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Final report

Crop-livestock systems development in southern Africa: priorities for future research

Botswana country report

**Prepared for
For UN-CGIR, Bulawayo, Zimbabwe, Institute For
Crop Research in Semi-Arid Tropics (ICRISAT)
and International Livestock Research Institute
(ILRI)**

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List of abbreviations

ALDEP	Arable Land Development Programme
ARAP	Accelerated Rainfed Arable Programme
BIDPA	Botswana Institute for Development and Policy Analysis
BDC	Botswana Development Corporation
BMC	Botswana Meat Commission
CBPP	Contagious Bovine Pleuropneumonia
CDM	Cold Dressed Meat
CEDA	Citizen Entrepreneurial Development Agency
CSO	Central Statistics Office
EU	European Union
ICRISAT	Institute for Crop Research in Semi-arid Areas and the Tropics
ILRI	International Livestock Research Institute
FAP	Financial Assistance Policy
FMD	Foot and Mouth Disease
GDP	Gross Domestic Product
GoB	Government of Botswana
LBRP	Labour Based Relief Programmes
LITS	Livestock Identification and Traceback System
LWDP	Livestock Water Development Programme
MoA	Ministry of Agriculture
NAMPAADD	National Master Plan for Arable Agriculture and Dairy Development
NDP	National Development Plan
NPAD	National Policy for Agricultural Development
SADC	Southern African Development Community
SLOCA	Services to Livestock Owners in Communal Areas
SWOT	Strengths, Weaknesses, Opportunities and Threats
TGLP	Tribal Grazing Land Policy
WMA	Wildlife Management Areas

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Chapter one Introduction

1.1 Country characteristics

Botswana is a large semi-arid country with a small population. Due to diamond mining, prudent development planning and good governance it has progressed into a lower middle income country with an average per capita income of Pula 20 538 (GoB, 2005). As a result of the economic achievement, poverty and unemployment have declined, even though they remain relatively high. Almost a third of the population (30.3%) live in absolute poverty and around a quarter is unemployed. The country is no longer eligible for development assistance from most donors. The SADC secretariat is located in the capital Gaborone.

The country covers an area of 582, 000 square kilometres and had an enumerated population of 1.7 million in 2001 (CSO, 2002) or an average population density of 2.9 persons/km². Botswana's population grew at an annual rate of 2.4% from 1991-2001. The slow decline in the growth rate has accelerated in recent years due to a rise mortality rate associated with HIV/AIDS. Life expectancy had dropped from 65.3 years in 1991 to 55.7 years by 2001.

Botswana is land-locked and centrally located in the heart of southern Africa, bordered by South Africa in the east and south-east, Namibia in the north-west, Zimbabwe in the north-east and Zambia in the north. The country is a relatively high (1000m), flat, undulating plain covered in deep sandy soils with occasional rocky outcrops, low hills and a network of dry riverine valleys and scattered and extensive salt pans, with sand dunes to the extreme south west.

Rainfall is low ranging from 250 mm per annum in the southwest to 650 mm in the north. Rainfall levels and variability are inversely related. The lower the rainfall is, the higher the variability and farmers' risks are. In eastern Botswana where most people live, rainfall average from 400 to 550 mm. per annum. Due to low, unreliable and unevenly distributed rainfall, surface water is scarce and most rivers are ephemeral. The western part has virtually no surface water. In eastern Botswana, the shallow valleys of the Limpopo, Tati, Shashe, Boteti, Notwane, Metsemotlhabe Rivers and other smaller tributaries are only in flood for a few weeks or months in good rainfall years. The few perennial rivers (Chobe and Okavango) are in the north and have their source outside the country. Due to scarcity of surface water, groundwater abstraction constitutes over half of the country's annual consumption. Groundwater abstraction is particularly important for rural villages, the livestock sector and mining (Arntzen *et al*, 2003). In eastern Botswana, cattle rely on boreholes and wells for nine months, and use pans and other surface water sources for around three months. Cattle in western Botswana rely entirely on groundwater.

Most of the population is found in the eastern parts of the country where the arable farming potential is better due to better climatic and soil conditions. Temperatures are very high in summer (up to 40 °C. for several months) further reducing the potential of arable production (e.g. maize).

Most soils are relatively poor. Traditionally, the distinction is made between the *sandveld* in western and northern Botswana and the *hardveld* in eastern Botswana. Sandveld soils are generally deep, coarse sandy with little structure and very low water and nutrient holding capacity. The hardveld has some more fertile soils consisting mainly of sandy loams and loamy sands. Some rocky outcrops and low hills occur, mostly in the east. Tick borne livestock diseases are rare in western Botswana as compared to the sandveld. However, conflicts between cattle and wildlife are more prominent in western and northern Botswana.

The country's vegetation is semi-arid bush or shrub savannah whose quantity and quality and biological productivity declines towards the south west. Better soils and dry ephemeral river valleys support denser tree savannah in much of eastern Botswana. In the north vegetation is lush around the Okavango delta and in the Forest Reserves. Estimated potential carrying capacities are in the order of 12 to 16 ha per livestock unit in eastern Botswana and 16-30 ha in western Botswana (Field, 1979). As rainfall is highly volatile, the actual carrying capacity strongly varies from year to year and season to season.

Due to the borehole technology, livestock has expanded over much of the country (except in protected areas such as parks, reserves and wildlife management areas). Land degradation follows the piosphere effects around boreholes: a small completely degraded zone around borehole (up to 200 m) followed by a bush encroached zone of up to three km followed by a 'grazing reserve' with better grazing. Bush encroachment and loss of biodiversity are the largest environmental problems associated with the livestock sector (other than conflicts with wildlife). While the recent livestock expansion took place mostly in western Botswana, the potential for dry land arable production is extremely poor in these areas, limiting the potential for local interactions between the livestock and arable sectors.

The country's economy has grown significantly and steadily over the last decades. Consequently, the agricultural sector has lost significant macroeconomic importance (accounting for less than 5% of GDP). In addition, families have explored and exploited non-agricultural livelihood opportunities. Formal employment and government support currently contribute more to rural livelihoods than arable and livestock sectors (BIDPA, 2002). As a result, many farmers are part time farmers whose main job is in formal employment or business. This situation has at least two important implications for the agricultural sector. Firstly, both livestock and arable sectors compete for household resources such as labour with non-agriculture, and especially arable farming is losing out. The arable sector is stagnating as it only attracts residual household resources, often from elderly persons. The livestock sector is more competitive due to better returns but still carries relatively high risks (BIDPA, 2001). Secondly, reduced growth in the non-agricultural sector is expected to increase pressure on the agricultural sector in future. Therefore, it is important that the agricultural sector becomes more appealing, also to the youth, and increases its productivity and returns. This would attract more full-time farmers.

In brief, the agricultural sector has to deal with a large but marginal natural resource base (that may further marginalised due to global climate change) and growing competition for resources from the non-agricultural sector.

1.2 The study's terms of reference and report structure

The ToR of ICRISAT-ILRI state that the scope of the country studies (in five southern African countries) as follows:

1. Review key trends and issues in the livestock sector;
2. Undertake a sub-sector analysis to identify opportunities and constraints in specific livestock sub-sectors;
3. Write report from the country case study and present the findings at a stakeholder workshop;
4. Revise country case study report based on stakeholders' feedback; and
5. Prepare and submit final report.

The trends and key issues are reviewed in chapters two and three of this report. The sector analyses are discussed in the chapters four (cattle sector), five (other livestock sectors) and six (crop sector). The analyses include a general review of the sectors, a SWOT analysis of each sector, and a brief section on the linkages between livestock and crops. Chapter seven provides a brief synthesis of the findings, focussing on the performance of the sectors and the interlinkages between crop and livestock sectors as well as research recommendations.

Chapter two Trends in the livestock and arable sectors

This chapter highlights the main trends in the livestock and arable sectors since 1980. The data are derived from Agricultural Statistics, annually published by Central Statistics Office from the Government. Additional figures are provided in Appendix 1. The Agricultural Statistics make a distinction between the traditional and commercial sectors for various sub-sectors, including cattle, small stock and crops. Some data are collected for poultry. Agricultural holdings (and not households) are the base unit.

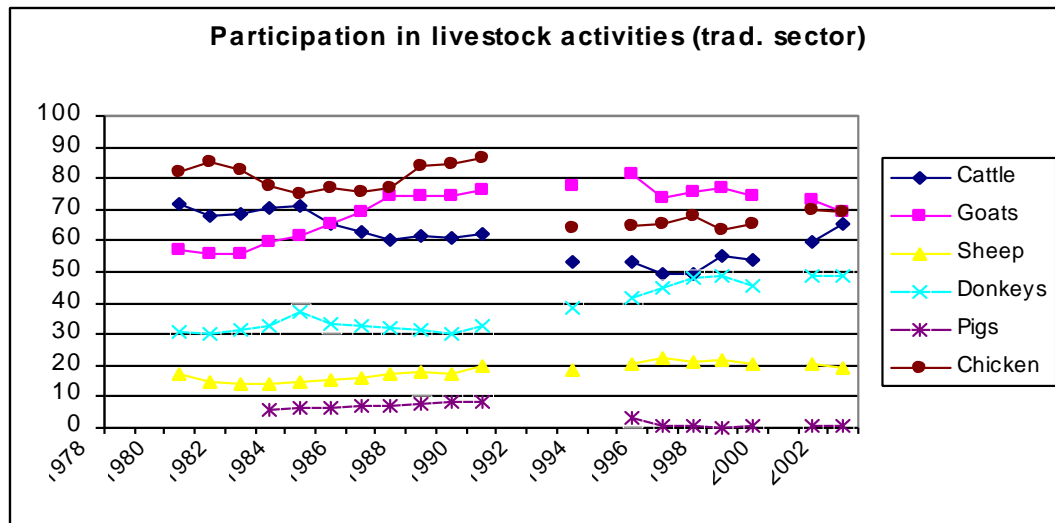
2.1 Cattle and smallstock

The trends in the cattle and small sectors are described with the aid of several indicators related to participation, size of operation and performance. Each will be discussed in more detail below.

2.1.1 Participation in livestock sub-sectors

The participation rates vary from year to year, but remain relatively high for smallstock, chicken cattle. Since 1980, there has been a significant increase in participation in smallstock at the expense of cattle, but in the late 1990s this trend reversed somewhat. Smallstock has become much more important than it was twenty five years ago. Most traditional agricultural holdings do not specialise in a particular type of livestock, and hold a combination of cattle, smallstock, chicken etc. In contrast, commercial holdings are more (and increasingly) specialised, and concentrate mostly on cattle. The Statistics show a remarkable drop in participation rates of the commercial sector since 1995. This needs further analysis¹ but it appears safe to conclude that the commercial sector is not flourishing.

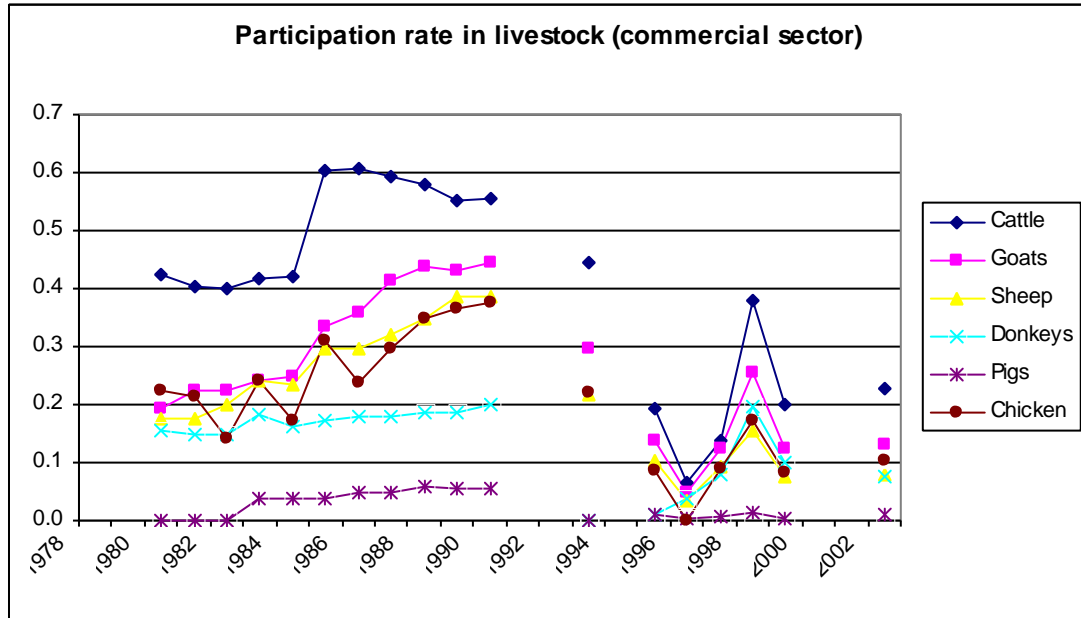
Figure 2.1:



Note: as % of total traditional agricultural holdings

¹ It is expected to be related to changes in sampling procedures- survey administration.

