Pro-Poor Livestock Policy Initiative
A Living from Livestock
Research Report

University of Reading

RR Nr 05-02; February 2005

Poverty and Livestock Agriculture

J. Otte and M. Upton

Introduction

Global Millennium Development Goals to Relieve Poverty

The main theme of this paper is that livestock production makes a significant contribution to the livelihoods of the poor and offers substantial scope for expansion to alleviate poverty. In order to develop this theme, we first give estimates of the extent and global distribution of poverty and summarise the internationally agreed 'millennium development goals' for its alleviation. This leads into discussion of the contributions of livestock to the livelihoods of the poor. The potential for increased livestock production is then examined with assessments of the direct benefits likely to accrue to poor households. Indirect benefits are also likely to accrue, in terms of expanded markets for labour intensive, non-tradable local goods and services, stemming from the increased incomes and expenditures of livestock producers. Finally policies and strategies for unleashing the potential are reviewed.

Despite economic growth and development in most countries of the world, large numbers of people, estimated at over on billion in total, remain in 'extreme consumption poverty', defined as those obtaining a 'global consumption bundle' worth US$ 1 or less per person per day in constant purchasing power of 1993. Low consumption is only one dimension of poverty, but it is closely linked with others such as malnutrition and hunger [1], illiteracy, low life expectancy,

[1] An estimated 852m people are undernourished, according to a new report from FAO , quoted in *The Economist* **374** (8407) 74 1st-7th January 2005

insecurity, powerlessness and low self esteem. None the less, the links are close enough to rely on consumption value as an overall indicator (Kanbur & Squire 1999).

Over recent decades, world leaders have repeatedly proclaimed their commitment to the alleviation of world poverty and recommended various targets. These were drawn together in the series of eight Millennium Development Goals by the United Nations General Assembly in 2001 (UN 2001). The first of these goals is to eradicate extreme poverty and hunger, with the twin targets of halving between 1990 and 2015, (a) the proportion of people whose income is less than US$ 1 a day, and (b) the proportion of people who suffer from hunger.

Progress in achieving the first target has been mixed, but globally, the reduction in numbers of the poor by 1999 appeared sufficient to predict the intended 50 percent halving by 2015 (see Table 1). The same findings apply to the developing countries as a group. However, there are large discrepancies between regions. While in East Asia the proportion of the population in extreme poverty was almost halved by 1999, progress in the other regions was slower. South Asia still has the largest number of people in extreme poverty (nearly 43% of the global total) but the proportion is lower than in Africa and it is predicted that the target halving will be achieved. In sub-Saharan Africa however, estimated numbers of the very poor are estimated to have risen and are predicted to continue to do so. Although, as a percentage of the total population, those in extreme poverty are falling, there is little hope of achieving a reduction by 50 percent by 2015 in Sub-Saharan Africa.

Table 1: Estimates and projections of extreme consumption poverty by main regions (million persons and percentage of total population).

	Developing Countries	Sub-Saharan Africa	North Africa & Near East	South Asia	East Asia (incl. China)	Latin America & Caribbean	World total[a]
1990	1,269 (32.0 %)	242 (47.7 %)	6 (2.4 %)	495 (44.0 %)	452 (27.6 %)	74 (16.8 %)	1,276 (29.0 %)
1999	1,134 (24.6 %)	300 (46.7 %)	7 (2.3 %)	490 (36.9 %)	260 (14.2 %)	77 (15.1 %)	1,151 (22.7 %)
2015	749 (13.2 %)	345 (39.3 %)	6 (1.5 %)	279 (16.7 %)	59 (2.8 %)	60 (9.7 %)	753 (12.3 %)

a. The world totals differ from the developing country totals by the estimated incidence of poverty in the transition countries of Eastern Europe and Central Asia.
Source: Adapted from World Bank (2001)

Poverty Incidence is Highest in Rural Areas

Within these broad regional groupings, there are major inequalities and differences in the extent of severe poverty between and within countries. In particular there is an imbalance between

urban and rural areas. Most of the world's extremely poor (about 75 %) live and work in rural areas. Despite high rates of rural urban migration in most developing countries, possibly driven by income disparities between town and country, most of the poor remain in rural areas. This occurs for two reasons, first because in most regions, a majority of the population still live in rural areas (see Table 2), and second because poverty is relatively more prevalent in rural areas.

