CHAPTER 3

Enhancing the role of livestock

3.1. Importance of livestock in African economies

Livestock significantly contribute to the agricultural GDP in Africa. It is estimated that livestock-derived food items (meat, milk and eggs) alone contributed around 30 percent to agricultural GDP in 2003 (see Table 1). This estimate does not include non-food livestock products such as draught power and manure, which enhance productivity of crop production, nor does it take into account intangible livestock contributions to rural communities through risk mitigation and wealth accumulation (Box 1). Around 10 percent of the human population of Sub-Saharan Africa is primarily dependent on livestock, while another 58 percent at least partially depend on livestock. In 1999, livestock were estimated to account for 53 percent of the agricultural capital stock in Sub-Saharan Africa, with land accounting for a further 42 percent.[1]

Nearly 60 percent of the value of edible livestock products is generated by cattle in the form of meat and milk, while small ruminants (meat and milk) and poultry (meat and eggs) generate around 20 percent each. On the continent as a whole, pigs only play a minor role in food production. Meat, milk and eggs constitute around 65 percent, 27 percent and 8 percent, respectively, of the value of edible livestock products.

Livestock contribute significantly to food supply and nutrition. Animals are a major source of food, particularly of high-quality protein, minerals, vitamins and micro-nutrients for the majority of African people. It is estimated that meat, milk and eggs provide about one fifth of the protein in African diets. Animals also make indirect contributions to human nutrition and play a major role in improving food security in Africa because cash incomes obtained from the sale of animals are regularly used to buy non-livestock food items and inputs to farming.

[1] Oxford Policy Management (2003), *Agricultural and Rural Enterprise in Africa: Is there an Investment Gap?*

Milk cow, www.codeart.org

3.2. Livestock populations by subregion and agro-ecological zones

In 2003, Africa's livestock population was estimated at 231 million cattle, 244 million sheep, 223 million goats, and 22 million pigs, unevenly distributed across the continent. The majority of the livestock population is found in the Eastern, Western and Northern subregions. About half of all cattle, more than a third of all sheep and 40 percent of goats are found in the Eastern Africa region. The Northern subregion accounts for 35 percent of all poultry while the Western subregion has about 35 percent of the goat population. Livestock populations in the central and Southern subregions are very low, mostly because of climatic conditions and high disease pressure. Major cattle producing countries (with cattle populations exceeding 10 million heads each) include Ethiopia, Nigeria, Kenya, Sudan, Tanzania and South Africa.

As elsewhere, livestock are kept in different livestock systems, each with different demands on resources, facing different constraints and possessing different potentials for growth. The systems have different production goals, varying levels of productivity and differ in their relative contribution to total off-take of livestock products. Two groups of livestock production systems exist in Africa, namely the traditional and the non-traditional systems. The former comprise: (i) pastoral and agropastoral systems; and (ii) mixed systems in the semi-arid, subhumid and humid zones. The non-traditional systems comprise: (i) ranching (meat and milk); (ii) smallholder and peri-urban

BOX 1

The importance of livestock

- Livestock are often one of the most important sources of cash income for poor households. Ruminants provide milk and poultry provide eggs in small but readily available and regular amounts.
- Livestock utilize feeds with few alternative uses to produce highly nutritious foods for people in small but regular amounts. These foods are particularly important for children, and pregnant or lactating women.
- Livestock are one of the few assets owned by poor households and can be crucial in maintaining household survival in times of crisis. Livestock assets can be accumulated in good times and sold when necessary, e.g. to pay school fees or buy health care. Livestock are both an inflation-proof and productive investment.
- Livestock are central to farming systems used by the poor, providing draught power and manure – often when the purchase of substitutes is impossible. Draught animal power drives crop production in many farming systems. The use of manure is an efficient and sustainable method for maintaining soil quality and water retention.
- Livestock allow the poor to capture private benefits from common property resources: they do not require private land holdings.
- Livestock are often central to major social events and ceremonies. In many African societies, livestock are the basis for traditional social support systems and are an integral part of the African way of life.
- Livestock provide a range of other benefits including hides and skins, fuel for cooking and appropriate transport for carrying water, goods and people.

commercial systems; and (iii) intensive livestock production in irrigated systems largely in North Africa. With perhaps the exception of poultry, the vast majority of African livestock are kept in traditional production systems. Pastoral systems are commonly located in arid and semi-arid zones, which are inappropriate for crop production. Nomadic and transhumant pastoralism is practiced where rainfall is less than 400 mm per year. Agropastoralists live in areas with higher levels of rainfall, between 400 to 600 mm per annum. They engage in cropping activities and keep livestock as well. Their reliance on livestock for income and nutrition is high, but crops also contribute to household livelihood.