Figure 2.2:



Note: as % of total commercial agricultural holdings

2.1.2 Livestock numbers

With the exception of smallstock, there has been no significant growth in the traditional herd since 1980. Instead, the total herd, particularly of cattle, fluctuated with rainfall patterns. Since the late 1990s, smallstock numbers are decreasing rapidly. The commercial herds show a rapid rise in the 1980s and early 1990s followed by a significant drop from the mid 1990s onwards (see appendix 1).

2.1.3 Herd size

According to Hubbard (1982), herd size is an important determinant of livestock performance due to the associated economies of scale. It is therefore a concern that the Agricultural Statistics do not show a significant increase in the average herd size in the traditional sector (Figure 2.4). Data for the commercial sector are provided in app. 1.

2.1.4 Herd performance

Cattle

Herd performance has been measured in terms of birth rate (calves/cows), mortality rate (deaths/ total number of cattle) and off-take ((sales + slaughter-purchase)/total cattle). Generally, there has been no improvement in birth rates and off-take. The mortality rate appears to have decreased with lower rates in the 1990s and 2000s as compared to the 1980s. The 1981-87 drought clearly caused a decrease in birth rates and increased mortality.

Commercial off-take rates (Figure 2.6) are consistently higher than those of the traditional sector, reflecting a greater market orientation and different strategies (one product output). Mortality in the commercial sector is lower, but birth rates are similar and seem to decline in the commercial sector.

Figure 2.3:

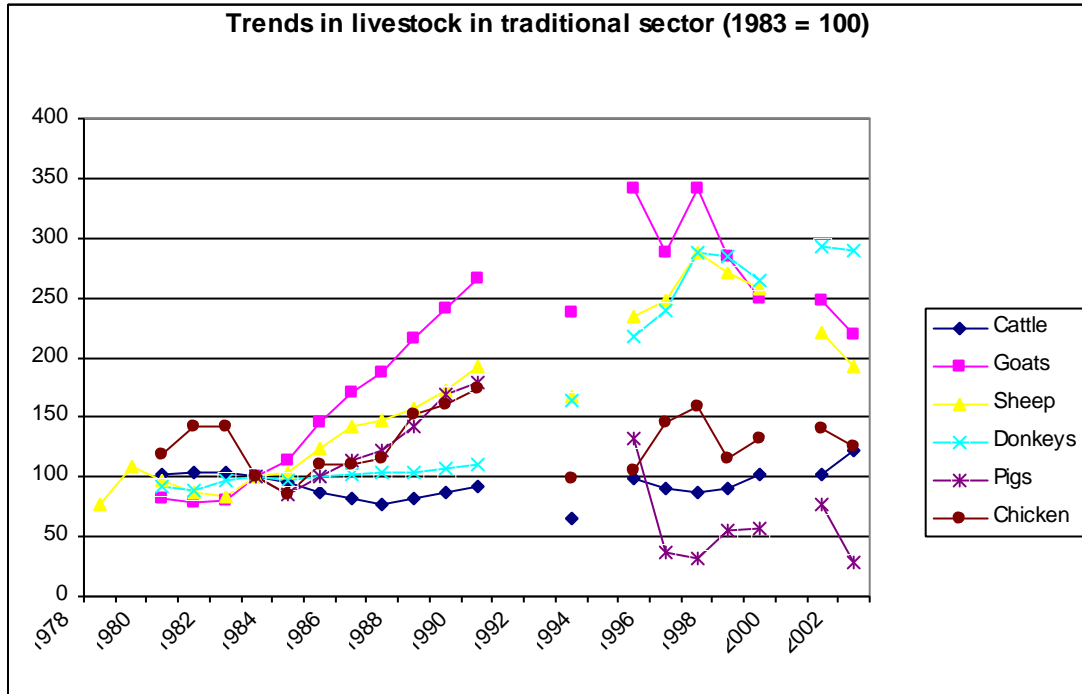


Figure 2.4:

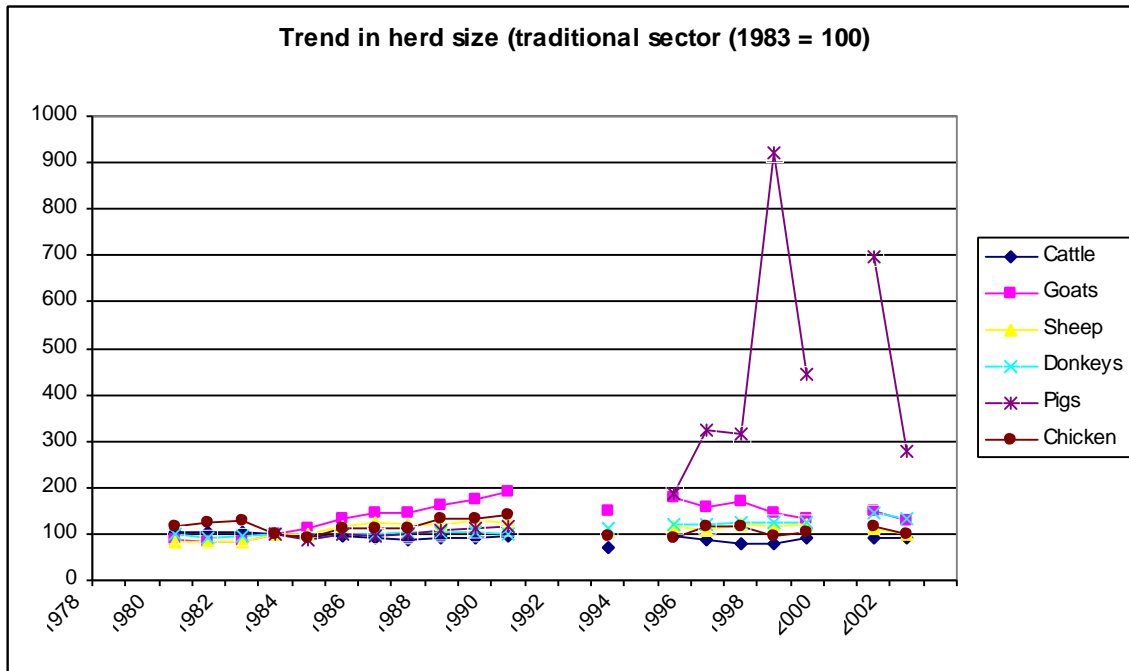


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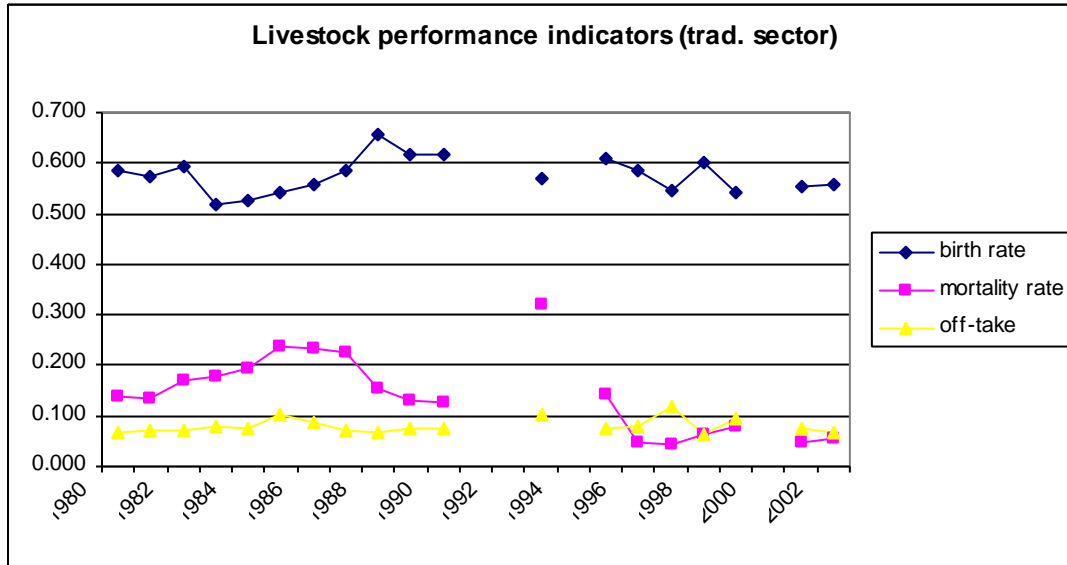
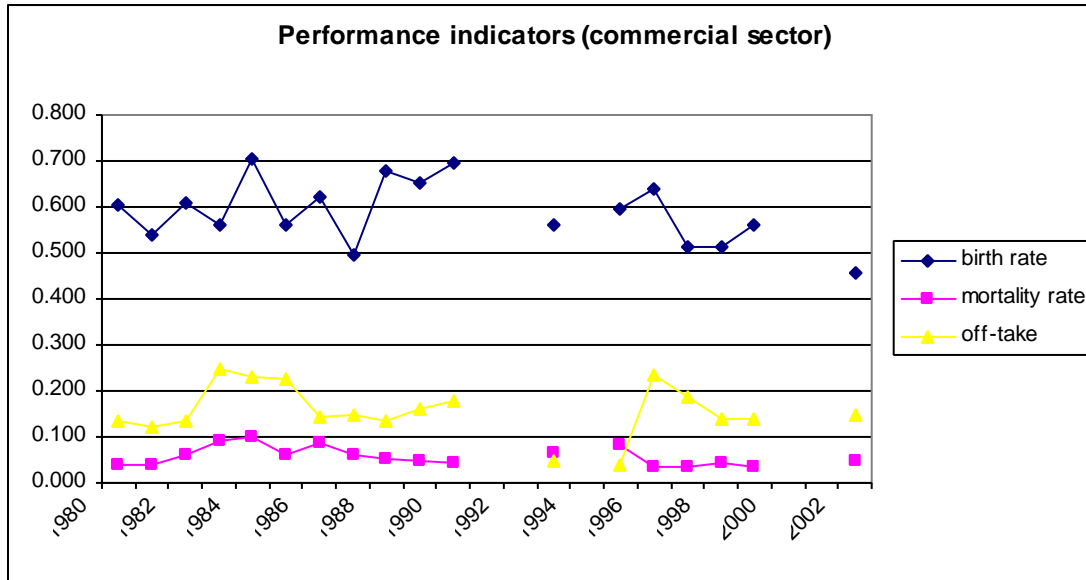


Figure 2.6:



Goats and sheep

The commercial sector has lower mortality rates, but otherwise the performance of the traditional and commercial sector is similar (see appendix 1). There is no visible improvement in performance in either sector.

The situation is similar for sheep. There is no significant improvement in performance and differences between the commercial and traditional sectors are relatively small.

2.1.5 Livestock markets and outlets

Livestock is slaughtered for home consumption or sold to the Botswana Meat Commission (BMC) for exports, municipal abattoirs, traders and local butcheries. Table 2.1 compares the percentage of sales and home slaughter for cattle, goats and sheep by sub-sector (commercial and traditional). Cattle and goats are mostly sold while sheep are slaughtered for household consumption and sold almost in the same proportion (traditional). Generally, cattle sales are much higher in the commercial sector, where home slaughter is very low (except for goats and sheep).