Table 2: Rural and urban populations in developing countries

	Develop-ing Countries	Sub-Saharan Africa	North Africa & Near East	South Asia	East & South East Asia (incl. China)*.	Latin America & Caribbean	Deve-loped Countries
Rural population as % of total (2003)	58.1	65.6	43.5	71.9	54.2	23.2	27.8
Annual growth (%) of rural population (1993-2003)	0.7	1.7	1.3	1.6	0.2	-0.2	-0.2
Annual growth (%) of urban population (1993-2003)	3.1	4.6	2.8	2.8	3.3	2.2	0.6
Rural population as % of total (2015)	51.6	58.4	38.8	67.0	48.3	19.4	23.6

Source FAOSTAT 2005

It may be noted that high rates of rural-urban migration and resultant rapid urban growth account for much of the total population increase, so rural population growth rates are slowing. The total rural population, world-wide is expected to decline after 2020. In the developed countries, as a group, and in Latin America and the Caribbean, the rural populations are already declining. However, in Sub-Saharan Africa, North Africa and the Near East and in South Asia the rural populations still growing by more than one percent annually. Hence increased income must be generated in rural areas if only to maintain current low income levels per head.

Meanwhile, the fast growing urban populations represent a steadily expanding market for food and raw materials produced in the rural areas. Thus, increased production is needed not only to reduce rural poverty but also to supply the expanding urban, and possibly world, markets. However, road networks and other communications are often poor and, as a result, market access is limited.

Rural poverty is exacerbated by lower levels of public spending per head on services such as health and education compared to urban areas. Few opportunities exist for local employment in the manufacturing or service sectors as these are concentrated in the urban areas. While rural-

urban migration may be an option, alternative local employment opportunities are restricted to agricultural production or rural non-farm (RNF) activities.

Rural Livelihoods, Agriculture and Rural Non-Farm Activity

Dependence on Agriculture

A majority of the people of developing countries, over 52 per cent of the total population, depend on agriculture for their livelihoods. In sub-Saharan Africa and South Asia the proportions are higher. The proportion of the rural population dependent on agriculture is obviously much higher, at around 75 per cent in North Africa, the Near East and South Asia, and close to 100 per cent in Sub-Saharan Africa. Although the proportion is decreasing, as a result of rural-urban migration, the absolute numbers securing their livelihoods from agricultural production are still increasing in the developing countries. Within the developing country group, only Latin America and the Caribbean has fewer people dependent on agriculture than ten years ago. In the 'transition economies' of the former Soviet Block, which in this study are not included among the developing countries, agricultural populations have fallen rapidly.

Poverty and malnutrition, exist in both a 'chronic', or long term, form and on a temporary, or 'transient' basis, as a result of droughts, or floods, pest and disease outbreaks or war and civil unrest. In some cases, the loss of income and productive assets associated with the temporary disaster, result in chronic poverty and malnutrition.

Within agriculture, the degree of poverty depends upon level of access to natural resources of land and water and physical resources (or the necessary finance) such as stocks of productive inputs, permanent crops, livestock, equipment and machinery. The 'extremely poor' or 'poorest of the poor' are likely to include smallholders with very small and/or infertile land holdings, pastoralists with depleted herds, and landless households. Landless people, who may be forced to depend on casual employment as wage labourers for their livelihoods, are found in all parts of the developing world. Africa is exceptional since even the poorest are likely to have access to some land and can operate a smallholding.

The particularly vulnerable are found in the more remote, often arid, marginal and degraded areas, among displaced persons and refugees, scheduled castes in South Asia, and notably among female-headed households in Africa, Asia and Latin America. Many situations have been documented where local institutions limit women's access to land, credit, technology, education and health and constrain their productive activities. Rural women are often also less likely to obtain off-farm work than men. Poverty incidence among children is everywhere much higher

than among adults. The HIV/AIDS epidemic in Southern Africa and elsewhere causes widespread poverty in urban and rural areas, by causing the death of able-bodied adult family members, leaving children and aged dependants without support.