Within mixed systems, rainfed agriculture tends to be the major household income earner. Livestock are usually integral to the biophysical and economic importance of cropping patterns, both by providing inputs and consuming outputs. While providing draught power, manure and transportation, livestock in turn rely heavily on crops as a feed source. Mixed highland systems are concentrated in Eastern Africa, and are particularly suited to dairy production. The comparatively good soil quality, climate more suited to forage and grain production, lower concentration of disease vectors (e.g. tsetse flies), have led to high human population densities supported by flourishing livestock production in these areas.

Non-traditional systems are commercially oriented and include ranching systems, smallholder and peri-urban dairy systems. Ranching systems are found in all agro-ecological zones, but are most common in the arid and semi-arid zones of Eastern and Southern Africa. Smallholder dairy systems are well developed in the highlands of Kenya and other East African countries, while peri-urban dairy systems are found throughout most of Africa.

The agro-ecological conditions are one of the important determinants of the characteristics of livestock production, in terms of species, breed, stocking rate, disease pressure, individual productivity, etc. They determine the distribution of cattle, sheep and goats. Estimates of the relative importance of livestock within agro-ecological zones and of the relative importance of the main agro-ecological zones to the supply of livestock products are provided in Table 2.

More than half of all livestock in Africa are kept in the arid (including deserts) and semi-arid zones. The lead species numerically in the arid zone are goats and sheep, followed by cattle. Although the lower rainfall areas of the semi-arid zone (500 to 750 mm rainfall per year) are best suited to grazing, livestock production in this zone is usually a component of mixed smallholder crop-livestock systems.

Camels used as means of transportation: a traditional usage in the Sahel, Niger.

The semi-arid zone has cattle as its lead species (containing about 32 percent of all cattle), followed by goats and sheep. In the subhumid zone, livestock production is undertaken in mixed crop-livestock systems. Again, cattle constitute the lead species, followed by goats and sheep.

Despite the large feed potential for livestock production in the humid zone, it is not an important economic activity because of severe disease constraints, primarily the predominance of trypanosomosis. Less than 10 percent of Africa's total livestock population is found in this zone, despite its constituting around 20 percent of the continent's land area.

Although the highlands account for less than 5 percent of Africa's land area, they account for nearly 20 percent of the total cattle population. The highlands have the region's highest density of both people and animals. Livestock are kept mainly in smallholder crop-livestock farms and cattle are important for the provision of draught power as well as for milk production as can be seen by the disproportionate share of milk (more than 20 percent) being produced in the highlands.

3.3. The need to increase livestock production and productivity

Africa's human population has been growing at an average rate of 2.7 percent over the past 20 years. It reached 796 million in 2000 and is currently estimated at about 832 million. Projections indicate that the African population will be about 1.1 billion by the year 2015. The urban population has been growing at an even higher average rate of 4.2 percent over the last 20 years and it is estimated that by 2015 about 490 million people (approximately 45 percent of total population) will be living in cities and large towns. This growing urbanisation will further amplify the growth in demand for food of livestock origin, because the urban population generally has higher incomes than those living in rural areas.

Despite the opportunity of growing demand for livestock products, the annual growth rates in production over the last decade have been variable across subregions. North Africa is the only subregion where production growth has outstripped population growth (see Table 3). East Africa has seen relatively good growth in milk production while in Central and Southern Africa growth rates of livestock production have severely lagged behind population growth rates (an exception being poultry production in South Africa).