Table 2.1: Sales and home slaughter in the traditional sector (2003; as % of herd)

	Traditional	Sector	Commercial	sector
	Sales	Home slaughter	Sales	Home Slaughter
cattle	11.1	1.5	22.0	0.4
goats	4.1	0.5	14.7	5.9
sheep	5.7	4.6	11.8	5.5

Source: Agricultural Statistics 2003.

Looking at sales destinations of beef, it is striking that the BMC with its export beef monopoly, has lost considerable market share. BMC's market share declined from 80% in 1981 to 44% in 2002 (BIDPA, 2005). Sales to other avenues than BMC now exceed the sales to BMC (168 753 in 2001). This change reflects a growing domestic market as well as dissatisfaction on the part of farmers with BMC prices. Consequently, farmers sell more locally or reduce sales.

Sales from the commercial sector have dropped from 110 1160 000 in the 1980s to 20 000 to 30 000 in the period 1992-2002² (BIDPA, 2005). Both traditional and commercial sales diversified and moved away from selling to BMC only.

While it widely accepted that the domestic demand for beef has grown faster than export, few data are available. Metroeconomica (1996) indicates that in 1970 domestic demand was around ten percent of total demand of 29.3 tonnes. In 1994, the domestic demand has risen to 43.2% of total demand of 53.2 tonnes. It can be assumed that domestic demand now exceeds exports (Jefferies, 2005) and that it could be in the range of 50 to 60% of total demand.

Goats are mostly sold locally, and are an important source of cash and local meat. BMC only plays a minor role in slaughtering of goats, and most goats are slaughtered by local

² The drop could reflect problems with the figures for the commercial sector in the recent Agricultural Statistics.

butcheries and consumed locally. The market for goats is good as goat prices have increased faster than cattle prices. A goat fetches P 250 to 350.

2.2 The poultry sector

The Agricultural Statistics show a rapid expansion of the poultry sector in the 1980s in terms of number of holdings and chicken kept (Table 2.2). The commercial poultry holdings almost doubled in number in the 1980s, but the number of chicken increased even much faster by an incredible factor of twenty. The average number of chicken kept increased from 289 per farm to 2884 or almost tenfold! It appears that enlargement has only taken place in the commercial chicken sector, thus benefiting from economies of scale. Unfortunately, the commercial sector data for the 1990s appear incomplete and erratic (see earlier) and no reliable conclusions can be derived.

The domestic market for chicken products has grown rapidly. The per capita consumption of eggs and chicken meat increased to 62 eggs and 20 kg of chicken per annum (MoA, 2003).

Table 2.2: Trends in the poultry sector (1980 – 2002)

YEAR	Traditional holdings	Sector no of chicken	commercial holdings	sector no of chicken	Total holdings	no. of chicken
1980	65700	781000	180	52000	65880	833000
1981	72000	938000	180	108000	72180	1046000
1982	70000	940000	120	206000	70120	1146000
1983	64000	660800	200	300000	64200	960800
1984	60500	558600	140	150000	60640	708600
1985	62400	728500	250	300000	62650	1028500
1986	63600	729500	200	449100	63800	1178600
1987	64800	757700	250	525000	65050	1282700
1988	72800	1009800	300	800000	73100	1809800
1989	76600	1058000	330	925000	76930	1983000
1990	78200	1145600	340	980600	78540	2126200
1991						
1992						
1993	64919	647100	223	430000	65142	1077100
1994						
1995	73940	693170	100		74040	693170
1996	79153	959810		395376	79153	1355186
1997	88993	1055529	118	135596	89111	1191125
1998	78697	767962	214		78911	767962
1999	80951	869631	101		81052	869631
2000						
2001	77559	928238			77559	928238
2002	82714	833494	124	32085	82838	865579

Source: Agricultural Statistics 1980-2002.

2.3 Crop production

The traditional sector dominates the arable sector with a few emerging changes such as the Pandamatenga commercial farming block and the possible revival of the Barolong farms under the National Master Plan for Arable Agriculture and Dairy Development NAMPAADD³ (see section 3). The commercial sector is small but its productivity is consistently double that of the traditional sector.

Most arable sector indicators are highly variable, and related to rainfall patterns (amount and distribution). While the drought impact is clearly visible, there is no trend towards expansion and higher production. Yields (kg/planted ha) remain very low, particularly in the traditional sector. The arable sector appears to be in recession.

³ The increase in planted area in 2002 is attributed to the Barolong farms. It is remarkable that there is no big impact on the production. This could indicate crop failure or data error.

Chapter three

Livestock, arable and other relevant policies

3.1 Introduction

Since Independence in 1996 the Government of Botswana has developed a strong development planning tradition driven by the implementation of successive five year National Development Plans and more recently District Development Plans. The National and District Plans are based on consultations and comprehensive socio-economic planning. At present, Botswana implements its 9th NDP and the 6th DDP (GoB, 2003). The overall planning objectives are: rapid economic growth; social justice; sustained development; and economic independence. Development planning is based on the national principles of democracy, development, self reliance and unity (GoB, 2003, p.60). Simultaneously, a variety of policies, programmes and legislation has been introduced to guide, boost and control economic development.

In this chapter the most relevant policies and programmes are briefly outlined and reviewed. The Botswana's livestock industry is largely guided by the Tribal Grazing Land Policy TGLP (GoB, 1975), and later National Policy for Agricultural Development NPAD (GoB, 1991) and the National Master Plan for Arable Agriculture and Dairy Development NAMPAADD (Tahal, 2002; GoB, 2002). These and several other core policy documents are critical to a full understanding of the present agricultural situation in Botswana.

Government has now set clear targets for productivity increases in the latest NDP9 (Tables 3.1 and 3.2).

Table 3.1: Performance targets for livestock industry

1.Cattle	Baseline situation	Target 2000\8/09
1.1 Calving Rates		
a) Traditional Farms	50%	70%
b) Commercial Farms	51.5%	70%
2.Offtake Rates		
a) Traditional	10%	15%
b) Commercial	13.9%	20%
3. Mortality Rates		
a) Traditional	12%	5%
b) Commercial	4.5%	4%
2. Small Stock		
2.1 Kidding rate	100%	150%
2.2 Offtake Rate	8%	30%
2.3 Mortality Rate	36%	15%
3. Dairy Industry		
3.1 Milk yield/cow/year	2,000 litres.	4,000 litres.
4. Poultry		
4.1 Broiler self-sufficiency	98%	100%
5. Fisheries	190 tons/year	300 tons/year
6. Honey (kg/colony)	5.03	25

Source: GoB, 2003

Table 3.2: Performance targets for the crop sub-sector

	Baseline situation	Target 2000\8/09
1. Cereal Yields		
1.1 Sorghum and Maize		
a) Traditional	200 kg/ha	500 kg/ha
b) Commercial	1,000 kg/ha	2,500 kg/ha
2. Pulses and Beans		
a) Traditional	150 kg/ha	300 kg /ha
3. Oil Crops		
a) Traditional Sunflower	-	400 kg/ha
b) Commercial Sunflower	700 kg/ha	2,500 kg/ha
c) Traditional Groundnuts	150 kg/ha	250 kg/ha
d) Commercial Groundnuts	300 kg/ha	600 kg/ha
e) Commercial Cotton (Pandamatenga)	800 kg/ha	1,400 kg/ha
4. Horticulture		
4.1 Cabbage, Tomatoes, Potatoes	20 tons/year	40 tons/year
4.2 Citrus Fruits	25 tons/year	30 tons/year

Source: Ministry of Agriculture, 2002

3.2 Tribal Grazing Land Policy (TGLP, 1975)⁴

The Tribal Grazing Land Policy (TGLP) was firmly rooted in the 1973 Rural Development Policy, and continues to shape the livestock sector. Concerns were expressed about the perspectives of small stock owners and those without cattle (the poor), land control by the affluent larger cattle owners, and the protection of access to sufficient land by every tribesman (GoB, 1975, p. 1-4).

In essence, TGLP attempted to create a commercial highly productive livestock sector on leasehold land (Tribal Land) and to improve the development chances of smaller herds in the remaining communal areas. The overall aim was to increase farm, income of small and large farmers. TGLP introduced new land categories within Tribal Land:

- Leasehold land for ranch development (50 year leases);
- Communal grazing areas for small herds (the big herds would have moved to ranches)
- Reserves meant for future cattle owners and other uses (e.g. wildlife).

The leasehold ranches (6400 ha) were planned in areas that were assumed to be empty, and hence movement of cattle out of communal areas would reduce stocking rates and improve range conditions. Most ranches were planned in the sandveld of western and northern Botswana. Ranchers would pay an annual land rental in exchange for exclusive access to land. This fees is now P 0.75/ha (after it has been a minimal P 0.04/ha for a long time). TGLP ranches currently occupy an area of 26 835 km² or around 4.5% of the country (source: Ministry of Agriculture).

⁴ This section is based on the study by Arntzen, Tshosa and Kaisara on Community Rangeland Management. (see Bibliography for full citation)

According to the TGLP, the size of commercial grazing land was to be determined after the required communal areas and reserves had been assessed. In communal grazing areas, the following measures were listed:

- training in improved livestock and rangeland management;
- Land Boards would control the number of livestock to be kept in communal areas, incl. ceiling per community member;
- No individual ownership of dams, wells boreholes for livestock would be permitted. Private boreholes would only be allowed for domestic use or arable agriculture.

The TGLP document balances livestock improvements and improved rangelands management as well as commercial and communal grazing areas. In practice, emphasis has been given to commercial ranch development. Most of the reserves are now zoned as Wildlife Management Areas (WMAs), where wildlife utilisation is the primary form of land use. No stock limits were set for communal areas and communal grazing areas became prone to open access.

There is little evidence that livestock productivity has increased on ranches, partly because of the slow development of ranches (fencing etc.) and partly because of the failure to change livestock management (MoA, 1990 and CSO, 2004). Stocking or rather overstocking rates in the communal areas have not declined as few larger herds moved out and ranchers continued to use communal grazing land (*dual grazing rights*) by leaving many of their animals to share and exploit the communal grazing. The limited success of TGLP is due to several factors, including (Bekure and Dyson-Hudson, 1982; Arntzen, 1989):

- Most land was not un-used, and it was difficult for large cattle owners to move;
- Water shortages and salinity in western grazing areas that were zoned for commercial ranch development;
- The misperception about a simple correlation between fencing and productivity;
- Ranch development is expensive and does not bring about improved livestock management. Enclosure restrict herd mobility that is a proven way of drought adaptation;
- Fenced cattle production is not necessarily the most suitable option in semi-arid areas with highly variable rangeland conditions;
- Dual grazing rights discourage management of communal rangelands by the small cattle owners.

3.3 National Policy on Agricultural Development (NPAD), 1991 – Government Paper No 1 of 1991

Given the problems with TGLP, it is surprising that ranching remains the central livestock component of the 1991 National Policy on Agricultural Development.

In 1988 government commissioned a major agriculture sector assessment study (Edwards *et al*, 1989), which resulted in the approval by the National Assembly of the National Policy on Agricultural Development in 1991 (GoB, 1991). The assessment found that production levels and productivity for both land and livestock were not progressing and that agricultural development was constrained by factors such as: poor livestock and crop management; unfavourable climate, poor soils; insufficiently targeted

government subsidies and poor use; low productivity; poor physical infrastructure; and inefficient utilisation and management of natural resources. Cattle herd growth offtake and crop yields are low.

Edwards *et al* (1989) noted that despite the drastic decline in the percentage of GDP contributed by the agricultural sector, farming is still a major source of livelihood in Botswana. This was confirmed in 2001 by the Rural Development Policy Survey (BIDPA, 2001). The major causes for poor performance in the agricultural sector were listed as follows: poor soils, water scarcity and low and erratic rainfall; poor management and skills; lack of appropriate technology and high fuel and energy costs; inadequate rural infrastructure, including roads, markets and services; unsatisfactory grain pricing policy; low diversification; indiscriminate government subsidies.

The policy has the following objectives:

1. Improve national and household food security;
2. Diversify the agricultural production base and income levels and employment opportunities;
3. Provide a secure and productive environment for those engaged in agricultural related activities;
4. Develop and conserve scarce land and agricultural resources for future generations.
5. Increase agricultural productivity and output.