Non-Farm Income and Off-Farm Employment

Non-farm income is important to farm households in developing countries. A review of about 100 farm-survey studies, conducted near the end of the 20th Century, found that on average the share of non-farm income in total rural household income was 42 per cent in Sub-Saharan Africa, 40 per cent in Latin America and 32 per cent in Asia (Reardon *et al* 1998). Thus the rural non-farm sector is second only to agriculture in providing incomes and employment for rural people. Income diversification into non-farm activities is likely to increase incomes and reduce risk.

In many rural areas of the developing countries, where communications with the major urban markets for manufactured goods and services are limited, they must be produced and traded locally within the village economy. These include activities such as house building, bicycle repairs, crafts, dress-making, food processing, firewood and charcoal selling, food retailing and local brewing and distilling. The products are described as non-tradable since they are delivered and used mainly within the rural community, and cannot readily be traded in urban or international markets. These activities are highly labour intensive, but can only expand in response to growth in local demand.

For many rural households, rural non-farm activities offer opportunities for investment and self-employment to supplement the farm income. However, for the very poor, rural non-farm activities can only offer opportunities for wage-employment, as an alternative to working on other people's farms. In either case complementarity exists between agricultural and non-farm activities. Increases in agricultural production and farm incomes, generate increases in demand for rural non-farm goods and services, which then induce a supply response and increased incomes for those engaged in the latter non-farm sector.

In comparison with urban based manufacturing and service industries, both agriculture and rural non-farm activities are labour intensive. This means that the labour input requirement is high in relation to the physical capital invested, and per unit of output. Expansion, of agricultural or rural non-farm production, is beneficial in creating employment in labour abundant but otherwise resource poor societies.

In very unequal societies, where there is bimodal development with some rich farmers and some poor, this complementary development is unlikely to occur. Because of pecuniary, and possibly technical, economies of scale, the rich, well-endowed farmers are most likely to benefit from

improvements in agricultural productivity or prices. However, they are also more likely to spend income gains on tradable goods and services available in the urban areas, and not on rural non-farm products.

The Contribution of Livestock to the Incomes of the Poor

Importance of Livestock Production within the Agricultural Sector

The important roles of livestock, within the agricultural sector, in contributing to rural livelihoods, and particularly those of the poor, are well-recognised (LID 1999, Upton 2004). Livestock and their products are estimated to make up about a third of the total value of gross agricultural output in the developing countries and this share is rising quickly (Bruinsma 2003). Production is increasing rapidly in response to the fast growing demand for livestock products resulting from increasing population, especially that of urban areas, and rising consumer incomes. Over the last decade, annual growth rates of the livestock sector have been around 3.8 percent, compared to 2.7 percent for crops and 1.2 percent for non-food agricultural products. Given also the estimate that livestock contribute to the livelihoods of at least 70 percent of the world's rural poor (LID 1999), the case for a focus on livestock in pro-poor development is clear.

Poor farmers are more likely to own poultry and pigs, sheep and goats, or other small stock rather than large stock. In comparison with larger stock such as cattle they have several advantages: small animals require less capital investment to buy and maintain; they are more convenient for distress sales while death of a single animal is less damaging; they grow and breed faster and can often thrive on harsher terrain. Having made an initial investment in small stock, it may be possible to expand, and having accumulated a large enough flock, to switch to cattle or other large stock.

Livestock not only produce meat, milk and eggs, wool and other products, for sale or home consumption, but also yield manure for use as fertilizer or fuel and may serve as a form of saving or reserve against emergencies when they may be sold to provide essential cash. In many societies livestock have ceremonial uses and ownership enhances the status of a household. However, there are many different species and breeds of livestock and different livestock production systems. Ways in which livestock keeping contributes to the relief of poverty, vary with the type of production system, a subject to which we now turn.