In Sub-Saharan Africa as a whole, the current annual growth rate of cattle, sheep, and goat populations has been estimated at 1.4 percent, 2.5 and 4.3 percent, respectively, while the annual growth rates in production were only 2.0 percent, 1.9 and 2.4 percent for meat, milk and eggs, respectively.[2] As production methods in Sub-Saharan Africa are currently less reliant on expensive growth promoting inputs such as feeds, farm machinery and housing, average yields per animal are relatively low: average carcass weights achieved are only 129 kg, 13.2 kg 11.8 kg and 48.2 kg for cattle, sheep, goats and pigs, respectively, while milk yield per lactation is 341 kg. In comparison, the average yields per animal for all developing countries are 162 kg, 14.9 kg, 12.1 kg and 72.8 kg for cattle, sheep, goats and pigs, respectively, while milk yield per lactation is 994 kg.

Overall, livestock production and productivity growth has not been sufficient to keep up with the demand of expanding populations. This has led to increasing levels of imports of livestock products into Africa, currently valued at close to US$2.3 billion per year and projected to further increase. In order to keep pace with human population growth, and so avoid declining self-sufficiency ratios and rising import bills, the output of livestock products in Africa would have to increase by at least 2.7 percent annually. Based on FAO projections[3] available for Sub-Saharan Africa, total livestock production would have to grow at an average annual rate of 4.2 percent by the horizon 2015 to meet the needs of the growing population, improve nutrition and progressively eliminate food imports, while required growth rates for the individual components would be 2.5, 4.9 and 4.4 percent per annum for meat, milk and egg production, respectively (Table 4).

If current livestock production trends continue unchanged, the output of meat, milk and eggs will substantially fall short of future demand and the shortages will increasingly have to be met through imports. The challenges are daunting but can be met if concerted efforts are made to address the major constraints facing livestock production in Africa.

3.4. Constraints to increased livestock production and productivity

A variety of constraints impact negatively on livestock production and productivity and must be addressed if substantial growth is to be achieved for the subsector. These constraints fall under three main categories[4]: (i) technical constraints; (ii) policy and institutional constraints; and (iii) specific agro-ecological zone related constraints.

[2] FAO (2002). *Cattle and Small Ruminants Production Systems in Sub-Saharan Africa: A Systematic Review*. Food and Agriculture Organization of the United Nations, Rome, Italy.

[3] FAO (2003). *World Agriculture: Towards 2015/2030*. Food and Agriculture Organization of the United Nations, Rome, Italy.

[4] Winrock International (1992). *Animal Agriculture in Sub-Saharan Africa*.

3.4.1. Technical constraints

Feed supply. This constraint is more acutely felt in the drier regions, where the quantity of forage is often insufficient for the numbers of livestock carried, and where the availability of feed is subject to pronounced seasonal patterns. In wetter regions, the problem is more of a qualitative than of a quantitative nature; forages often being of poor quality, with low energy and protein contents. In both the drier and wetter regions, the feed shortages and nutrient deficiencies are more acute in the dry season. Increases in feed availability at low cost will be the most significant factor, which will determine whether the required 4.2 percent annual growth in animal production is achieved.

Not all agro-ecological zones are affected in the same manner. In the arid and highland zones, feed resources are almost completely utilized. In the highland zones, however, opportunities may exist for farmers to raise production through increased use of technology and inputs. Because of the relatively moderate stocking pressure in the semi-arid zone and the good feed production potential in the subhumid zone, opportunities exist in these two zones for a moderate expansion of cattle populations.

Animal health. Animal diseases continue to constrain livestock productivity and agricultural development. It has been estimated that in Sub-Saharan Africa animal diseases result in annual losses in excess of US$4 billion, which represent about one fourth of the total value of animal production. The impact of animal diseases stems from direct losses due to mortality and its indirect effects through slow growth, low fertility and decreased work output that result from morbidity. According to a recent study[5], the diseases with the highest impact on smallholder livestock keepers in Sub-Saharan Africa are ecto- and endo-parasites, respiratory complexes, Newcastle disease, trypanosomosis, contagious bovine pleuro-pneumonia (CBPP), Rift Valley Fever (RVF), and tick-borne diseases such as heartwater and theileriosis.