The NDAP measures include the following:

- Subsidies to be targeted in order to maximise the net socio-economic benefits to the country.
- Productivity would be improved through both improvements in technology and training of the agricultural labour force.
- Regarding crop production, more attention is to be given to non-conventional crops such as various beans and the grapple plant
- Need to facilitate the process of agricultural development through research, extension and provision of infrastructure.
- Fencing of grazing land where possible by individuals and communities after taking into account the technical, socio-economic and environmental factors.
- Granting of exclusive rights to individuals, groups and communities.

Further, agricultural activities would be promoted where economically and environmentally sustainable. This is in line with the policy shift from food self reliance to food security under the revised Food National Food Strategy, which has the following objectives:

1. Achieve sustainable and broad-based recovery of agriculture following the drought period;
2. Attain household and national food security (not necessarily through self-sufficiency);
3. Ensure healthy diet and life for all, eliminating malnutrition;
4. Build and maintain national capacity to cope with drought and other national emergencies.

Taken together the NPAD and Revised 2000 National Food Strategy aimed to raise farming production, productivity, employment and income levels, in all agricultural sub-sectors, including substantial diversification, without adversely affecting the environment and resources available for the future. Major components of the revised National Food Strategy covered the following;

- Provision of subsidies and loans:
 1. Support through ALDEP for small-scale and subsistence rain fed crop farmers;
 2. Support through ARAP of commercial rain fed farms and using FAP (now CEDA) to support the new large scale commercial farms at Pandamatenga;
 3. Medium and large scale irrigation projects using FAP and Botswana Development Corporation (BDC) resources;
- Drought relief and post drought recovery;
- Alleviation of drought impact on livestock;
- Labour Based Relief Programmes (LBRP) and other rural income support mechanisms;
- Human water supply;
- Support for the Strategic Grain Reserve at 3 months or 30,000 tons of sorghum;
- National and household food self-sufficiency to be replaced with national and household food security;
- Clear targets to be set for small-scale and commercial rain fed, molapo, and irrigated staple food production, plus cash crops.

Among the major new policy directions and accepted recommendations the following are the most significant:

1. All farming subsidies would be more clearly targeted;
2. Government will act as facilitator to promote private sector farming development;
3. Livestock will be developed through; extended AI breeding, improved veterinary services and support for dairy production;
4. More group and individual ranch fencing Eradication of Tsetse fly;
5. Subsidies for fodder
6. Financial grants and credit support for livestock programmes under FAP and now CEDA;
7. Arable farming will be developed by: import parity pricing, diversified food, animal feed and cash crops, loans for tractor hire, improved seed supply;
8. Promotion of commercial irrigation including for fodder crops and feeding schemes;
9. National pest control;
10. Financial support to crop farmers through FAP;
11. National and District land use mapping and water development.

According to NCSA (2002), there have been some delays as to the implementation of the NPAD policy. Hence the performance of this policy is yet to be established, almost fifteen years after its approval. The ranching component is currently under implementation.

3.4 National Master Plan for Arable Agricultural and Dairy Development (NAMPAADD, 2002) – Government White Paper No. 1 of 2002

The Plan can be viewed as elaboration of the NADP for the crop sector, and to a lesser extent the livestock sector (dairy only). NAMPAADD has three main trusts, i.e. development of large scale, mechanised dry land farming, promotion of irrigated crop production, where feasible (with treated wastewater and other non-potable water sources) and dairy development. While overall agricultural policy priorities remain the same, the focus on Sustainable Economic Diversification, which is central to the last two NDPs, will be more practically applied through the three major elements of NAMPAADD.

3.4.1 Dairy development

According to Tahal (2003) dairy productivity can be increased by utilisation of concentrated cattle feed, which can be imported at one third the cost of imported milk. The national demand for milk and related products could accommodate over 136 dairy farms with herd sizes of 50 milking cows, particularly around urban areas.

Zero grazing/stall-feeding is recommended due to the saving in management, land and cattle body maintenance energy, which could increase milk yields by up to 1000 litres/cow/year. This demand for economical local sources of dairy cattle feed should stimulate the research, development and extension of both rain fed and irrigated fodder crop production and a feed processing and storage industry supporting, on and off farm agri-business development and crop diversification. Apart from Lucerne, alfalfa and other field crops, research is ongoing into the cultivation of more drought resistant browse species, such as acacia pods and seeds, edible cactus and saltbush, etc. Moreover, treated wastewater irrigation schemes for fodder production will be developed in order to increase the cattle feed.

3.4.2 Rainfed arable agriculture

Two complementary policy approaches are recommended. The *socially-oriented* approach will continue to support the large majority of traditional farmers (e.g. through ALDEP etc.), with a medium to long term goal of transforming them progressively to commercial production. The *economically-oriented* approach will focus on commercial agricultural investors who will be encouraged to develop comprehensive agri-businesses, including large scale crop, dairy and processing activities.

Components of the economically oriented rain fed approach will include:

- Increase the minimum farm size to at least 150 ha. to ensure economic viability;
- Mechanisation for improved low tillage and optimum field management;
- Promotion of arable farming groups to shared means of production and economies of scale;
- Consolidation of the present farming households into some 15,000 units some of which, with entrepreneurial management, may expand to large scale advanced agro-industrial farms of around 1000 ha.
- Establishment of agricultural one-stop service centres in high potential areas;
- Prioritise most suitable arable areas for development based on their soil and climate conditions;

3.4.3 Irrigated agriculture

It is estimated that a total of 5000 ha could be irrigated, primarily using reclaimed urban wastewater. Small horticulturists will be clustered into advanced production units of 20-40 ha. High value vegetable, fodder and fruit crops will be targeted to the nearby urban markets and potentially lucrative high season export sales. Some of the water sources will compete with existing domestic water supply aquifers, but 36 Mm³/yr. of wastewater are included in the plan.

Other farm related improvements that are planned include:

- Development of Agricultural Service Centres;
- Provision of publicly funded infrastructure to farm clusters;
- Expansion of network of marketing points;
- Training elements to develop technical, managerial, marketing and comprehensive agri-business entrepreneurship;
- Development of an actuarially based crop insurance scheme to provide some measure of drought risk cover;

The implementation of NAMPAADD will require considerable investment in both on farm, infrastructure and human resources. Much of this will be borne by government initially, but as all the proposed farms are planned to become fully commercial, private investment and repayment of some of the development, and all of the recurrent costs is anticipated.

Implementation of the three production components of NAMPAADD would initially only extend over less than 1% of the national land surface, but have the potential to create an additional 3.7 million person days per year of agricultural employment, and about P 300 million of additional farming income, annually. The demonstration and multiplier effects of even a partial implementation of these commercial farming activities, would impact considerably on the traditional farming sector, raising and setting new and achievable agricultural standards. The possibilities for import substitution in this vital sector, and the benefits to national food security are considerable, provided water and other key inputs are available.

3.5 Services to Livestock Owners in Communal Areas (SLOCA)⁵, 1979

Services to Livestock Owners in Communal Areas (SLOCA) were developed after TGLP to assist livestock owners in communal grazing areas. The programme has been adjusted several times.

SLOCA provides small grants for livestock farmers and syndicates in communal areas. Demonstration facilities have also been set up to provide a base for improved livestock management extension. SLOCA has also provided support for smallstock rearing, targeted to women farmers. Funding has been modest and not available in all years. Total expenditure has been estimated at P 30 million (1982-2000). Less than 5% of communal pastoralists have benefited and the demonstration facilities have mostly ceased to operate.

⁵ These sections draw heavily on a study by the Centre for Applied Research, Review of Four Agricultural Subsidy Schemes in Botswana, May 2002

The demonstrations undertaken during SLOCA programme are shown in table 3.3.

Table 3.3: Details of reported SLOCA- demonstration projects

Topic	Details
Water development	Biogas digester, two hand pumps, animal drawn pump all with borehole syndicates
Land rehabilitation	Four plots in Southern district run by project; Three enclosures in Kgalagadi district run by local farmers' committee. Enclosures failed.
Fencing plots	Nine throughout the country, mostly managed by local farmers' committees.
Firebreak	
Dipping systems	At least ten operated through local show committees and coops.
Fodder production	For 1986/87, 148 farmers were selected for trials and demonstration in Maun, Francistown and Central Agricultural districts

Source: Centre for Applied Research, 2002

SLOCA reaches few livestock owners and the grants are relatively small. An average of 193 applications per annum were approved from 1980-87, which increased slightly to an average of 219 per annum for the period 1997-2000. Over this latter period 84% of approvals were for individuals with an average of P3, 219 granted, while syndicates got an average of P 8,901. Typical packages included dipping facilities and water reticulation, followed by purchase of fodder. This latter element plus vaccinations have been incorporated into SLOCA from the drought relief programme

3.6 Livestock Water Development Programme (LWDP 1988)

The Livestock Water Development Programme (LWDP) started in 1988 and is open to farmers with herds of 60 up to 500 cattle and syndicates with a minimum of 60 head, of which members have a maximum of 60 each. Both leasehold and communal farmers are eligible. LWDP provides funding (40-60%) to drill or equip boreholes in high cost areas. (Kgalagadi, Gantsi and Bobonong), and drought affected areas. Grants are once off support.

About 65% of applications are for drilling, providing grants of 40-60% of the costs estimated at an average of P 100,000 in 2001. Borehole equipping grants averaged P 18,645 during the period 1989-1995. Since 1989, grant approval rates were 11 per year on average. 66% of approved applications were for syndicates.

Constraints on the implementation of the LWDP have included the high risk of striking a blank or saline borehole, or failure to equip and utilise the borehole fully. In the review by CAR, 2002, it was recommended to modify LWDP and integrate it with SLOCA. It was further suggested to: stop grants to individual farmers, advice farmers on the most cost effective and comprehensive and sustainable water development plan for their specific area; expand support for syndicates; and extend the programme nationally.

3.7 Arable Lands Development Programme (ALDEP)², 1982

ALDEP was initiated to improve household and national food security by expanding area planted, yields per hectare and fodder production. The target group of farmers is those with less than 40 head of cattle (or equivalent) and an annual income of less than P20 000. Typical ALDEP packages cover a variety of farming assets, led by fencing, donkey and other animal draught power, scotch carts and implements. Extension support, monitoring and evaluation were also funded. One of the negative elements of mixed crop-animal farming systems, which ALDEP and other programmes have attempted to address is the increase of crop damage as more livestock are kept in lands areas. The customary land tenure system, complex land use planning and the high cost of modern fencing have all exacerbated this problem of crop damage by livestock.

ALDEP reaches many farmers. During the period 1980-2000 over P 78.8 million was spent, comprising 65,000 packages reaching up to 55,000 farmers. Women farmers have been better targeted after the programme was modified. Fencing has taken up one quarter of all the packages approved; its popularity is due to the high incidence of drop damage by livestock. Central District benefited most in phase 1 and Ngamiland in phase 2. Western Botswana has been under-represented due to their adverse agro-climatic and soil conditions for arable production.

Table 3.4: Beneficiaries of ALDEP phase 1 (by model farmer and gender)

Farmers' group	Assisted male farmers	Assisted female farmers	Total assisted farmers
Model 1	4 259	5 539	9 798
Model 2	17 617	14 515	32 132
Model 3	4 559	1 824	6 383
Total	26 435	21 878	48 313

Source: Kerapeletswe 1992 in CAR 2002

3.8 Revised National Policy for Rural Development (GoB, 2003) and the National Strategy for Poverty Reduction, 2003

The original Rural Development Policy (1973) was the basis for all the subsequent agricultural and general rural development policies, strategies and programmes. It has been subject to a major review recently. The government with UN support has also undertaken a strategic analysis of poverty reduction needs and potentials.

These two policy and strategy documents taken together, provide a framework for the development of agriculture and associated rural infrastructure and services. Both are targeting the improvement of rural livelihoods, the Strategy most notably highlights the following agricultural areas: small scale horticulture development; expanding employment opportunities through rain-fed crop production; increasing small stock production; strengthening community based natural resources management; and building capacity for small and medium citizen businesses, including agri-business and agro-industries).