Main Types of Livestock Production System (LPS)

Livestock production systems may be broadly categorised into (i) 'grassland-based' pastoralism and ranching (ii) 'mixed-farming', either rainfed or irrigated, and (iii) 'landless', mainly pig and poultry production systems (Seré & Steinfeld 1996). These are listed in order of increasing intensity. In Table 3, a distinction is also drawn between small-scale, often traditional, production systems and the large scale commercial types of system. The majority of the poor engaged in livestock production are likely to use 'small-scale' methods, listed on the left, although some may be employed as unskilled labour in 'large-scale' commercial enterprises.

The 'landless' production systems are largely responsible for the rapid growth in average meat supply per person in the developing countries, poultry production having doubled over the last 10 years. Reproduction and growth rates are faster in pigs and poultry than in the ruminant species of livestock. However, housing and hand feeding increase capital requirements and labour costs. Much of the expansion has been due to increased production from large-scale, commercial and peri-urban enterprises.

Table 3: Types of Livestock Production System

Livestock production system	Small-scale, (semi-) subsistence	Large-scale, commercial
Grassland-based	Pastoralism	Ranching
Mixed-rainfed	Rainfed smallholdings with livestock	Large farms or estates with livestock; no irrigation
Mixed-irrigated	Irrigated smallholdings with livestock	Large farms or estates with irrigation and livestock
Landless	Scavenging poultry & small-stock	Industrial type production; poultry, pigs or feedlots

Adapted from Seré & Steinfeld (1996)

Grassland-based systems are dependent on ruminant livestock, such as camels, llamas and other camelids, cattle, sheep and goats, and are mostly found in arid or semi-arid regions of both tropical and temperate zones. The description of pastoralism as being a 'small-scale' and 'semi-subsistence' system is somewhat misleading, since some pastoral herds and flocks are very large, while livestock are raised, largely for sale, to provide for the purchase of staple crop products. None the less a clear distinction may be drawn between pastoralism, which requires little physical capital (other than that embodied in the livestock) and is labour intensive, while ranching requires relatively little labour and is capital intensive. Human population densities are low in both systems, while poverty is transient, rather than chronic, as a result of periodical droughts.

Mixed crop-livestock production systems are important as the source of the bulk of ruminant livestock production and the home of the majority of the world's poor. Complementary relationships exist with livestock, fed on crop by-products and other plant material, contributing draught power, manure, additional sources of food and income, savings and a buffer against risk. As intensity and livestock numbers rise, crop-livestock interactions become increasingly competitive, for the use of land and other resources. There is then little, or no, interaction between crops and supplementary, landless livestock systems.

Landless livestock systems provide most of the world's production of pig and poultry meat. Most is produced in developed countries and from large-scale commercial enterprises, now also increasing in the developing countries. These products make up two thirds of all meat production world-wide, while, in the developing countries, poultry meat now accounts for more than half of all meat produced. Ruminant fattening, in feed lots, is less important. Concerns arise regarding limited benefits to the rural poor and risks of environmental pollution. However, pig and poultry production converts feed efficiently and provides a cheap source of animal protein, but policies are needed to alleviate the adverse environmental effects of production and to facilitate market access for small-scale producers.

Distribution of Numbers of Poor by LPS and Continent

Inter-regional differences in livestock production systems depend upon agro-ecological features, human population density and cultural norms. Although livestock production systems vary considerably between regions within countries, some broad differences may be identified between continents and linked with the availability of natural resources. Results are given in Table 4. Landless systems are omitted from this analysis as their prevalence is largely independent of the natural resource base and climatic conditions. Furthermore, given that much of the production is from large-scale, commercial systems, the numbers of dependent poor people may be relatively small, and included in the numbers of poor not allocated to the other systems.

Table 4: Land use per head of agricultural population, distribution by agro-ecological zone (AEZ) and proportion of poor within livestock production systems.

