreeding for dairy production for the tropics the best performance is obtained from crosses with about 50% *Bos taurus* inheritance (Cunningham and Syrstad, 1987). While this may generally be so, consideration should be given to regional differences in environment and management. Low input production systems may, indeed, be better off with less exotic inheritance. Whatever crossbreed composition is appropriate, the biggest challenge is always how to ensure sustained supply of the chosen genotype to farmers. This problem is partly responsible for the creation of many synthetic (composite) breeds found around the world today. It should be pointed out that successful matching of genotypes with environments assumes availability of a wide range of genotypes. Africa is endowed with numerous genotypes. What is required is knowledge of their relative merits and utilization of these merits as appropriate. African countries should look at what is available in the continent before going for importations of inappropriate genotypes.

Even when some sort of crossbreeding is opted for, it is important that a programme of evaluation, improvement and conservation of the indigenous parental breeds be maintained in parallel.

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. Agroecological zones (AEZ) of sub-Saharan Africa

				Area in each region [a)]									
				West Africa as % of:		Central Africa as % of:		Eastern Africa as % of:		Southern Africa as % of:		Total	
	Definition [b)]	Rainfall range (mm)	Area of zone (% of total)	SSA total	AEZ total	SSA total	AEZ total	SSA total	AEZ total	SSA total	AEZ total	SSA (%)	Area of zon (million km²
	<90 pgd	0 - 500	36	54	51	1	1	52	39	20	9	100	7.7
rid	90 - 180 pgd	500 - 1000	18	20	37	7	10	18	26	34	27	100	4.0
mid	180 - 270 pgd	1000 - 1500	22	16	24	29	32	16	19	38	25	100	4.8
	>270 pgd	>1500	19	10	17	59	75	2	3	7	5	100	4.1
ıds[c)]	<20°C	n.a.	5	0	0	4	23	12	72	1	5	100	1.0
·egion) (%)			100	100	-	100	-	100	-	100	-	-	-
rea (million km²)				7.3		5.3		5.8		3.2			21.6

= Sub-Saharan Africa

= plant growth days

; within the other ecozones where mean daily temperature during the growing period is less than 20°C

: Adapted from ILCA (1987).

:. Distribution of sub-Saharan Africa's ruminant biomass by agroecological zones and species

Cattle		Sheep		Goats		Camels		Totals	
TRLU[a)]	%[b)]	TRLU	%	TRLU	%	TRLU	%	TRLU	%
23.6	48.32 (20.7)	5.2	10.6(33.5)	6.9	14.1 (38.1)	13.2	27.0 (100.0)	48.9	100 (30.4)
34.9	80.6 (30.6)	3.6	8.3 (23.2)	4.8	11.1 (26.5)	0	0	43.3	100 (27.0)
25.8	83.2 (22.7)	2.2	7.1 (14.2)	3.0	9.7 (16.6)	0	0	31.0	100 (19.3)
6.9	69.7 (6.1)	1.3	13.1 (8.5)	1.7	17.2 (9.4)	0	0	9.9	100 (6.2)
22.6	82.2 (19.9)	3.2	11.6 (20.6)	1.7	6.2 (9.4)	0	0	27.5	100 (17.1)
113.8	70.9 (100.0)	15.5	9.7 (100.0)	18.1	11.3 (100.0)	13.2	8.2 (100.0)	160.6	100 (100.0)

minant livestock units (250 kg): Cattle 0.7; sheep and Goats 0.125; Camels 1.0; All TRLU x 10^6
:side parenthesis expressed as % of row totals. (Figures in parenthesis expressed as % of column totals).

culations based on 1988 livestock statistics using ratios derived from Jahnke (1982)

Table 3. Estimates of offtake rates for ruminant and non-ruminant livestock in sub-Saharan Africa [a)]