There have been some constraints, lack of imagination and under-investment in integrating agriculture into a modern approach to rural and peri-urban development. The tendency to support absentee and part time commercial farmers, at the expense of both fulltime agricultural entrepreneurs and the mass of remaining traditional farmers, is not an effective use of scarce resources in an already marginal sector. This critique applies to both livestock and crop sectors and most if not all of the sub sectors.

Even in the successful poultry sub-sector there is no clear intention to build on the current commercial self-sufficiency towards export or diversified poultry product processing. The emphasis on basic support to the small scale traditional chicken producers is a necessary but quite insufficient approach to a huge untapped economic opportunity to create jobs and raise incomes in the rural and peri-urban, with expanded and diversified poultry production, e.g. ostriches, guinea fowls, turkeys and geese, etc. as well as more meat and egg chickens.

3.9 Citizen Entrepreneurial Development Agency (CEDA) 2001

Small, medium and large scale agricultural development has been funded through a grant/loan system in part by the Financial Assistance Policy (FAP) from 1982 to 2001. While some FAP projects were successful, the failure rate was relatively high. A major review was undertaken in 1999 and the programme was replaced by the Citizen Entrepreneurship Development Agency (CEDA) from 2001. CEDA's mandate is to manage and monitor some of government's financial (loans) and technical assistance schemes to citizens wishing to go into business or to expand existing businesses. It provides mainly training and assistance in the areas of; project feasibility study and development, identification of technical problems and their solution, technical improvements to present operations, quality management, financial management, human resource management, business development and market development (GoB, 2001). With the introduction of CEDA, it is highly anticipated that more jobs will be created, including in farming, since the interest rate for the loans are low (5% per annum for small projects).

3.10 Concluding remarks

Government has supported the livestock and arable sectors since the 1970s through policies, programmes, subsidies and tax advantages. The key interventions have not changed and focus on commercialisation of livestock production through ranching and various support programmes for arable and livestock inputs (ALDEP, SLOCA and LWDP). The plans for commercialisation of the crop sector (large mechanised dryland farming and irrigation) are new and cannot yet be assessed as yet. A difficult process of land consolidation is necessary to promote large scale crop farming in communal areas (given the existing field size of 16 ha).

The following observations can be made about agricultural policies and support. Firstly, support and subsidies are generous and they support the provision of inputs. There is virtually no linkage between subsidies and outputs; this discourages productivity increases, as farmers do not depend on their outputs. The generous support has attracted marginal farmers whose primary interest does not necessarily lie with current productivity increases. Most farmers are old and the younger ones are part-time farmers in employment or business elsewhere. These do not aim primarily at current production increases but develop farming for their future. Secondly, programmes are usually

country-wide, and do not fully appreciate the different agro-ecological conditions. It is important that support programmes are relevant to local environmental conditions. Thirdly, while policies and programmes are regularly reviewed, changes are small and slowly implemented. For example, the recommendations from the 2002 Review of Agricultural Subsidies Programmes have not yet been implemented. The cancellation of ARAP is the exception. The lack of change may be due to the fact that agricultural support now has an important social welfare aspect rather than mere agricultural objectives. Fourthly, agricultural policies and support are not adequately integrated into rural development planning and processes. The rapid growth of alternative sources of livelihood and the implications thereof for agriculture need to be better recognised by agricultural programmes and policies. Fifthly, interest in agricultural diversification is growing and so are the opportunities, particularly around urban areas. NAMPAADD and CEDA could contribute towards agricultural diversification. Crop policies and programmes remain focused on traditional crops. Opportunities of non-conventional crops (e.g. morama bean, grapple plant, Kalahari truffle, aloes) are not yet recognised in the policies. Livestock diversification is being pursued, among others, through the establishment of an ostrich abattoir to serve the some forty small scale and two large ostrich farmers, and the promotion of piggeries, of which there are more than hundred nationwide. Game ranching and farming also offer diversification opportunities. Botswana has sixty to eighty game ranches, and their number is rapidly increasing. The country has several crocodile farms with a good economic potential. Agricultural research and technology development need to address this. Finally, policies and programmes recognise several linkages between crop and livestock production (e.g. fodder), but do not prioritise them. There is opportunity to review, prioritise and develop the most promising linkages between crop and livestock sector, particularly in the broader perspective of agricultural and crop diversification.

Chapter four

Analysis of the cattle sector

The cattle industry has long been the dominant rural and national economic sector, boosted by exports to the European Union. After the development of groundwater, the cattle sector has spread throughout most of the country. The exceptions are protected areas. Botswana has a large traditional and a small commercial cattle industry. The sector has traditionally benefited from strong government support in the form of veterinary services, subsidies and tax advantages as well as a well developed beef processing infrastructure. The parastatal BMC holds an export monopoly on beef and operates two abattoirs in Lobatse and Francistown. A smaller abattoir in Maun has been closed after the cattle lung disease in 1995 and was never reopened.

Three cattle production systems may be distinguished. Firstly, small herds (below forty cattle) are kept around villages in so-called *mixed farming areas* (grazing and arable production). Stocking rates are relatively high and grazing conditions usually poor. Rangelands are not managed at all and vegetation is exposed to open access. The livestock producers in these areas are subsistence oriented. Secondly, cattlepost production systems around boreholes are found at larger distances from villages. The boreholes are owned by individuals or syndicates, who also control grazing resources. While the land is communal, it is de-facto run as private land. Herds are bigger, usually from forty to hundred cattle upwards. Cattle post farmers are subsistence oriented but also semi-commercial (some are fully commercial). Thirdly, fenced cattle ranches allow the control of cattle movements and disease, and offer in principle better opportunities for improved management (e.g. breeding). Cattle ranches are located on freehold and leasehold land. Their number has grown rapidly since the late 1970s due to policies such as TGLP and the NADP. Ranchers are supposed to be fully commercial, but especially on leasehold ranchers many lack proper management. Somewhat confusingly, the Agricultural Statistics distinguish the traditional and commercial sector, the latter being the ranches and the former being the first two cattle production systems.

The communal cattle production systems often produce multiple products such as beef, milk, draughtpower, transport and prestige. Non-beef products represent a considerable portion of the cattle value (Townsend and Sigwele, 1998). In contrast, cattle ranches tend to produce a single product, mostly beef. Research has led to three important conclusions in the 1980s. Firstly, cattle productivity appears related to herd size rather than land tenure (fenced-unfenced; Hubbard, 1982). Secondly, unit production costs decline with herd size, indicating economies of scale. Thirdly, large herds are more drought resilient than small herds. Critical herd thresholds are (Carl Bro Int, 1987):

- Twenty head are necessary to have a team of animal draught power; becoming more drought resilient;
- Forty head are likely to survive droughts (at least some), and offer a possibility to obtain a share in a borehole syndicate;
- Hundred head allow the owner to acquire own borehole, benefiting from economies of scale, and drought resilient.

Drought management is critical in Botswana. Traditionally, livestock owners moved cattle in search of grazing. Farmers applied opportunistic stocking strategies (in Sandford's terminology, 1980), accepting increased mortality during droughts as one of the inevitable results. The increase in veterinary fences, crowding of communal areas

and fenced ranching have reduced the potential and led to a decrease in effectiveness of mobility. Livestock farmers are struggling to adjust their drought coping mechanisms, for example by using fodder and moving cattle between different production systems, especially ranches and cattleposts.

The cattle industry has grown significantly in the distant past, but since 1980 growth has been limited and performance stagnating or even declined (GoB, 1991). A few examples illustrate the stagnation:

- natural increase has stagnated and off-take remains relatively low, especially in the traditional sector;
- No increase in cold dressed meat CDM of exported beef;
- Inability to meet the EU quota for beef (19 600 MT);
- The cattle sector has lost macro-economic importance, now accounting for less than 3% of GDP and 3% of exports (2004);
- Problems of BMC to get sufficient cattle for slaughter.

Government has taken a variety of measures to boost the sector's performance and efficiency, in particular promotion of fenced ranches with rotational grazing, artificial insemination, veterinary services and disease outbreak control, including the expensive Livestock Identification and Trace-Back System (LITS) to comply with EU import requirements. Botswana has acquired BSE risk level I, and around 80% of the country has the status of FMD disease free without vaccination. Nonetheless, disease outbreaks in border regions have occurred in recent years (cattle lung disease and FMD), but they were all quickly controlled, but at significant economic costs, especially cattle lung disease (Townsend and Sigwele, 1998). In order to reduce the incidence of transboundary diseases, such as Contagious Bovine Pleuropneumonia (CBPP) and Foot and Mouth Disease (FMD) government is maintaining annual sero-surveillance in high risk areas. In addition improved disease control fences and border patrols are being established and intensified. Existing disease control facilities, including cordon fences are being maintained. Tsetse fly is progressively being eradicated from the Okavango. Veterinary public health and food safety are also being strengthened which will contribute to better local marketing for Botswana's many beef farmers. The major strategies include:

- Harmonisation of meat inspection regulations for slaughter facilities and regular and high standard inspections;
- The digital Livestock Identification and Traceback System (LITS) will be intensified, to achieve 100% coverage;
- Residue testing will be undertaken regularly to maintain adherence to maximum levels of agricultural and veterinary chemicals; and
- Veterinary drug use will be better regulated and controlled.

The beef market has the following characteristics. There are not significant beef imports. Beef exports are substantial, but the EU quota cannot be met. In other words, the export potential of a guaranteed market is underutilised. Finally,

Additional cattle marketing facilities have been constructed across the country resulting in improved communal area cattle off take. Botswana Meat Commission (BMC) Francistown was operating at 89% in 2001 compared to 65% in 2000. BMC nationally

has taken steps to market leaner, healthier meat (grown on relatively chemical free rangelands), which has better sales advantage and shelf life.

The future of the beef cattle industry in Botswana also depends on better conservation and utilisation of the range resource. Overgrazing has long been identified as a critical problem of the cattle industry. In recent years, fear for country-wide overgrazing has subsided somewhat due to the stabilisation of cattle numbers. Moreover, it is now recognised that overgrazing is concentrated around boreholes and villages. One of the dangers is therefore that a decrease in the distance between boreholes will connect degradation zones.

A SWOT analysis of the cattle industry is summarised in Table 4.1 and further discussed below.

Table 4.1: SWOT analysis of cattle industry

<p>Strengths</p> <ul style="list-style-type: none"> • High participation rate of rural households; • High level of traditional skills • Sector is mostly indigenous and culturally important; • Large resource base (sandveld, hardveld and water) • Strong and effective support system • Effective veterinary services and control 	<p>Weaknesses:</p> <ul style="list-style-type: none"> • Low and stagnating productivity; • Doubts about international competitiveness; • Skewed her distribution and distribution of land and water; • Inadequate natural resource management, particularly in communal areas • Relatively high input and asset requirements; • Failure to achieve economies of scale in production; • Crop damage in communal mixed farming areas;
<p>Opportunities:</p> <ul style="list-style-type: none"> • Borehole and other water technologies are improving; • Improved rural infrastructure; • Expanded processing of beef and by-products locally. • Integrated farming, fodder, manure, animal draught power, etc. 	<p>Threats:</p> <ul style="list-style-type: none"> • Reduced EU market preferences; • Growing competition for scarce natural resources • BMC operational constraints; • Diseases, neighbouring herd standards; • Global warming, desertification, and reduced water sources; • Rising production costs • Absentee, part- time and inadequate management levels

Strengths

This is the major agricultural sub-sector in Botswana with substantial subsistence and semi-commercial holdings, and significant commercial exports and by-products. Most Batswana are active or aspiring cattle farmers. Agriculture in Botswana has been undertaken for over a hundred years as a traditional, mostly subsistence livelihood. Since Independence cattle producers have had a growing market share of the high value European, boneless beef market. The costs of exports to the EU have been substantial and have risen. Many small cattle farmers sell locally to butcheries or meat processors,

where the price may be better than that paid out by the formerly prized BMC export market or there is instant cash payment.

Around 70% of the land is agro-climatically suited to cattle grazing. Given the small population of less than 2 million people, cattle production has therefore considerable space. While the carrying capacity decreases during recurrent droughts and cattle numbers decrease likewise, the range is resilient and recovers quickly after droughts.