Animal genetics. Low genetic potential is also a serious constraint especially for milk production. However, the introduction and use of imported stock in breed substitution and crossbreeding programmes with the aim of achieving a more rapid increase in milk and meat productivity, has not always yielded the expected results. In tropical countries, indigenous breeds are often more disease resistant, heat tolerant and have the ability to efficiently utilize poor quality feed. Therefore, genetic sources of resistance or tolerance to diseases and pests and adaptation to harsh climates need to be both preserved and combined with the capacity to generate higher meat and/or milk outputs.

[5] ILRI (2002) – *Investing in Animal Health Research to Alleviate Poverty,* a report commissioned by the United Kingdom's Department for International Development (DFID).

3.4.2. Policy and institutional constraints

The livestock subsector has in the past been subjected to unfavourable government policies, through incentive policies biased towards urban consumers and excessive regulation and unfair public sector competition. In addition, the subsector has also suffered from poorly functioning institutional settings and hence weak implementation capacities of policies, regulations and standards. These constraints are examined below.

Bias towards urban consumers. African governments have often given priority considerations to supplying urban consumers with cheap agricultural products, including meat and milk. The resulting economic distortions have contributed to depressing local production and caused inefficient use of scarce human and financial resources. Prices have been kept low in several ways, including through exchange rate policies, import policies, and direct price controls.

Excessive regulation. African governments have often been involved, through parastatal agencies, in production, processing and marketing activities. Such involvement has often stifled private entrepreneurship through excessive regulation and monopolistic behavior of the public sector. Such practices have been, however, progressively abandoned since the 1990s, as parastatal agencies were dismantled and an active private sector started emerging in several countries.

Institutional constraints. Over the past decades, National Agricultural Research Systems (NARS) have increasingly experienced budgetary constraints. The result of these budgetary constraints can be seen as NARS are not generating sufficient new technology to promote agricultural and livestock development, and links with extension services are limited.

Budgetary and institutional constraints hamper the provision of effective *extension services.* Extension agencies have been, and still are, more responsive to government bureaucracies than to the needs of the farmers. There is often difficulty in delivering integrated crop-livestock extension services to mixed crop-livestock farmers because extension agents are located in different ministries and respond to different administrative entities.

Public, government-operated *veterinary services* have shown their limitations in providing the comprehensive animal health services needed for livestock development, mostly because of issues related to under-funding. This has led to weak implementation of programmes for disease surveillance and vaccine production, and control measures for epidemic disease are inadequate. The weak implementation capacities of many government livestock services in Africa have been compounded by decentralisation of veterinary services in a number of countries without adequate provision for the co-ordination of the control of major infectious diseases.

While privatisation of veterinary services has been considered as an option, it would need to be adapted to the varying realities and needs of different countries. Because the private sector is profit-oriented, it is clear that only selected services could be efficiently privatised. Governments would remain responsible for "strictly public good" activities such as national research and extension, legislation and policies, disease surveillance, public health, transboundary animal diseases, livestock movement control and quality control of livestock inputs and products.

Marketing and processing. Most livestock production is constrained by market access, both for inputs and outputs, being mainly restricted to local and informal markets. Access to the larger national, regional and international markets is limited because of poor infrastructure and increasing technical requirements. The absence of functioning marketing facilities and conservation and processing infrastructure is a major constraint to livestock sector development.

Policy formulation and planning. In addition to the above, livestock departments are often limited by weak policy-making, sector planning and implementation capacities, resulting from inadequate human resources, the lack of accurate and detailed statistical information, and poor negotiating powers. Furthermore, although technological problems are relatively well understood, there is a lack of institutional capacity to apply appropriate solutions because institutional linkages between research institutions, extension services and veterinary services are extremely weak in many instances, resulting in poor design and delivery of programmes.