Species and Zone	1995	2010	2015	2025
Cattle (total)	10.8	10.9	12.2	13.0
Arid/Semi-arid	10.2	10.6	10.7	11.0
Subhumid/humid	10.6	12.2	12.8	14.0
Highlands	12.5	13.7	14.1	15.0
Sheep and goats	28.5	37.7	41.4	50.0
Pigs	82.6	90.9	93.8	100.0
Poultry	116.4	131.4	136.8	148.0

[a)] Figures for 2010 and beyond predicted from rates of growth in 1980s through 1990s

Table 4. Distribution of sub-Saharan Africa's ruminant biomass by agro-ecological zone and subregion (1988)

Agroecological zone	% of SSA's total				Total %	No. of TRLUs[a)] (millions)
	West Africa	Central Africa	Eastern Africa	Southern Africa		
Arid	8.0	0.4	18.0	3.4	29.8	50.1
Semi-arid	11.7	1.2	10.3	3.9	27.1	45.5
Sub-humid	3.5	1.8	11.3	3.1	19.6	32.9
Humid	2.8	0.9	1.4	0.9	6.1	10.3
Highlands	0.3	1.5	15.3	0.3	17.4	29.2
Total (%)	26.3	5.8	56.3	11.6	100.0	
No. of TRLU (millions)	44.2	9.7	94.6	19.5	168.0	

[a)]Tropical Ruminant Livestock Units (equivalent to 250 kg): Cattle 0.7; Sheep and Goats 0.125; Camels 1.0.

Table 5. Distribution (%) of African livestock by geographic regions (1995)

Region	Species				
	Cattle	Sheep	Goats	Pigs	Chickens
Eastern Africa[a)]	55	39	47	21	26
Southern Africa[a)]	16	16	10	16	13
Rest of Africa	29	45	43	63	61
Africa - %	100	100	100	100	100
- (x1000 head)	196,393	211,612	174,904	21,541	1,068

[a)] As defined in Table 11

Table 6. Rates of annual population growth (%) of different livestock species (1970-1995) in eastern and southern Africa[a)]

Species and zone	Eastern Africa	Southern Africa
Cattle	1.4	0.6
Sheep	1.6	-0.5
Goats	1.7	1.5
Pigs	8.0	2.1
Chickens	3.4	3.7

[a)]Countries included in these regions are listed in Table 11.

Table 7. Value of agriculture and livestock products in selected countries in eastern and southern Africa (1988)

Region and country	Value of sector ($ millions)		Livestock share of agric. output (%)
	Agriculture	Livestock	
Eastern Africa			
Burundi	739	42	6
Ethiopia & Ertirea	3,243	1,299	40
Kenya	2,202	826	38
Madagascar	1,765	472	27
Rwanda	645	70	11
Somalia	709	514	72
Sudan	3,261	1,901	58
Tanzania	2,837	642	23
Uganda	2,840	404	14
Zaire	2,740	143	5
Southern Africa			
Angola	632	201	32
Botswana	121	107	88
Lesotho	95	66	70
Malawi	831	98	12
Mozambique	796	160	20
Namibia	300	245	82
Swaziland	193	47	24
Zambia	527	169	32
Zimbabwe	1,137	260	23

Source: Winrock (1992)

8. Estimated eastern and southern Africa's ruminant livestock population and meat and milk output (1995)

	Meat output					Milk output			
and Species	Inventory (millions)	% Indigenous	Offtake (%)	Carcass wt (kg)	Quantity (1000 MT)	% Indigenous milked	Inventory milked[a)] (millions)	Lactation yield (kg)	Quantit (1000 M
ı Africa[c)]									
ıttle	107.054	85	10.5	143	1,366.3	26	11.829	320	3,785.
eep	82.730	93	28.5	14	307.0	-	-	-	971.
›ats	82.458	98	28.5	14	322.4	-	-	-	1,341.
rn Africa[c)]									
ıttle	32.282	65	10.4	148	323.0	18	1.888	270	509.
eep	34.106	79	28.5	14	107.5	-	-	-	-
›ats	17.182	98	28.5	14	67.2	-	-	-	13.

ntory of indigenous animals in systems where milking is practised, accounting for herd/flock structures (and sex ratios).
sheep and goats: direct sum of milk output for countries in which the species are milked.
efined in Table 11.