The effective veterinary services have boosted exports and were successful in limiting and eradicating disease outbreaks, with increased fencing, disease control, water development, supplementary feeding, selective AI breeding, etc., there is still potential for greater incomes, employment and overall stronger performance in the Botswana beef industry.

Weaknesses

Botswana has low and unreliable rainfall and limited water resources. Consequently, the carrying capacity of rangeland is low, particularly in the sandveld, and cattle depend on boreholes for considerable parts of the year (nine months in the hardveld and throughout the year in the sandveld). The vegetation and soils are deficient in nutrients for most types of livestock farming. Supplementary feeding is required during the dry season and during droughts. Bush encroachment adversely affects livestock productivity as browse cannot fully replace grass in cattle diets.

Despite, or perhaps because of, government support, cattle production systems have not gained in terms of production and efficiency. Many farmers operate part time livestock operations and invest in it for future benefits from their formal sector income.

The average herd size has not increased, leading to a failure to reduce unit production cost. This affects the long term viability of the sector and its international competitiveness.

Mounting export requirements have increased the production costs of farmers and government.

Given the resource conditions, water and grazing are common constraints to cattle operations. In the western and northern parts groundwater is often saline. Water provision is costly, even if it is sometimes subsidised by government (LWDP and SLOCA)

Opportunities

Beef prices in neighbouring countries are higher than those in Botswana. Therefore, export opportunities exist to southern Africa, including selling live animals (Jefferies, 2005).

The international demand for Botswana's organically produced beef may rise along with the high prices such healthy and specialised meat may command. This requires that artificial supplements, bonemeal, growth hormones etc., must be avoided. Using stover from the arable sector and intensive fodder crops and browse to make hay and silage in good years, the cost of expensive cattle feed imports may be reduced.

The by-products of the cattle industry can be more widely used, in particular leather goods, horns and hooves and bone meal fertiliser, etc.

Threats

Global warming may adversely affect the biological productivity of rangelands. The expectations are that temperatures will rise, and that rainfall variability will increase leading to more droughts and floods. It is also alleged that global warming contributes towards bush thickening and lower cattle productivity. This would reduce the carrying capacity and increase variability in the national herd, requiring more adaptive management. The long-term Southern African climatic projections predict 20% drier conditions, which will further marginalise the agro-climatic situation and exacerbate the rangeland degradation, especially bush encroachment. This would adversely affect the cattle performance and would give advantages to small stock and wildlife species that are better adapted to drier conditions with bush. Weak resource management poses a long term threat to the sector ('tragedy of the commons'). It is necessary to develop effective communal resource management systems, for example driven by local communities. Otherwise, the risks of resource depletion remain high.

In many areas the cost of deep borehole water supplies is simply prohibitive. Saline and low recharge boreholes add considerably to the high cost and risk of livestock water development. Low disease control in neighbouring states presents a considerable problem for Botswana farmers and government alike. Beef markets are insecure, especially internationally as more competition emerges from other developing nations and the developed world protects its inefficient farmers at the expense of its consumers.

Preferential treatment of Botswana beef exports will decrease or disappear, and the country's export ability will then depend on international competitiveness. Metroeconomica (1996) argues that Botswana beef will not be able to compete. Others such as Fidzani and Makepe (1996) are less pessimistic. Whatever the case may be, the threat of losing international competitiveness is real.

Links with crop sector

The large number of cattle offers a substantial amount of manure and a pool of animal draughtpower. Due to the high transport costs, the application of manure from remote cattleposts is costly. However, manure near villages could be utilised. Traditionally, cattle are sent into harvested fields to eat crop residues. In the village areas, cattle frequently cause widespread and substantial crop damage.

Chapter five

Analysis of the other livestock sub-sectors

This chapter reviews the different livestock sub-sectors other than cattle. The smallstock sector is by far most important in terms of level of participation and livestock numbers (section 5.1); subsequently the dairy and poultry sub-sectors are being reviewed.

5.1 The smallstock sub-sector

Goats and to a lesser extent sheep form the smallstock herd of Botswana. Unlike the cattle sector, the smallstock sector relies almost entirely on the traditional sector. The involvement of the commercial sector in smallstock is very limited. According to the Agricultural Statistics, the national goat herd increased from 1.8 million in 1993, to 2.2 million in 1998 but then declined to 1.7 million by 2002: still well above the level of 1980). Of these latest figures only 12,000 goats were found in the commercial sector. The sheep numbers in the same period grew from 250,000 in 1993, to 393,000 in 1998 and then declined to 273,000 by 2002. Sheep remain a minority livestock holding, with about 19% of farmers keeping sheep with an average of 12 sheep per farm. In 2002, the average goat holding was 20 animals, kept by about 70% of traditional livestock farmers.

Switching from cattle to goats has been a traditional drought coping mechanism. The same happened during the 1980s drought, but different from before goat numbers kept increasing after the drought. Although the number of smallstock has recently dropped, the smallstock sector has seen tremendous long-term growth since the 1980s (unlike the cattle sector). This new phenomenon may be attributed to several factors:

- Smallstock are relatively cheap and easy to keep around villages. Unlike cattle, large parts of the rural population, including women, can afford to keep and manage smallstock. This is reflected in higher participation rates in the smallstock sector than in the cattle industry;
- Related to the above, those who lost their cattle during recent droughts may be unable to rebuild their cattle herd and accumulate goats instead; and
- Poor grazing conditions, especially around villages, favour browsers such as goats. Cattle are less productive under such conditions.

The market and processing industry for smallstock is less developed than for cattle. Goats are mostly reared on small farms and slaughtered or sold locally. In this way, goats and sheep contribute significantly to local food security either through meat provision or cash raised from sales. The BMC slaughters very small number only.

Goats are typically reared with minimal inputs: no fodder, small amounts of water (usually from villages or cattle boreholes), and medicines/ vaccinations when needed. Herding is usually minimal and often done only using dogs.

In the past, government offered grants to establish smallstock farms through the Financial Assistance policy. A total of 470 small stock farmers were assisted by the Financial Assistance Policy (FAP) acquiring about 47000 smallstock. Currently, CEDA offers soft loans for all types of farms. While the Ministry of Agriculture has a smallstock unit to support the sector, the support is small in comparison to the cattle sector.

The sector has grown significantly in size, but productivity has hardly increased since 1980. The trend analysis shows that off-take remains just under 10% and birth rates fluctuate between 40 to 50%. Mortality rates are volatile ranging between 20 to 35%. No trend can be discerned toward lower mortality (which is lower in the commercial sector). These figures are far below the NDP 8 targets (e.g. 15% for off take; GoB, 1997).

NDP 9 indicates that the main problems in the smallstock sector result from low management inputs and high mortality resulting from disease and external parasites. Suggested improvements include:

- Intensive training for smallstock farmers, focusing on management inputs;
- Improve the availability of breeding stock through breeders societies;
- Encourage smallstock handling and marketing facilities to be established.

Smallstock in Botswana refers primarily to goats and to a lesser extent to goats and to a minor degree pigs. Although the smallstock population fluctuates like that of cattle, it does so at a lower level and in inverse relation to the drought conditions. There were about half the number of goats compared to cattle in Botswana in 2002, whereas in 1995 the goat population exceeded that of cattle. Goats, unlike cattle thrive during drier years as they depend more on browse than grazing. In higher rainfall years goats tend to be more affected by external and internal parasites and their mortality rate increases, as management levels are generally low and diseases spread rapidly.

The results of a rapid SWOT assessment are summarised (Table 5.1).

Table 5.1: SWOT analysis of the smallstock sector

<p>Strengths: Easy to purchase and manage for majority of rural population Relatively drought resilient Able to survive in degraded rangelands Fast reproduction</p>	<p>Weaknesses: Disease prone (e.g. internal and external parasites) particularly during wet years Small, mostly local market Poor management due to low inputs and limited support systems Disputed destructive foraging behaviour</p>
<p>Opportunities: Possibilities of international markets on the back of beef exports (and favourable veterinary status) Development of domestic market and small abattoirs) Potential milk and goat cheese products, etc. (organic and health market) Diversification with e.g. angora goats and merino and karakul sheep for wool products; Global warming could favour smallstock over cattle on the long run</p>	<p>Threats: Diseases</p>

Strengths

Goats are hardier and more manageable than cattle, especially for the smaller farmer. As they require less water and no extensive grazing area, goats are easier to keep. Many small herds are maintained in the lands area and around the village settlements. Some goats are kept at the cattle post, often in larger herds. Goats thrive in semi-arid

conditions, as they are browsers and are able to get adequate nutrition even in drought years. Their fast reproduction is a potential strength that is currently negated by the high mortality rate.

Weaknesses

Goats are disease prone, which has led to high mortality given the low input management strategy of goat farmers and limited support systems for smallstock (focus on cattle). Better management together with improved support systems (public and private sector) could reduce smallstock diseases and mortality.

The commercial sector is hardly involved in smallstock, possibly due to the perceived lack of benefits and returns. This may indicate market weaknesses as well as weaknesses in the support structures for smallstock. It is probably a better deal to keep cattle (or game).

Opportunities and threats

The sector's future growth will depend on new opportunities such as emerging from domestic and international markets and on adopting a more productive management system than the current largely low input systems. The threats to the sector are limited as the sector remains underdeveloped. Disease control will be a major future challenge.

Links with crop production

Crop damage by goats is widespread, as many goats are kept in mixed farming areas and most existing arable fences offer little protection against smallstock. On the positive side, goats eat crop residues.

5.2 The poultry sector

The poultry sector is currently the only example of significant agricultural growth in the country. Poultry is important in both the traditional and commercial sectors. In the traditional sector, over three quarters of the agricultural holdings keep chicken, mostly for meat production and eggs. In some years, over 90% keep chicken. The commercial sector has grown rapidly during the 1990s and meat production increased by nine fold since 1995 to 64 323 tons. During the same period, the production of table eggs increased from 4.7 million to 6.3 million. As a result of the sector's growth, Botswana has reached virtual self sufficiency in chicken meat and egg production (Table 5.2). During NDP8 98% self-sufficiency in these two types of poultry production was achieved. By the year 2000 there were estimated to be 21.5 million broiler chickens slaughtered, and 300,000 layers were being maintained in egg production. In 2004/5 the total number of hatching eggs imported by the two largest hatcheries was about 45 million, while almost 9.5 million broiler chicks were imported in the same period by a variety of local producers and suppliers. In the same financial year an estimated 524,000 point of lay pullets were imported. Egg production in that year reached 6,285,050 dozens of table eggs. Poultry meat consumption was estimated at 37.8 kg per person.

The sector is still developing in terms of provision of inputs. Recently, two large-scale broiler breeding egg producers have become established to reduce imports of hatching eggs from South Africa and Zimbabwe. In addition, a large poultry input supply company has also developed a poultry farm support programme, providing 500 broiler chicks and the necessary equipment to nineteen chicken farmers, in a loan service scheme.

Table 5.2: Trends in local poultry production, import and local consumption (1995-2004)

Year	Local broiler meat (tons)	Local table eggs (dozens)	Imports of broiler meat (tons)	Imports of table eggs (dozens)	Consumption of broiler meat (Kg/capita)	Consumption of table eggs (eggs/capita)
1995	7,850	4,741,849	965	40,095	6.0	39
1996	7,722	4,010,849	834	51,596	5.7	33
1997	11,847	3,886,345	96	60,020	7.8	31
1998	15,461	4,963,861	1,201	11,024	10.6	38
1999	17,219	4,707,471	340	47,250	10.9	35
2000	27,950	5,625,000	43.1	0	16.1	45
2001	32,500	7,189,896	612	0	20	62
2002	38,961	9,975,150	434.9	240	21	78
2003	57,323	6,285,050	48.4	26,016	34	62
2004	64,323	6,285,050	0	0	37.8	44

Source: Ministry of Agriculture.

NDP 9 makes the following proposals to support the local production of breeding stock and poultry feed: encourage investment in locally produced poultry feed; set up poultry abattoirs in the main producing areas; promulgate export regulations and promote exports; and strengthen research on management of indigenous poultry.