BOX 2

The case for institutional and policy changes in the livestock sector

Much of the information related to policy and institutions in recent years comes from efforts to address poverty through livestock development. For the livestock sector two major studies have been completed and both concluded that technological solutions have limited impact if they are not supported by enabling policies and the institutional frameworks to make those policies implementable.[1] In 2003/2004, the African Union's (AU) Inter-African Bureau for Animal Resources (IBAR) consulted senior policy-makers to assess policy and institutional constraints in the livestock subsector. The AU team spoke to ministers, permanent secretaries, heads of livestock departments and a range of other stakeholders. One of the key observations from the consultation was that policy-makers were convinced of the urgent need to change policies and institutions to support livestock sector development. Reasons for the relatively substandard policy environment for livestock included:

- A weak livestock sector information base on which decision-making is made. Lack of quality information on the livestock sector in Africa has the effect of over emphasising the importance of crops with poor recognition of the actual contribution of livestock to national economies and rural livelihoods. As a result, livestock contributions to Poverty Reductions Strategy Papers (PRSP) and other national development strategies are underdeveloped and underfunded.
- Policy-making processes were deemed to have a top down orientation with heavy government influence and that the increasingly accepted good practices of developing policy through consultation and networking, evolution over time and during the actual process of implementation are poorly understood.
- Group of policies in the livestock sector were policies that just did not exist, that is, there are still major "policy gaps".
- Monitoring and evaluation of policies and policy processes were rarely in place.
- Civil society groups able to advocate for change were weak and insufficiently involved in policy-making. This was partly due to the extra costs involved in their inclusion and partly due to the belief that government should lead policy development.
- Furthermore, weak and poorly coordinated institutional arrangements for policy formulation and implementation occurred at nearly all levels but especially at central government levels. The underlying causes of this were usually linked to the creation of government structures and ministries without due consideration of manageability or definition of core functions and weak government/ private sector linkages.

[1] – Ashley, S., Holden, S. & Bazeley, P. (1998). *Strategies for Improving DFID's Impact on Poverty Reduction: A Review of Best Practice in the Livestock Sector.* Department for International Development, London.
– AU/IBAR 2004 Institutional and Policy Support to the Livestock Subsector in Africa: *Regional Overview of a Preliminary Consultation in the Greater Horn of Africa,* July 2004. Institutional and Policy Support Team Report, Interafrican Bureau for Animal Resources (IBAR), Directorate of Rural Economy and Agriculture (DREA), African Union.

3.4.3. Specific agro-ecological zones related constraints

Arid zone. Livelihoods in the arid zone are under growing threat due to recurring droughts and the presence of animal diseases. High production risks due to droughts, diseases and inadequate veterinary services, and increasing degradation of the environment reduce the productivity of livestock in this zone whilst making the livestock owners increasingly vulnerable to shocks. The low potential of the land restricts intensification of livestock production. However improved market access and improved use of rangeland resources could significantly increase offtake and allay many of the problems that new restrictions to the movement of pastoralists, such as rangeland degradation, are creating.

Semi-arid zone. The major constraints in this zone include high population pressures, declining soil fertility, inadequate dry season feed, scarcity of water, lack of veterinary services, poor infrastructure for transportation, processing and marketing, poor input delivery systems and lack of technology, especially for improving the output of the integrated crop-livestock farming systems.

Subhumid zone. Although opportunities for expansion of livestock numbers are greater in this zone than in any other, there is an even larger potential for growth in meat and milk production through productivity increases. Animal diseases constitute the major constraint, in particular vector-borne and parasitic diseases (trypanosomosis and tick-borne diseases). Although disease pressure from trypanosomosis has been reduced, losses are still important. Low soil fertility and poor feed quality are also constraining livestock development. Native pasture grasses are often of poor quality and dry season feeds are low in protein. Like all the other zones, the subhumid zone also faces severe infrastructure deficits.

Humid zone. In addition to all major constraints of the subhumid zone, the humid zone is more prone to animal diseases, especially trypanosomosis, which limits ruminant production to trypano-tolerant breeds. However, there is a shortage of such breeding stock. Prospects for increased ruminant production in this zone are very limited, but potential for poultry and pig production exists, provided the unavailability of concentrate feeds and poor infrastructure are overcome.