	Developing countries	Sub-Saharan Africa	North Africa & Near East	South Asia	East & South East Asia (incl. China)	Latin America & Caribbean	Developed countries
Land area ha / head	3.2	6.7	10.3	0.6	1.4	19.0	56.5
Cropped land ha / head	0.4	0.4	0.8	0.3	0.2	1.5	6.6
Permanent pasture ha / head	0.9	1.9	3.5	0.03	0.5	5.6	12.5
Prop. of crop land irrigated %	23.9	5.9	30.2	38.5	31.8	11.7	10.7
Land within AEZ as percentage of total							
Arid	46	63	88	76	12	31	
Humid	30	31	0	21	23	46	
Temperate	24	6	12	4	65	22	
Percentage of poor within production systems							
Grassland-based systems	4	11	9	1	1	6	
Mixed rainfed systems	42	70	40	38	33	57	
Mixed irrigated systems	40	1	30	55	31	7	

Sources: FAOSTAT 2003; Thornton *et al* 2002

The data provided in the first four rows of Table 3, on land availability per head of the agricultural population and the proportion of cropland which is irrigated are derived directly from the FAOSTAT database (FAOSTAT 2003). These figures reveal striking differences, between continents, in agricultural population density and the importance of irrigation. The remaining six rows of the Table are taken from a GIS mapping study of poverty and livestock systems in the developing world (Thornton *et al* 2002). The country membership of the different continental groups differs slightly from that used in FAOSTAT, but the broad estimates will serve to illustrate the pattern of livestock production systems. The three rows recording extent of climatic zones, is based on the mapping of livestock systems by land area, whereas estimates in the last three rows give the proportions of the total numbers of the poor engaged in each type of farming system

In Sub-Saharan Africa, agricultural population density is relatively sparse, so that land endowments per person are quite good. However, much of the land is classified as arid, and only a very small proportion of the crop land is irrigated. Grassland based ruminant production is prevalent in the arid/semi-arid areas but most people are supported by, and most ruminant meat and milk is produced from, mixed rainfed farming systems. Mixed farming is practised in both

arid and humid regions along with some in the temperate highlands of East Africa. There is some limited development of pig and poultry production, particularly in peri-urban areas. Overall levels of production and consumption per capita are low and improving rather slowly.

In contrast South Asia, including India, is densely populated, with very limited land resources per person depending on agriculture. Much of the land area is arid or semi-arid. However, a high proportion of the crop land is irrigated. Thus virtually all the ruminant livestock production is derived from mixed production systems, either irrigated or rainfed. Little meat is consumed but milk production and consumption have grown rapidly: India is now the world's largest milk producer. Poultry meat production and consumption have also grown rapidly albeit from a fairly low base.

The land resource availability per person in agriculture in East and South East Asia, including China, is similar to that in South Asia, the only difference being that most of the land area is classified as 'temperate'. Most of the livestock are produced on mixed irrigated and rainfed farms, but the main species are pigs and poultry rather than ruminants. Milk production and consumption are very low. However, the production and consumption of pig and poultry meat and eggs are high and growing fast, although the quantities are possibly exaggerated in the Chinese statistics.

Land resources per head of agricultural population, in Latin America and the Caribbean, are higher than in other parts of the developing world. This low agricultural population density is linked with higher than average levels of urbanisation and per capita incomes. Only about a third of the land supporting livestock systems is arid. The extensive grassland of the 'pampas' allows production of ruminants, mostly ranched cattle. Nonetheless, rainfed mixed farming systems are the source of most of the ruminant production. Landless poultry and pig production is expanding rapidly, particularly in Brazil. Overall livestock production and consumption per person are considerably higher than in most developing countries, and are increasing quite rapidly.

Land areas per person dependent on agriculture, in the Near East/ North Africa, are high but the climate over much of the region is arid or semi-arid. A substantial proportion of the crop land is irrigated. The large areas of 'permanent pasture' carry ruminant stock, mostly sheep and some camels. The majority of ruminant stock are raised, however, on mixed farms, many of which are irrigated. No pigs are kept but landless poultry production systems are expanding in number. Livestock products make a relatively small contribution to human diets, but the contributions from milk and poultry meat are increasing.

Comparison of the main developing country continents, shows that Sub-Saharan Africa, Latin America and the Near East, with reasonably large areas of land per person engaged in agriculture, have a greater proportion dependent on grassland-based, ruminant livestock

systems than do the more densely populated, land-scarce, regions of South and East Asia. Nonetheless, in all the continents listed, most of the agricultural population are engaged in mixed farming systems. These are mainly rain-fed in Africa and Latin America but, in South and Eastern Asia and the Near East, about half are irrigated. Poultry production is a key enterprise in Latin America, particularly Brazil, and in East and South East Asia, mainly China which is also a major pig producing country. South Asia is the largest milk producing region.