Table 9. Contribution of indigenous ruminant livestock to total meat and milk output in eastern and southern Africa as % of total output for each species (1995)

Region and Species	Meat	Milk
Eastern Africa[a)]		
Cattle	94	41
Sheep	98	100
Goats	100	100
Southern Africa[a)]		
Cattle	43	18
Sheep	82	—[b)]
Goats	100	100

[a)]As defined in Table 11

[b)]Proportion milked is negligible

Table 10. Estimated value of output of meat, milk and hides/skins from indigenous domestic ruminant livestock of eastern and southern Africa (1995)

Species	Product	Value (million $)[a]		
		Eastern Africa[b]	Southern Africa[b]	Total
Cattle				
	Meat	3,825.6	1,065.9	4,891.5
	Milk	1,362.7	193.7	1,556.4
	Hides	70.0	16.0	86.0
Sheep				
	Meat	792.1	311.8	1,103.9
	Milk	349.6	0	349.6
	Skins	39.5	13.8	53.3
Goats				
	Meat	825.3	182.1	1,007.4
	Milk	482.8	4.9	487.7
	Skins	40.1	8.4	48.5
Totals				
	Meat	5,443.0	1,559.8	7,002.8
	Milk	2,195.1	198.6	2,393.7
	Hides/skins	149.6	38.2	187.8
Grand Total		7,787.7	1,796.6	9,584.3

[a]At April/May 1997 retail prices (converted to US $ using current exchange rates) averaged across countries within each region; Cow milk prices assumed to apply for sheep and goat milk; Prices for hides & skins assume suspension/air drying only; number of hides and skins estimated from offtake figures.

[b]As defined in Table 11

Table 11. Net exports of livestock products from eastern and southern Africa[a] (1993)

Region and country	Value of products (US $ million)[b]		
	Meat & Meat preparations	Milk & Milk products	Hides & Skins
Eastern Africa			
Burundi	0	0	0.855
Comoros	0	0	0
Djibouti	0	0	0.124
Egypt	0	0	0
Ethiopia & Eritrea	0	-	35.152[c]
Kenya	0	2.092	0.814
Madagascar	0	4.337	0.680
Mauritius	0	0	0
Rwanda	0	0	2.030
Seychelles	0	0	0
Somalia	0	0	1.340
Sudan	0	0	6.240
Tanzania	0	0	1.700
Uganda	0	0	7.306
Zaire	0	0	0.200
Region total	0	6.429	56.441
Southern Africa			
Angola	0	0	1.000
Botswana	0	61.880	6.777
Lesotho	0	0	0.100
Malawi	0	0	0.879
Mozambique	0	0	0.500
Namibia	0	28.670	4.238
South Africa	25.372	0	72.446
Swaziland	0	0	0.409
Zambia	0	0	0.296
Zimbabwe	3.503	18.740	8.558
Region total	28.875	109.290	95.203

[a] As defined for purposes of the workshop
[b] Zero is no exports or negative net exports.
[c] 1992 figure

Source: FAO data tapes.

Table 12. Some promising indigenous cattle breeds of eastern and southern Africa for dairy production

Breed	Location	Milk production (kg)	BF(%)	Lactation length (days)	Fat corrected milk (kg)[a)]
Barca	Ethiopia/Eritrea	670-1800	5.0	170-185	817-2194
Butana	Sudan	1000-5600	5.5	190-580	1299-7272
Kenana	Sudan	700-4600	4.5	220-400	798-5242
Kenya Sahiwal	Kenya	900-2700	5.0	270-320	1097-3291
Mpwapwa	Tanzania	350-1600	4.9	92-285	421-1925
Nkone	Zimbabwe	300-2300	4.2	100-290	328-2511

[a)]Corrected to milk of 3.6% butter fat

Table 13. Comparison of various cow genotypes on basis of productivity indices[a)]