Highland zone. Even though the highlands are the most intensively farmed zone in Africa, there is the potential to increase meat and milk production through improvement of livestock productivity and modest increases in livestock numbers. Productivity improvement will require the utilisation of higher levels of technology and increasing quantities of inputs and services. The unavailability of such technologies and services – including fertilisers, year-round feeding systems, high-yielding forages and feed crops, improved breeding stocks, effective veterinary services etc. – is the major constraint to livestock development in this zone.

3.5 Strategies and priority areas for livestock subsector development

Strategies to meet the challenge of an annual 4.2 percent growth rate of the livestock subsector will focus on the higher potential regions of Africa that is the semi-arid, subhumid and highland zones, by enhancing the role of livestock in the agricultural intensification process, and promotion of market-based livestock development. In the marginal arid areas, the focus will be the protection of vulnerable livelihoods by arresting the degradation of the rangelands. For the humid zone, efforts will need to be geared towards the protection of the tropical rainforest.

Development of these broad strategies will require strengthened policy analysis, planning and implementation capacities, both at national and regional levels, to ensure effective delivery of different programmes identified. As regards prioritization of interventions and programmes, these are likely to be different across subregions, agro-ecological zones and livestock systems.

3.5.1. Strategies and priorities by agro-ecological zone

The greatest opportunity for expanding livestock production lies in the medium rainfall region of the semi-arid and subhumid zones, which have a largely under-exploited potential for producing animal feed (pastures, forages, and multi-purpose trees for ruminants and grain, root, and oilseed crops for pigs and poultry). The development strategy requires enhancing the input functions of livestock within the crop-livestock systems so as to expand and increase overall agricultural production and productivity while promoting market-based livestock development. Rural based livestock production needs to be connected to the growing demand in the urban centres. Priority policies and actions for these zones will include the following:

- development of means to increase the sustainable productivity of the infertile, fragile soils of the region, including crop-livestock systems, using legumes, forages, organic and mineral fertilisers, and improved pasture management;
- expansion of coarse grain, root crop, and oilseed production and development of a commercial feed industry based upon these crops and agricultural by-products;
- facilitation of technology transfer, in particular for animal-based mechanisation and integrated nutrient management;

- development of practical technologies for controlling animal diseases that limit livestock productivity, in particular trypanosomosis, tick-borne, and other parasitic diseases;
- facilitation of access to inputs and services such as development of more effective animal health delivery systems, extension services, financial services;
- improvement of the productive potential of indigenous livestock breeds while taking advantage of the positive attributes such as adaptability to the local environment, particularly trypano-tolerant animals, for use in these zones;
- development of infrastructure for transportation, processing and marketing of livestock, livestock products and feeds;
- promotion of equitable market policies that encourage smallholder investment in livestock production and balance the interests of producers and consumers (e.g. appropriate foreign exchange rates, anti-dumping measures, equitable land and water policies, avoidance of subsidies to large-scale operators, advocacy for equitable international standards);
- control of animal diseases that limit regional and international trade and the development of commodity-based export systems that supply processed livestock products to international recognised standards and at acceptable levels of risk to importing nations; and
- development of adapted sanitary and technical standards and the deepening of regional trade agreements within Africa to increase trade in livestock and livestock products.

In the *highland zone,* most agricultural systems have reached a relatively high level of intensification and crop-livestock complementarity. Despite high human and animal population densities, these areas have potential for further growth in livestock productivity and possess the advantage of strong and expanding markets for meat and milk. Productivity increases can be achieved through improved production technologies, greater use of production inputs and overall improvement in market chain efficiency. Priority policies and interventions will focus on the following areas:

- use of higher yielding legumes, forages, trees and increased use of fertilisers for increased feed production;
- increasing production of coarse grains and oilseeds and developing a commercial feed industry;
- development of practical technologies for the control of tick-borne diseases;
- improvement of animal health delivery systems;
- improving genotypes, particularly for milk production through delivery of artificial insemination; and
- improving infrastructure for transportation, processing, marketing, sanitation and water.