Contributions of Livestock to Rural Livelihoods

Increased Supply of Animal Protein (and Calories)

Within the household, livestock production contributes to improved nutrition, particularly of children, in any of three ways. Diets may be improved:

- by direct consumption of milk or eggs and meat occasionally,
- by the use of the income earned from sales of livestock products to buy food, or
- from increases in crop production resulting from mixed farming (Tangka *et al* 2000, Neumann 2000, Shapiro *et al* 2000).

By contributing to human protein and calorie consumption, livestock production reduces the incidence of under-nutrition. An indication of poor diets in the developing world, and hence of the necessity to improve nutrition, is given by the average daily calorie supplies per head, which for all regions are lower than in the developed countries (Table 5). The regional averages are between an eighth (in the Near East) and a third (in Africa) lower than in the developed countries. While the regional averages are lower, the calorie intakes of the poor within each region are much lower

Table 5: Supplies of Calories and Livestock Products Per Capita (2002)

	Developing Countries	Sub-Saharan Africa	North Africa & Near East	South Asia	East & South East Asia (incl. China)*.	Latin America & Caribbean	Develop-ed Countries
Calories /cap/day	2,666	2,207	2,894	2,427	2,703	2,860	3,314
Meat supply/cap/year (kg)	28.5	11.4	22.5	5.9	21.6	61.2	79.5
Milk-excluding butter supply/cap/year (kg)	45.6	29.0	75.0	66.9	13.9	106.3	202.1

Source FAOSTAT 2005

While developing country diets are poorer, than those of developed countries, in quantitative terms, the difference in dietary quality is more marked. The poorer quality of diets in the developing countries is reflected in the low average levels of supply (and consumption per head) of meat and dairy products . In all regions but Latin America, the average intake per head of meat and dairy products is a small fraction of that in the developed countries. (For detailed country by country analysis, see PPLPI 2005, 'Maps').

Low levels of dietary intakes of livestock products, such as meat, milk and eggs, may be explained by the higher cost of production, per tonne and per unit of food energy, than for staple crop products. To some extent, high levels of cereal supply and consumption per person compensate for the low levels of meat, milk and egg consumption.

However, as incomes rise, in the developing countries, consumers seek more variety and better quality foods in their diets. Hence demand for livestock products rises rapidly, an effect which is also driven by quite rapid growth in the number of consumers. The high rates of growth in meat supply, and consumption, per capita recorded in all regions except North Africa and the Near East, is significant and forms the basis of the so-called 'Livestock Revolution'. If the growth in consumer demand continues at the same rate, livestock producers are faced with rapidly expanding domestic markets.

The rapid changes in demand and supply of meat is accompanied by shifts in the types of meat contributing to the total. Over the past ten years, while consumption per head of bovine and sheep and goat meat have stagnated in all regions of the developing world [2], poultry meat consumption has risen annually by over 6.5 percent in South Asia, and by nearly 6 percent in Latin America and on average for all developing countries. Significant increases in consumption of eggs are recorded for all regions except Africa. Hence it can be argued that the rapid increases in consumption of livestock products have largely stemmed from a shift towards consumption of poultry products.

However, much of the growth in demand is the result of rising per capita incomes and is concentrated in urban areas. As mentioned above, access to urban markets is limited for many of the rural poor. We will return to this issue in the section on tradable and non-tradable products.

[2] with the exception of Latin America where beef consumption rose by 1% annually

Non-Food Products, Wool, Hides and Skins

Wool production, in the developing countries, is restricted to temperate regions, or high altitude tropical regions as in Bolivia, Peru or Nepal, where wool sheep thrive. Washing, carding and spinning or felt-making may be carried out locally, with transactions occurring between near neighbours and acquaintances. However, local markets for woollen products are likely to be small, so increased income from sales depends upon access to the larger urban markets.