Cow genotype	Index 1	Index 2	Index 3
Afrikaner	281.1	253.1	142.8
Mashona	346.5	317.0	232.9
Nkone	335.0	297.0	198.0
Tuli	317.8	293.6	202.9
Brahman	311.3	271.3	181.9
Charolais	284.0	241.0	157.6
Sussex	281.0	251.7	143.0
Afrikaner x Mashona	322.2	296.3	185.1
Afrikaner x Nkone	322.2	296.3	185.1
Afrikaner x Brahman	299.5	273.5	170.8
Afrikaner x Sussex	306.0	276.7	174.9
Charolais x Afrikaner	302.1	261.7	183.1
Sussex x Brahman	315.3	282.2	187.8
Charolais x Brahman	313.4	291.3	206.7
Charolais x Sussex	297.7	272.0	176.2

[a)]Definition of indices:

Index 1: Weight of 18 month calf per 100 kg of metabolic weight per year considering only surviving calves.

Index 2: Weight of 18 month calf per 100 kg of metabolic cow weight per year adjusted for calf mortality between birth and 18 months of age.

Index 3: Weight of 18 month calf per 100 kg of metabolic cow weight mated per year. This index was, thus, adjusted for both calf mortality and calving rate.

Source: Moyo (1996)

Table 14. Comparison of cow genotypes on basis of preweaning calf mortality and cow productivity indices[a)]

Cow genotype	Preweaning calf mortality (%)	Index 1	Index 2	Index 3
Nguni	4.3	173.4	165.9	212.3
Brahman	10.2	168.8	151.6	209.8
Simmental	10.6	71.3	63.7	78.1
Brahman x Nguni	5.1	258.0	244.8	334.9
Simmental x Nguni	3.4	82.5	79.7	88.0
Drakensberger x Nguni	5.7	109.6	103.4	129.6
≥7/8 Brahman x Nguni	8.8	165.2	150.7	223.4
≥7/8 Simmental x Nguni	11.8	78.5	69.2	66.3

[a)]Definition of indices:

Index 1: Weight (kg) of weaner (210 days) calf per 100 kg metabolic cow weight per year at constant age at first calving

Index 2: Index 1 adjusted for preweaning calf mortality

Index 3: Weight (kg) of 18 month calf per cow per year at constant age at first calving

Source: Vilakati (1990)

Table 15. Framework for matching genotypes with environments[a)]

Agroecological zone & input level		Ruminants			
		Meat	Milk	Pigs	Poultr
Arid/Semi-arid					
	Low input	I	I	I	I
	Medium input	I	I	I	I
Sub-humid/Humid					
	Low input	I	I	I	I
	Medium input	I*,G	I*,G	I*,G	I,I*
Highlands					
	Low input	X[b)]	I*,G,E	I	I
	Medium input	X	I*,G,E	I*,G,E	I*,G,I
All AEZ:	Intensive[c)]	I*,G,E	I*,G,E	I*,G,E	I*,G,I

[a)]Definitions: I,G,E = Indigenous, Grade, Exotic; I* = Specialized or improved indigenous

[b)]X = Not appropriate

[c)]Intensification assumed to address environmental constraints specific to AEZs.

THE PRIVATE SECTOR'S CONTRIBUTION TO LIVESTOCK DEVELOPMENT IN KENYA: A Paper Presented during the Seminar on Livestock Development Policies in Eastern and Southern Africa, Mbabane, Swaziland, 28th July - 1 August 1997; By J.K. Waweru, Chief Executive, Kenya National Farmers' Union, P.O. BOX 43148, Nairobi.

Abstract

Livestock accounts for over 10% of GDP and over 30% of farm-gate value of agricultural commodities produced in Kenya. The subsector employs over 50% of the agricultural labour force and provides raw materials for various industries. The sector also contributes considerable foreign exchange earnings through exports and has great potential to expand due to increasing local and external demand for livestock products. However, many constraints still hinder further development of the sector. These constraints largely revolve around factors of production such as adequate supplies of quality feed and feed supplements, veterinary drugs, water, credit and extension combined with marketing infrastructure. The private sector has a most important role to play in ensuring that the constraints are reduced to the minimum possible, particularly in the liberalized environment. However, many of the constraints such as lack of proper extension messages and the quality of livestock feeds can only be eliminated by strong collaboration between the private sector and the government.