The sector needs to replace imported inputs such as breeding stock, feed and equipment with locally produced goods and services. This will improve profitability and employment creation. Training programmes for staff and farmers are ongoing to raise management standards and increase processing of poultry products.

The potential for growing crops to manufacture chicken feed is considerable though a strategic balance of rain fed grains and residue, and irrigated high protein supplements has to be assessed according to land availability and crop and climate conditions.

The results of a brief SWOT analysis are summarised in Table 5.3.

The sector has developed quickly due to a combination of rising demand, strong government support and relatively quick turn over that reduces capital requirements. The sector's future will be determined by its competitiveness, the development of efficient input supplies and improved processing facilities and regulations. Most supermarkets are South African chains, which may find it easier to import from South Africa. Therefore, local producers need to meet the supply requirements of supermarkets in terms of price, reliability and volume of supplies. In the past, problems have arisen with halaal requirements, domestic provision of day-old chicks and domestic supply of chicken feed. The latter could be promoted through irrigation with treated wastewater.

Links with the crop sector

Poultry farms are usually located in the vicinity of urban areas and large villages, and therefore chicken manure can be used in crop production and horticulture. For example, the sale of chicken manure for gardens is now common in Gaborone. This could be expanded. Vice versa, the crop sector could produce chicken feed to strengthen the viability of the poultry sector. This is not happening as yet.

Table 5.3: SWOT analysis of the poultry sector

<p>Strengths: Rapid growth and self sufficiency Small scale holdings are viable Quick turn-over and return to investments Low land and water requirements Strong government support</p>	<p>Weaknesses: Breeding stock is mostly imported Inadequate slaughter/abattoir facilities Most chicken feed is imported at high costs Access to big retail chains Meeting of supermarket requirements</p>
<p>Opportunities: Consumer preferences for chicken meat, especially in urban areas Local chicken feed production, e.g. with treated waste water Export potential, depending on the sector's competitiveness Localise the production of breeding stock, day old chicks, etc. Poultry diversification with geese, ducks, guinea fowl, etc. Integrated farming using manure, growing poultry feed and vegetables using urban waste water and in good rainfall years.</p>	<p>Threats: Diseases Trade liberalisation Health concerns about cholesterol rich products such as eggs Overtrading</p>

5.3 The dairy sector

The commercial dairy sector has recently grown, but remains very small. Consequently most commercial milk is imported. Milk is also produced in the traditional sector but mostly for subsistence (own) use. In this sector, milk is one of the main by products that is undervalued (Townsend and Sigwele, 1998; Arntzen, 1998). An estimated thirty percent of commercial milk is locally produced but virtually all other dairy products are imported. Recently, small companies have started to produce yoghurt and cheese.

Increasing dairy production is a priority for government, as demonstrated by the fact that dairy production was added to the National Master Plan for Arable Agriculture (to become NAMPAADD) The NAMPAADD report (TAHAL, 2003) estimates the number of dairy farms in 1999 at about 100, with an average herd size of 15-20 milking cows. Average annual milk production is about 2000 litres, which is extremely low. The growth of the commercial dairy sector is summarised in Table 5.4. The production of milk has doubled to 6 million L in the period 1997-2001, while the number of milking cows reached 2 552 in 2001.

Table 5.4: Dairy cows and milk production (1997-2001)

Year	Herd Size	Milking Cows	Litres /year (million)
1997	2,629	1,414	3.0
1998	3,021	1,527	3.8
1999	2,673	1,384	3.5
2000	2,919	1,458	3.8
2001	3,936	2,552	6.0

Source: Division of Animal Production, 2001

Government has set up a dairy cattle multiplication unit, which sells high quality pregnant dairy heifers and dairy bullocks at subsidised prices. Breeds include Friesian, Brown Swiss and Jersey. The Financial Assistance Policy (FAP) has benefited local dairy production. According to NDP9, government seeks to improve dairy productivity through several measures. A modern dairy farm will be established as a demonstration project. Milk quality testing and veterinary services will be established in dairy production areas and expanded alongside the growing dairy herd. An inventory of dairy breeders will be compiled to help supply quality dairy animals. Treated waste water will be used for irrigating fodder to supplement imported dairy feed.

The major strengths, weaknesses, opportunities and threats of the sector are summarised in Table 5.5

Table 5.5: SWOT analysis of the dairy sector

<p>Strengths: Small scale dairies viable; Growing urban market for milk and milk products; Targeted for increased NAMPAAADD support; Job creation if hand milking and dairy products;</p>	<p>Weaknesses: No indigenous dairy cows; Limited management skills for dairy hygiene and processing Agro-climate and natural vegetation unsuitable; Capital intensive</p>
<p>Opportunities: High value, growing urban demand; Import substitution; Potential exports to other dairy deficit areas in Southern and Central Africa; Speciality, niche, export, markets for increases production of diverse dairy products with significant value added; Fodder production with treated wastewater</p>	<p>Threats: EU and other 'dumping' of imported milk and dairy products, globally and regionally; Diseases; Currently expensive imported feed not easy to replace with locally grown fodder High cost and scarcity of water</p>

Strengths

The local market for milk and dairy products is growing demand, particularly in urban areas. A substantial part of the demand is met by imports. According to NAMPAAADD (Tahal, 2003) the cost of importing milk is about double the cost of importing cattle feed. The provision of fresh milk by local dairies to the major urban centres could therefore be a profitable part of the livestock industry in Botswana.

Weaknesses

The natural grazing in most parts of Botswana in an average year is inadequate to support dairy cattle. Supplementary feeding is essential and requires considerable investment. At present, the country has limited stock of good dairy cows, hence significant investments are needed. Management requirements for dairy farming are higher than for regular livestock production, and such management skills are limited. The required skills include knowledge about milk processing and hygiene standards and feeding and breeding support for these exotic herds.

Opportunities

Providing high management standards can be established and maintained dairy farming can be expanded in Botswana to provide more import substitution of milk and milk products. As indicated above the largest part of the fresh milk, cheese, yoghurt, etc., consumed in Botswana are imported from neighbouring countries, and even from

international sources in a few cases. NAMPAD plans to expand the number of local dairy herds significantly and provide additional technical and marketing support. The provision of locally grown feed supplements would be a major step towards increasing the viability and profitability of Botswana dairying.

Threats

Botswana provides a small market and a harsh environment for sustained fresh milk and dairy products supply from local farmers. The neighbouring countries have established dairy industries and can easily export. Unless some form of limited protection is applied Botswana's dairy industry may not progress or even survive.

Links with crop production

The links between dairy and crop sector are similar to those of the poultry sector: use of manure and supply of fodder to cut the feeding costs.

Chapter six

Brief analysis of the crop sector

The arable sector consists of a large traditional sub-sector and a very small commercial sector, mostly in Pandamatenga in northern Botswana. Arable production remains an important livelihood activity as most households have land and are able to plough/ plant. The natural resource base is semi-arid (rainfall ranging from 250 mm in southwest to 650 in the north) and only a small part of the country is suitable for arable production (also due to poor soils). Droughts are frequent and therefore the risks of crop failure are high. One year in three the rains fail, and there appears to be a quasi 15-20 year drought cycle which results in several consecutive years in any period being drier, followed by a period with several years wetter than average.

Formal employments outside agriculture and livestock production are more rewarding and less risky. Therefore the arable sector tends to be considered as a residual activity, where households allocate resource to if there are no alternatives.

In general, planted area, yields and production have not shown an increase in the last twenty five years. Instead they are highly variable mostly related to rainfall. The annually planted area ranges from 100 000 to 400 000 ha, mostly related to rainfall. According to the Agricultural Statistics 2002, commercial farmers in Barolong planted over 500 000 leading to a total planted area of over 700 000 (but not higher yields!)⁶. The average annual yields (kg/planted area) are very low, usually below 250 kg/ha. Commercial yields are higher, but the exceptional yield of 1996 in the commercial sector needs further probing. Total production of the main crops (maize, sorghum, millet and pulses) is usually well below 100 000 tonnes. The commercial farms in Pandamatenga contribute 38.6% to 92.5% of the total national cereal production. Thus, though the commercial sector is small, it is important for domestic production.

Arable practices have not significantly changed in the traditional sector with the exception of the increase in mechanised ploughing and ploughing with donkeys at the expense of cattle. Typical traditional practices include broadcasting and very limited weeding. Most fields are now fenced to reduce crop damage from livestock (reported by around 80% of the arable farmers).

Since 2000, the government aims to achieve food security, and accepts that food self sufficiency is very difficult to achieve and would be very costly. As a result, a significant part of the food is imported (Table 6.1).

Table 6.1: Annual Cereal Balance Sheet during NDP 8 (maize and sorghum; in '000 MT)

Year	National Requirement	Gross Harvests	Local Deficit
1997/98	230.5	28.4	-202.1
1998/99	214.5	10.2	-204.3
1999/00	218.9	18.7	200.2
2000/01	209.0	20.7	-188.3
2001/02	181.0	11.2	-169.8

Source: Botswana National Early Warning Unit, 2002

⁶ This is considered to be unlikely and the figure could be an error.

Government has traditionally supported the traditional arable farmers through ALDEP and drought relief efforts. ALDEP provided grants for inputs such as fences, donkeys and farming implements. Government also supports commercial farmers in Pandamatenga. NAMPAADD promote large scale dryland farming (150+ ha), as it considers smaller farms not economically viable. In addition, NAMPAADD promotes irrigation where opportunities exist, offering opportunities for fodder etc.

Under these circumstances the crop sector is always in shortfall and greater effort is still needed to move to drought resistant varieties and innovative crops and technologies to conserve moisture and maximise the yield from the brief and erratic growing season. Maize gives higher yields and is the preferred crop in good years but sorghum and millet are more drought resistant and dependable in low rainfall times. Water melon, sunflower, groundnuts and beans are also planted in a traditional mixed cropping system which is drought risk averse, but results in fairly low productivity even in good years.

The sector's weaknesses currently outweigh the strength by far. This is clearly shown in the SWOT analysis (Table 6.2). The marginal resource base, expected increase in temperatures and rainfall variability and the relatively low returns in comparison to other sector raise all doubts about the long term viability of the arable sector as it is.

Table 6.2: SWOT analysis of the crop sector

<p>Strengths Government support for inputs</p>	<p>Weaknesses Natural resource base is marginal: low and variable rains, mostly poor soils, frequent droughts Hot conditions unsuitable for crops such as maize Mostly elderly traditional farmers with traditional skills; failure to attract the youth Lower returns to labour and capital than other sectors (livestock, formal employment) Dependency on traditional farming sector</p>
<p>Opportunities Import substitution provided economic opportunities Development of commercial crop sector Crop diversification (non-conventional crops, fodder) Use of treated wastewater</p>	<p>Threats Global warming and increase in rainfall variability</p>

Large scale operations and mechanisation may be one way forward (as argued by NAMPAADD) but will be difficult to implement given the current land distribution patterns. Other ways forward are to:

- Diversify arable production towards non-conventional crops;
- Horticulture around urbanised areas with a sufficiently large demand;
- Diversification by exploiting the linkages with other sectors such as livestock through fodder production (cattle and dairy cows) and chicken feed.

Chapter seven

Brief synthesis and recommendations for research

Agricultural performance

The performance of the traditionally leading sectors of cattle and crop production has been unsatisfactory in terms of production and productivity. The traditional sector has not improved its performance and the commercial sector is either very small or relatively insignificant (crops) or has failed to grow (cattle). Particularly, crop production has lost ground to more attractive livelihood opportunities outside the agricultural sector.

The poultry sector is the best performing sub-sector and a rare example of agricultural growth and expansion of farm size, benefiting from economies of scale. The smallstock sector has grown too, but the herd size remains small, and the sector has contracted in recent years.

The expected productivity impact of the development of commercial ranches is not visible. The development of commercial sector through NAMPAADD is just starting and cannot be assessed as yet. The required land consolidation for large scale mechanised dry land farming appears to make it difficult in most communal areas, except areas such as Barolong.

Linkages between livestock and crop sectors

While the linkages between the livestock and crop sectors have been recognised in policies, those linkages are rarely targeted as a source of strengthening the sectors and their productivity. Integrated farming is not explicitly promoted, even though only small parts (2-5 ha) of arable fields (standard size of 16 ha) are planted and it is a key characteristic of the traditional sector. There is need to strengthen the integrated farming approach in research and policies.