Hides and skins are a by-product of meat production. Hides and skins from home slaughtered animals are rarely processed. The necessary salt may not be available and returns may be insufficient to justify the cost. Tanneries are usually associated with large-scale abattoirs. Hence small-scale producers are unlikely to be involved in selling these products.

Mixed Farming, Manure and Draught Power

In mixed and integrated farming systems livestock contribute to both intensification and diversification of income streams. The majority of the world's rural poor depend on such systems (see Table 4). Complementary relationships between crops and livestock may be exploited, through nutrient recycling, with animals feeding on crop residues, and returning manure to the soil. Not only is additional income earned from livestock products but also benefits may be derived from increases in crop yields. Where livestock are largely supported on crop residues and by-products or waste land, little or no cultivated land is devoted to fodder production. Research devoted to improving the quality of crop residues, such as the treatment of straw, and the better utilisation of crop residues may extend the livestock carrying capacity without reducing production of crops for sale or human consumption. The application of animal manure to the crop-land contributes to increased crop yields. As a result production from both crops and livestock is increased.

At the lower rural population densities found in parts of Sub-Saharan Africa and Latin America, labour-saving and land-using technology may be appropriate. The use of ruminant animals for draught power is such a technology. Studies have shown that cultivation, with animal power or tractors, produces little or no improvement in crop yields in comparison with hand-cultivation. The main benefit is to allow a larger area to be cultivated per household or per unit of labour. In this sense, it is a labour-saving and land-using technology. However, animal draught is also used for cultivation in intensively cultivated and irrigated land in Asia and other parts of the world, with buffalo replacing cattle, camels or donkeys in wet rice zones. In these cases, motive power requirements per hectare are very high so there are benefits derived from saving labour, despite the high population density. A recent estimate suggests that about half of the total cropped area in developing countries is cultivated using animal draught power (Bruinsma 2003, Chapter 5).

The main benefits from the use of manure as fertiliser and employment of animal draught, are derived within the farm system, in terms of increased crop production. However, both these products may be marketed. Manure may be bought and sold, for use as a fertiliser, a fuel or a building material. Although it is bulky and costly to transport, cases are reported of manure being transported over quite large distances for sale and use on high value crops (e.g. for use in potato and onion growing areas of Bolivia, J. Rushton personal communication). Arrangements, between pastoral livestock owners and crop cultivators, for the post-harvest grazing of crop remains by the pastoral livestock, allow for manuring of the land in exchange for supplementary feed.

The hire of draught animals is only likely to occur between neighbours or kinsmen. The extent of the market is limited by competition for the use of teams during the main cultivation periods and the costs of moving draught animals and equipment from one site to another.

Livestock as Capital Assets

Livestock embody saving and may provide a reserve against emergencies. If an urgent need for funding arises, for a special occasion or a disaster such as a drought, animals may be sold to raise the needed money or slaughtered and consumed to provide food energy and protein. Risks are mitigated by combining crop and livestock production, since the livestock may provide the means of subsistence if crops fail. Both as a store of savings and as a risk reserve, small-stock (sheep and goats or poultry and pigs) have advantages over larger animals (cattle or camels) in terms of greater convenience and security. In many societies, livestock also serve social and cultural functions. They may have special roles in religious ceremonies and other social institutions, and provide a tangible measure of personal or family status.

Women rarely hold property rights or usage rights in land. In both traditional inheritance systems and in many land reform and settlement schemes, land rights are generally transferred to males as the ‘head of household’. Female headed households, resulting from death or extended migration of the husband, or divorce, generally control less land than male headed households (IFAD 2001). In contrast women often independently own small livestock, such as goats in West Africa (Okali & Sumberg 1986) and ‘backyard’ poultry in many developing countries. Such livestock scavenge or are fed on household waste, at negligible cost. Though subject to disease and other losses, they provide a valuable supplementary income source. It is estimated that 70 percent of the world’s rural poor are women, for whom livestock represent one of the most important assets and sources of income (DFID 2000).