The private sector plays a major role in the supply of breeding stock, production and distribution of animal feeds, animal health products, marketing and processing of meat dairy products and provision of credit services.

1. INTRODUCTION

There are many livestock types in Kenya, the major ones being cattle, sheep, goats, pigs, camels and poultry. In the paper, I will limit myself to cattle, shoats, pigs and poultry. Livestock provides food, cash, fuel, clothing, employment and capital stock. It is a source of wealth, provides manure for crop production and utilises crop wastes and other fodder otherwise useless to man. Livestock accounts for over 10% of GDP and over 30% of the farm-gate value of agricultural commodities. Table 1 below shows the value of various livestock an livestock products marketed between 1989 and 1994.

1.1 Overview of Production Structure.

1.1.1 Beef

Beef production in the country comes from three prominent herds. These are:

- The pastoral herd (local and external)
- The commercial ranches/farms
- The smallholder herd (zebu and dairy)

The smallholder and pastoral systems supply over 70% of the total beef consumed in the country. Production from large scale farms and ranches has declined due to resettlement and subdivision of farms whereas that from the smallholder dairy herd has grown very rapidly over the years. The bulk of beef cattle and small ruminants which provide red meat is produced in the Arid and Semi-arid Lands under ranching and nomadic pastoralism systems. However, there is a significant proportion of beef coming from bull calves and cull cows as by-products of the dairy industry in high potential areas. Kenya's sources of beef extends beyond the

indigenous and exotic birds are kept. Indigenous chicken production is characterised by small flock sizes per household for domestic consumption mainly. Commercial chicken production is based on purchase of dayold chicks from hatcheries plus imports. Production of layers and broilers is mainly in urban areas close to the market.

1.2 The Role of Farmers' Organizations

Several farmers organizations are actively involved in the livestock sector. Major organizations include cooperative societies and unions, farmers associations and companies. These are involved in production, marketing and processing of livestock and livestock products as well as policy representation. They also supply farm inputs and offer other services. Details of this will be presented in later parts of this paper.

2. PROVISION OF LIVESTOCK SUPPORT SERVICES.

2.1 ANIMAL HEALTH

Livestock diseases occur widely causing severe, depressing effects on productivity and retard introduction of higher yielding stockand new innovations. Estimates of adult livestock mortalities are in the order of 15% to 20%, while calf mortalities may be as high as 30% or more. Available data show that economic losses due to diseases amount to more than Ksh. 70 billion or U.S Dollars 1.3 billion per year.

The private sector plays an important role in the provision of clinical services,

country's borders and substantial supplies of livestock come from Somalia, Ethiopia, Uganda and Tanzania.

1.1.2 Milk and Dairy Products

Kenya has one of the largest dairy sectors in Sub-Saharan Africa, consisting of over one million dairy cows which produce more than 1.5 million litres of milk annually. 80% of the milk is produced by smallscale farmers under zero-grazing or semi-intensive production systems while the rest is produced by medium and large scale farms. The major dairy products processed in the country include whole milk, butter, cheese, ghee, milk powder and other products. Production of milk is based mainly on forage with concentrates fed during milking time and therefore output follows the rainfall pattern resulting in seasonal fluctuations. Kenya is basically self sufficient in milk production during normal years except in drought situations when considerable amounts have to be imported.

1.1.3 White Meat

About 90% of pig production is carried out by small scale farmers with less than 20 sows. There is one major multinational company involved in pig production which owns pig farms and also receives pigs from contracted farmers. Pig and pig products are marketed mainly by the same multinational company and other small outlets run by smallscale traders.

Chicken is the most important of the poultry types produced in Kenya. Both

importation, local manufacture and distribution of drugs and vaccines, dipping and artificial insemination services, contractual vaccinations and in the supply of animal health equipment. It consists of private veterinarians, local and international companies, farmers' co-operatives societies and individual large scale farmers.