The *arid zones* and the *drier parts of the semi-arid zones* also have potential for expansion and raising productivity of livestock. Development strategies should aim at the protection of pastoral livelihoods, preservation of productivity of the rangelands, prevention of land degradation and improved market access. Specifically, efforts in these zones should aim at:

- facilitating empowerment and formation of partnerships in the control of, and access to, assets and commonly owned assets;
- creating institutions for the management of common property resources, in particular for improved water management and communally grazed lands;
- controlling animal diseases that threaten livelihoods;
- developing practicable and economic systems for delivering animal health services, using, wherever possible, a combination of private veterinarians and auxiliaries;
- facilitate alternative livelihood strategies, in particular diversification of livelihoods;
- support to infrastructural development, including roads and water access; and
- local processing of livestock and improved market chain efficiency.

Crop-livestock interactions are unlikely to play a significant role in the *humid zone* unless trypanosomosis is controlled. Improved animal disease control and strategies to expand the availability of trypano-tolerant livestock will contribute to improving livestock production. Support to the development of intensive commercial livestock production enterprises around large coastal cities is advocated. Such a development should, however, be accompanied by measures to mitigate their environmental repercussions.

It is anticipated that the number of intensive commercial dairy, poultry, and pig production operations will increase as demand for meat, milk, and eggs expands. Most of these operations will be located in peri-urban areas, irrespective of agroecological conditions. The availability of, and demand for, concentrate feeds and forages will influence the speed at which these operations develop. Such commercial operations will increasingly contribute to the provision of poultry and pig meat and milk in the near future. Strategies to encourage the development of these systems should focus on feed supply, infrastructure, policy and institutional frameworks and credit. Feed should come from local production, except in coastal areas which are probably better served by imports. Policies encouraging the development of intensive peri-urban systems should also take into account environmental issues and propose ways to mitigate them.

3.5.2. Priorities for research to alleviate technical constraints

Feed supply: In the arid zone, low rainfall precludes significant increases in biomass production and the emphasis will be to sustain production, improve market offtake and encourage local processing to increase the value of offtake. Practical early warning systems and contingency planning are needed to forecast forage production to assist timely introduction of community-based drought relief.

In the semi-arid and subhumid zones, low protein and energy content of feed plus seasonal fluctuations in quality are the critical issues. Research is needed on improved fodder crops, leguminous trees, and forages for pastoral and crop-livestock systems; improving the digestibility of high fibre feeds; development of improved systems of protein nutrition through use of non-protein nitrogen, by-pass protein, and other sources of protein; appropriate use of mineral supplementation to correct dietary mineral deficiencies; improving means of storing forages and fodders for dry season use; and improving nutritive quality of residues and by-products of food crops for use as animal feeds.

In the highlands, research may concentrate on overcoming the growing shortage of feedstuffs by developing high-yielding and more nutritious forage, and protein crops and improved production practices. For poultry and pigs, research would focus on the strategies and technologies to produce the coarse grains, root crops, and oilseeds, which are needed for white meat production and to optimise feeding strategies based on agro-industrial by-products.

Animal health. Research for improving animal health will focus on strategic and applied studies to devise better means to control parasitic and vector-borne diseases (e.g. trypanosomosis, theileriosis, and heartwater), including the identification and utilization of sources of genetic resistance to diseases and parasites in livestock, the development of animal health technologies appropriate for African conditions (thermostable vaccines, animal-side diagnostic tests, and slow-release pharmaceuticals), the design of sustainable and appropriate animal health delivery systems; plus the development of management strategies and control measures for diseases of intensification.

Genetic improvement. Priority areas in the domain of genetic improvement will include characterising indigenous African livestock genetic resources, strategic research on the molecular genetics of resistance to diseases and parasites, adaptation to environmental stress (and the identification of genetic markers), and development of technologies for the multiplication, conservation and preservation of genetic resources.

In addition to addressing technical constraints, research will be needed to address knowledge gaps about farming systems and livestock management, environmental processes and policy issues relating to the livestock sector and economic development.

The quality and effectiveness of institutions responsible for managing and conducting research in Africa will determine their level of impact on livestock development. The agricultural research system comprises international agricultural research centres (IARCs), NARS, the latter being the focal points of the research system. NARS are responsible for identifying researchable problems, conducting research and providing the primary links with extension services, educational institutions, the private sector, NGOs, donors, and international organizations. For a number of reasons, NARS have not been able to generate sufficient new technology to boost agricultural development. Their improvement should be prioritized.