Most linkages have weakened in the last twenty five years due to an increase in mechanised ploughing and expansion of livestock production into areas far away from the crop sector. The existing linkages are summarised below:

Main linkages	Comments
Use of manure on fields	High costs due to transport, only feasible around villages No increase due to high costs and stagnation of planted area
Animal draughtpower	Decrease in use of cattle Increase in mechanised ploughing and use of donkeys
Eating of crop residues	Only in village areas; no baling of crop residues. Reduced access to crop residues due to fencing of fields
Fodder production by crop sector	Negligible. Growing potential for chicken and dairy sectors.
Crop damage	Very common; around 80% of arable farmers report crop damage by cattle and goats. Crop damage leads to fencing of fields, but goats remain problematic.

Opportunities for stronger linkages

The drive towards agricultural diversification may open new opportunities for strengthening the linkages between both sectors. Diversification may take the following forms:

- Crops; horticulture, irrigation, production of non-conventional crops and fodder;
- Livestock: current diversification efforts together with ostrich farming and game ranching.

The growing amount of treated wastewater also offers opportunities for stronger linkages. For example, a farmer in Lobatse grows Lucerne as livestock fodder with treated wastewater.

Finally, urbanisation offers opportunities for integrated farming and stronger linkages between the livestock and crop sector.

Research recommendations

1. Investigate the feasibility of re-use opportunities of chicken, dairy and cattle manure for the crop sector
2. Investigate opportunities for commodification of crop residues and road side grazing resources for use in intensive livestock farming systems;
3. Investigate the opportunities to promote integrated farming on under-utilised communal areas arable fields, especially around large settlements with a good market (e.g. fodder, smallstock etc.).
4. Investigate efficient ways of domestic feed production for chicken, ostriches and dairy cows. Fodder research has been carried out in the past (e.g. lablab, Lucerne, leucenia, saltbush, acacia seedpods, but fodder production has not been widely taken up by farmers. Therefore, additional fodder research should focus on applications and markets right from the start.
5. Evaluate the success of the poultry sector, and apply lessons to other sectors and to to enhance the sustainability of the poultry sector.
6. Botswana has 405 000 donkeys (2002 estimate), most of which are unmanaged and under-utilised. Animal draught power has declined, and the main use is now transport (around 65 000 donkey carts in 2001). Research needs to assess the productivity of donkeys and identify possibilities to increase their productivity (e.g. slaughtering) as well as their impacts on rangeland resources, including considering the control of their numbers and improved management.

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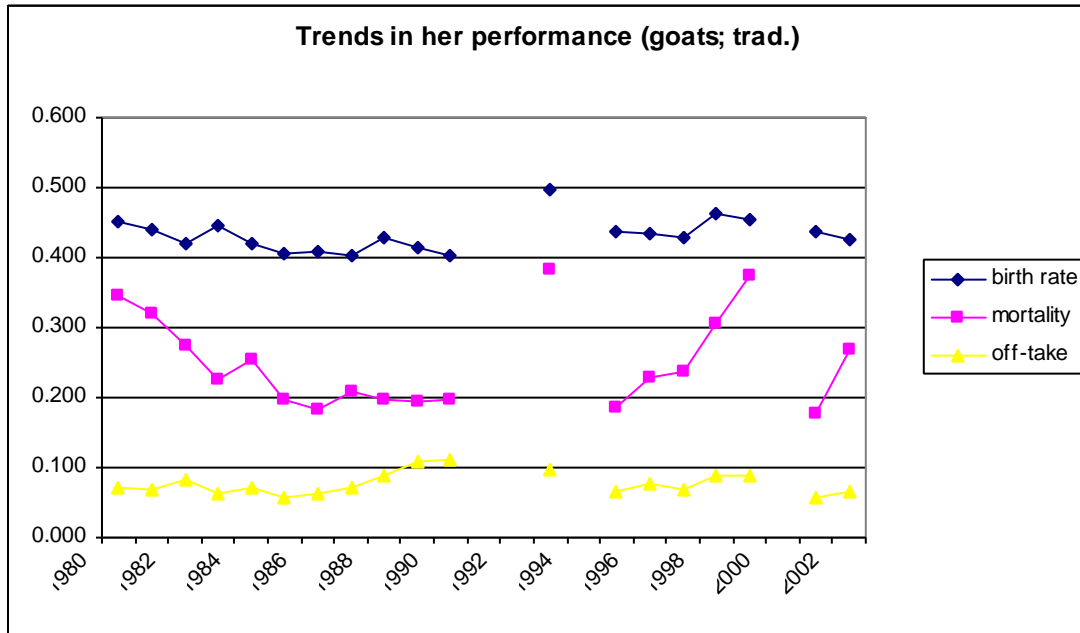
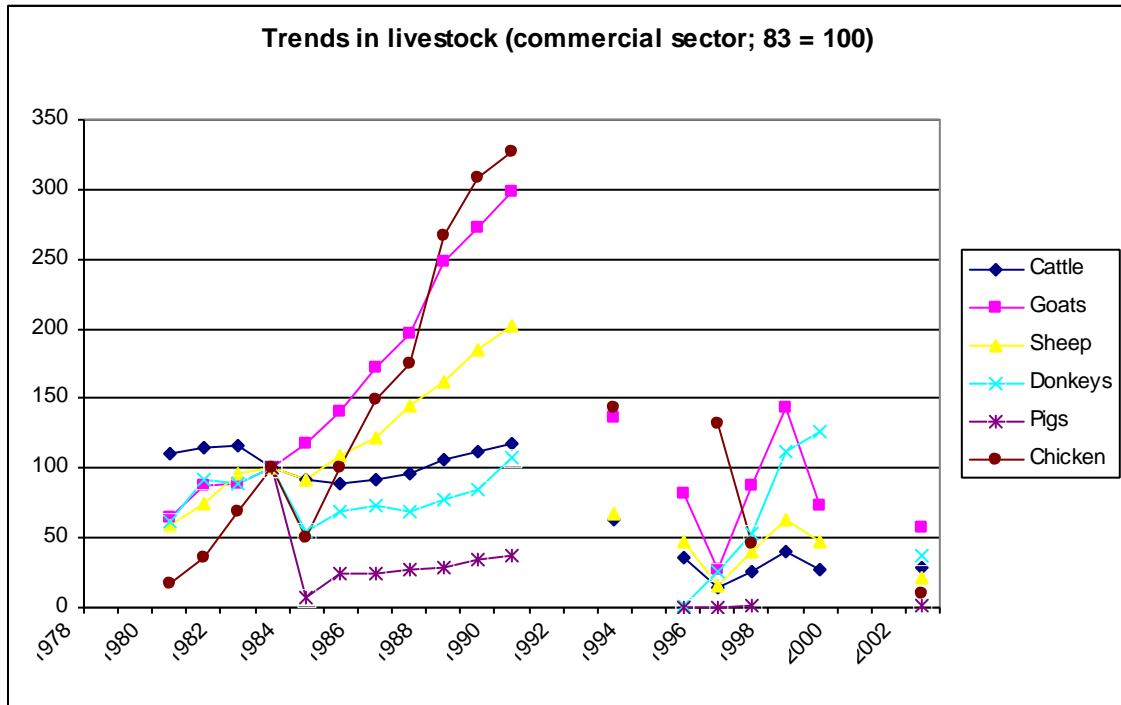
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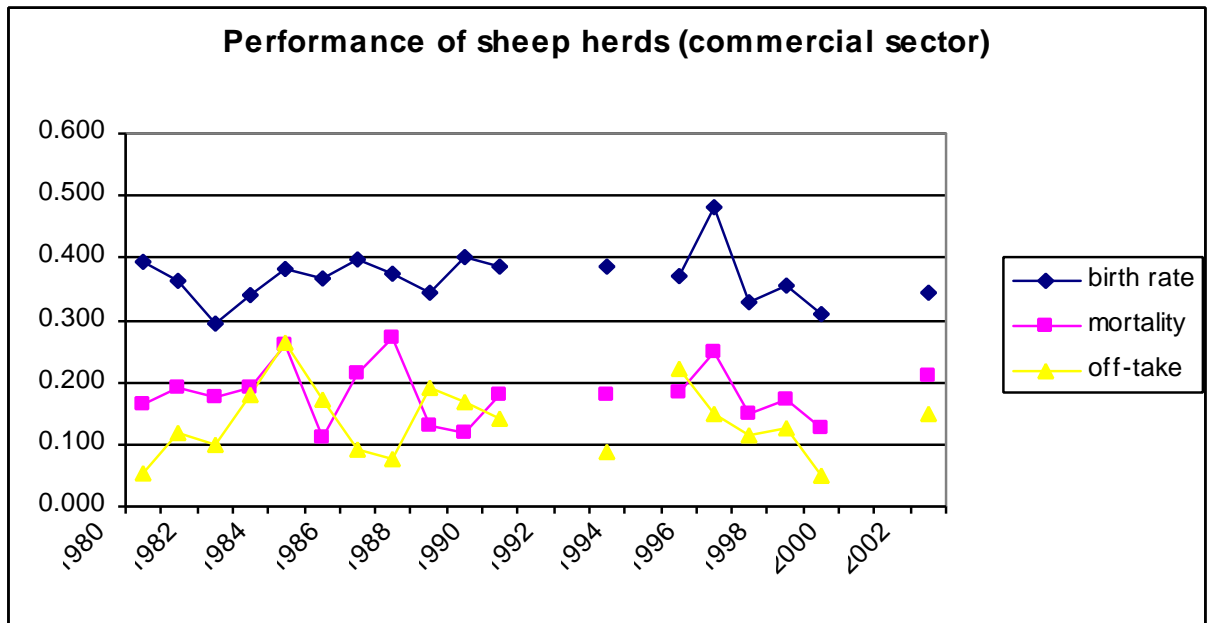
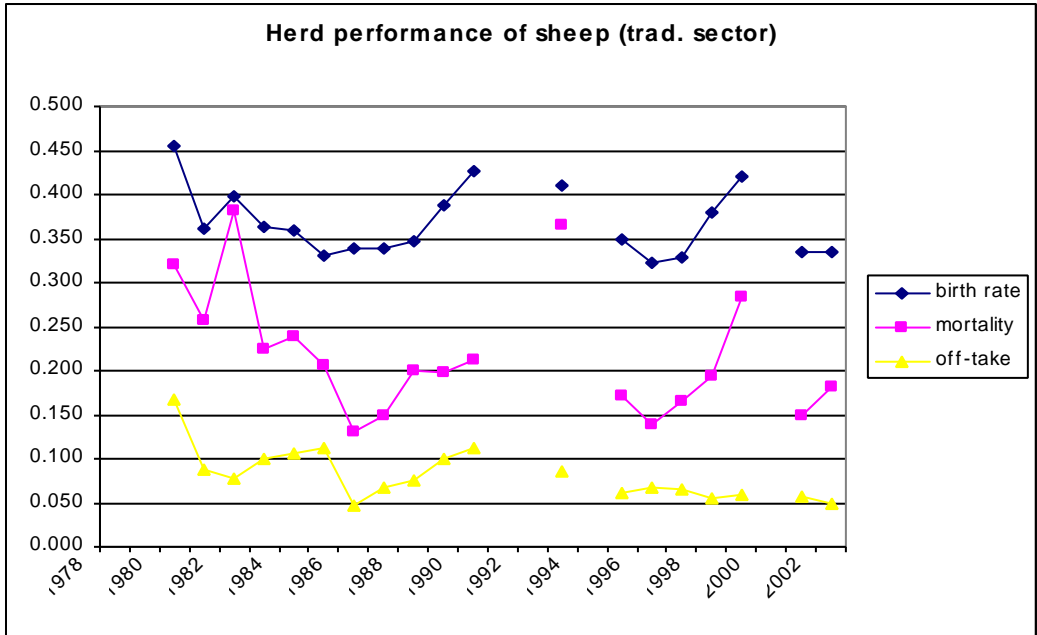
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Appendix I: Additional tables





Planted area