Only one public institution, the Kenya Veterinary Vaccines Production Institute is involved in the manufacture of vaccines. The rest is carried out by the private sector. The World Bank is also currently supporting a scheme to enable private veterinarians by giving them soft loans channelled through local commercial banks.

2.2 MARKETING

2.2.1 Red Meat

The marketing of livestock and livestock products is wholly in the hands of the private sector. Beef cattle and shoats which produce red meat are marketed through several channels.

i) Sale to local butchers - mainly in the high potential areas where only a few animals are involved at a time.

ii) Producer - trader channel - this is most common in pastoral areas where smallscale traders sell to local butchers but larger ones may trek or truck the animals to distant slaughter houses in major urban centres.

iii) Producer - abattoir channel - some producers transport to trek their animals from the pastoral areas direct to slaughter houses in major towns.

iv) External marketing - a number of large scale farmers export live animals, mainly sheep and goats, about 6,000 to 15,000 annually.

2.2.2 Milk and Dairy Products.

Milk is marketed formally and informally. The co-operative societies play a leading role in milk marketing in the country.

In 1994, there were about 207 dairy co-operatives with a membership of about 206,000 concentrated in the high milk potential areas of the country. The marketing of milk has until recently been dominated by the Kenya Co-operative Creameries, a private company but the situation is rapidly changing. Due to liberalization of the industry, many small scale milk processing factories have emerged and are expected to play an increasing role in milk processing and marketing and over 20 small dairies are now in operation. The largest of these dairies, however, hardly is reach 10,000 litre per day and the processing capacity of most of them is below 5,000 litre per day. Trade in raw milk has also considerably increased. There are over 1,000 small scale traders in the industry. Milk marketing in Kenya is carried out through the following channels:

i) Direct producer - consumer sales of raw milk - very common in the rural areas where small scale farmers sell to neighbours and nearby institutions.

ii) Direct sales of processed liquid milk from processors to consuming households and institutions.

2.2.3 White Meat

The major market for pig products is mostly in the major urban areas. The market is currently dominated by one large international company with a few local ones. Poultry meat producers sell directly to consumers and hotels.

2.3 BREEDING STOCK.

Various organizations both private and public, are involved in and give support to livestock breeding activities in Kenya. The private sector is represented by the Kenya Stud Book, the Dairy Recording Services, Agricultural Society of Kenya and Breeds' Societies whereas public institutions include the Central Artificial Insemination Station, Kenya National Artificial Insemination Service and Livestock Recording Centre. Even in these public organizations, however, there is now a strong move to privatize many of their functions.

The Kenya Stud Book (KSB) was started in 1920 within the then Agricultural and Horticultural Society of Kenya and its role is to register livestock and maintained Pedigree Registers of cattle, goats, sheep and pigs. These register are very useful and fundamental for the development of commercial livestock breeding, improvement and production. Such livestock data are extremely useful, important and mandatory when selling, buying and exporting breeding stock and when exhibiting at agricultural shows. The Kenya Stud Book registrations are recognized as the official and authentic records. For example, in 1994 alone, 3946 cattle, 271 pigs and 269 sheep, or a total of 4486 animals were registered by the KSB.

iii) Direct sales of raw milk by smallscale traders in villages and urban centres.

iv) Direct sales of processed liquid milk by small private shops and supper markets.

2.4 ANIMAL FEEDS AND OTHER INPUTS

The production of animal feeds in Kenya is wholly a private sector affair. There are over 20 livestock feed millers in the country but most of them are located in the major cities and towns far from the majority farmers. Many are local companies and co-operative societies and only a few are multi-national companies. There has been a major increase in the number of small scale millers providing animal feed in the last few years. Table 4 below gives the value and quantity of manufactured feeds for the year 1994. Judging by the value of production, the table indicates that poultry feed manufacture leads with 64.9%, followed by cattle feeds. Pig feed manufacturing is the lowest with only 6.5% share. The same trend is maintained using quantities produced as poultry leads with 55.4%, followed by cattle with 28.0%, pig feeds 11.6% and the rest 5.0%.