Given the magnitude of the identified research agenda, cooperation on a regional basis is essential for conducting the livestock research needed to increase production and productivity of the subsector. The Consultative Group on International Agricultural Research (CGIAR) centres, such as the International Livestock Research Institute (ILRI) and the International Institute for Tropical Agriculture (IITA), carry out strategic and applied research in Africa, and collaboration between these and the NARS needs to be enhanced.

3.6. Financial resource requirements

The figures used for the estimation of the financial resource requirements are average estimated values per country (public and private) and are meant to provide orders of magnitude of the investment needs. Great variations between countries will occur depending on the importance of livestock in the country or region. Countries located in the higher potential agro-ecological zones, which should require priority attention (highlands, subhumid, and wetter parts of semi-arid zone), should invest more resources into sustained livestock sector development.

Policy development and reform. It is assumed that each country would spend on average US$1 million/year in the immediate and short term, and then increase investment to US$1.5 million in the medium term: total about US$50 million/year in intermediate/short term and US$75 million in the medium term.

Research (including genetic improvement). In the 1980s, it was estimated that US$75 million was spent annually on livestock research in Africa (20 percent of total research for agriculture, which was estimated at US$372 million)[6]. Assuming that this figure has increased to US$100 million by now (a modest increase of about 33 percent in over 15 years), the same amount can be estimated to be invested in the immediate term, and then a substantial

[6] Winrock International (1992). *Animal Agriculture in Sub-Saharan Africa.*

increase should be targeted for the short and medium term (US$120 million and US$150 million, respectively).

Extension/training. A conservative average figure of US$2 million/year/country in the immediate and short term; an increase to US$3 million/year/country in the medium term, taking into account the increased needs in terms of training to cope with livestock development.

Animal health (including vaccine production). It is estimated that on average US$3 million per year/country need to be spent on animal health and veterinary services. This amount may be reduced to US$2 million/year/country in the medium term as more animal health activities are transferred to the private sector.

Marketing infrastructure (including stock routes). The estimate uses US$5 million per year/country in the immediate/short term, to increase to US$10 per year/country million in the medium term as the livestock sector grows.

Meat/milk processing facilities. Average investments are estimated to be in the order of US$10 million/ year /country in the immediate/short term to reach US$20 million per year per country in the medium run to keep pace with increased demand and livestock production growth.

Feed production facilities. Average investments are estimated at US$5 million/year/country in the immediate/short term, rising to US$7 million/year/country in the medium term.

On the basis of the above assumptions, total resource requirements for livestock development are estimated at a little over US$21 billion over 12 years. This represents average annual funding requirements of US$1.8 billion. Actions relating to policy and institutional development are estimated to require US$5.3 billion (25 percent of the total) Investment requirements for infrastructure development would amount to almost US$16 billion (75 percent of the total). While marketing facilities would continue to be funded through public funds (markets, stock routes), it is envisaged that most of the funds to finance meat and milk processing and feed production facilities will come from private sector sources. An amount of US$1.4 billion has already been included under "livestock infrastructure" under the third pillar of the CAADP *(Improving Infrastructure and Trade-related Capacities for Market Access).*

Estimated resource requirements of identified priority areas, 2004-2015

Programme/Priority	*US$ million*				
	Immediate 2004-2005	Short-Term 2006-2010	Medium-Term 2011-2015	Total 2004-2015	Annual average
Policy & institutional development	**800**	**2 100**	**2 400**	**5 300**	**442**
Policy analysis	100	250	400	750	63
Research	200	600	750	1 550	129
Extension/training	200	500	750	1 450	121
Animal Health	300	750	500	1 550	129
Infrastructure development	**2 000**	**4 700**	**9 150**	**15 850**	**1 321**
Marketing	500	1 100	2 500	4 100	342
Processing	1 000	2 500	5 000	8 500	708
Feed production	500	1 100	1 650	3 250	271
TOTAL	**2 800**	**6 800**	**11 550**	**21 150**	**1 763**