Despite the private sector's efforts to provide feeds, producers face several problems. The key problem is the high price of quality feeds. This often forces farmers to resort to cheaper but poor quality substitutes. Feed production is itself constrained by availability of protein supplying feedstuffs such as soya, fishmeals, meat and bone meals, and oil-cakes which sometimes have to be imported. There is also competition directly with the human population for feedstuffs such as maize. Feed alternatives have not yet been developed which do not compete with human population, or which have better drought tolerance.

2.5 LIVESTOCK CREDIT

The major source of credit has been one key parastatal, the Agricultural Finance Corporation. Although the role of the private sector, particularly commercial banks has been quite significant, much of the credit has gone to large scale producers to the disadvantage of small scale farmers. The interest rates charged by commercial banks of as high as 30% have been unaffordable to most farmers. It is estimated that only 2% of the smallscale farmers have access to credit.

2.6 EXTENSION SERVICES

The provision of extension services is largely the responsibility of the government. However, with implementation of structural adjustment programmes, the government is reducing its role and transferring this to the private sector. Already a number of farmers' organizations and private sector firms are carrying out limited extension services but they lack both human and material resources to be effective.

3. CONSTRAINTS TO LIVESTOCK PRODUCTION AND MARKETING

Constraints in livestock production and marketing can be summarised as being the following:

* Capital: most of the supporting infrastructure such as water, dips and acces roads remain undeveloped especially in the rangelands.
* Research and extension: current research is biased towards crops, especiall the major cash crops such as tea and coffee.

* Range utilization is poor due to poor extension, game encroachment, unev water distribution and insecurity (cattle rustling).

* Marketing: is poorly organized and market infrastructure is poor.

* Breeding and reproduction:- Artificial insemination services are very unreliat and there is lack of quality breeding stock.

* Animal diseases: The country experiences a multitude of diseases and veterinary services have seriously deteriorated since the government started implementing structural adjustment programmes with drastic reduction of support for these services.

* Diminishing land resource due to population pressure.

* High cost of feeds which are often of low quality.

* Lack of credit

3.1 Intervention Required.

The following interventions are needed by both the public and private sectors in order to have a properly functioning system livestock production and marketing:

* Promotion of production systems that are land saving and employment generating such as in integrating crops and livestock production to attain optimal land utilization.

* Promotion of improved water and soil conservation and environment enhancing measures such as better water harvesting techniques and growing of suitable tree and crop species for rangelands.

* Improvement of marketing and associated infrastructure such as cold storage facilities, construction of stock routes and establishment of abattoirs as close to farmers as possible.
* Improvement of animal husbandry by promoting demand driven extension messages through extension.
* Improve marketing efficiency be restructuring marketing organizations, especially cooperatives which are rife with mismanagement.
* Provision of market information
* Supply of appropriate technologies suitable to small scale processing
* Provision of credit for both production and processing at affordable interest rates to all entrepreneurs.
* Feed millers should contract farmers to grow grain that are less competitive with human beings such as sorghum, triticale, millet and yellow maize.

* Strengthening of research and extension in production aspects
* Strong monitoring of the quality of feeds and the development of adequate quality standards.

2.6 Summary and Conclusions

The livestock sector plays an important role in Kenya's economy in terms of income generation for farmers, processors and marketing firms as well as

creation of employment. The sector also contributes considerable foreign exchange earnings through exports and has great potential to expand due to increasing local and external demand for livestock products. However, many constraints still hinder further development of the sector. These constraints largely involve factors of production such as adequate supplies of quality feed and feed supplements, veterinary drugs, water, credit and extension combined with marketing infrastructure.

The private sector has a most important role to play in ensuring that the constraints are reduced to the minimum possible, particularly in the liberalized environment. Many of the constraints such as lack of proper extension messages can only be eliminated by strong collaboration between the private sector and the government.