Livestock are valuable capital assets that not only produce future income but also increase numerically by reproduction. Once a foundation flock or herd is established, expansion is

possible by rearing increasing numbers of replacements. Of course there is a trade-off between consuming the young or rearing them to join the breeding herd. However, this special characteristic of livestock, as self-generating capital, makes them a particularly valuable form of investment for the poor. The cost of establishing the foundation stock for a new enterprise, may be beyond the means of the poor. External aid and/or credit is then needed.

Tradable and Non-Tradable Livestock Outputs

Home Consumption and Local Markets

Limited market access is a key constraint on the rural poor. Remoteness and poverty both tend to reduce access to markets, particularly for disadvantaged groups, such as the illiterate or poorly educated and different ethnic minorities. There are five main physical reasons why market access may be difficult: poor road network, high transport costs, poor postal and telecommunication services, low value to weight ratios of some products, such as manure, and the perishability of products, such as milk or meat. These last two characteristics determine whether livestock products are tradable in the larger urban and international markets. (For a fuller discussion of livestock marketing see Upton *et al* 2005).

Even if no products are sold, livestock may still contribute to rural livelihoods by increasing household consumption. As already suggested nutrition, particularly that of children, is improved by home production of milk and meat, eggs or honey. Smallstock, such as poultry, sheep and goats, are often kept near the home, largely scavenging for food and requiring very few resource inputs. They are more convenient as a source of household meat, than cattle and other large ruminants. Meat from large ruminants may spoil before it can all be consumed within a single household, while cost would prevent it from being a regular item of diet.

Livestock products alone are unsuited to providing basic subsistence needs. Meat is rarely a staple item of diet, even in pastoral society, where the main livestock products consumed are milk and blood complemented by purchased cereals. This is despite the fact that for many people living in the arid climatic zones, is the only livelihood option available, allowing the exploitation of common property rangeland resources.

In mixed farming systems, the main benefits of manure production and the provision of animal draught power, are derived within the farming system. Crop yields are increased by the use of manure as fertiliser, while cropped areas, or cropping intensity, may be increased by using animal draught. Increases in crop production then contribute to improved livelihoods and human nutrition.

Hence livestock production can contribute to the livelihoods and nutrition of purely subsistence households. However, such situations are rare; the vast majority of rural households are partly engaged in market activities, despite also aiming to produce food for the family. Whilst production of staple food crops for home consumption is generally a key objective, livestock production is commonly seen as a cash earning enterprise.

Escape from poverty requires production of a marketed surplus over basic subsistence needs, to pay for productive inputs, consumer goods and immediate cash requirements. Although herd or flock expansion may be based simply on the natural processes of reproduction and growth, the initial investment in a new enterprise and other forms of asset accumulation require cash savings or credit supplies. Sale of produce provides income to improve consumption levels, to purchase inputs (concentrate feeds, labour, drugs and veterinary services) and to invest in genetic material, housing and equipment for increased future production.

In rural areas, where access to the large urban markets is limited, many market transactions take place within the local community or 'village economy'. Agricultural products and the necessary inputs may be bought and sold locally, while services may be hired. The importance of the rural non-farm sector has already been emphasised, as a source of local services and consumer goods. Live animals, particularly small-stock, may be bought and sold locally, and loaned or hired for breeding or, in the case of large ruminants, for draught purposes. Products such as meat, milk and eggs may also be sold locally, but for meat and milk some basic processing is needed; slaughter and butchery for meat and cooling or fermentation to increase the shelf life of milk. Manure sold as fuel is generally dried before sale.

Intangible benefits conferred by livestock ownership, such as the gain in status, are only realised in the context of the local community. The transfer of land use rights and labour hire are transacted in local markets, but access to 'new' inputs, such as improved genetic material, pre-mixed feeds and animal health services, is dependent on there being sufficient local market demand and/or special programmes to provide these inputs. Similarly the growth of the non-agricultural rural industries, that provide local goods and services, is highly dependent on the growth of demand. In the following section, it is argued that certain types of livestock, and livestock products, are 'tradable' in the larger urban and even international markets. Given the fast growing demand for livestock products in many developing countries, there is great potential for rapid expansion, of production, producer incomes and rural non-farm economic activity. This in turn will increase employment opportunities for poor landless labourers.

Urban Markets

Large towns and cities are market foci, where demand for most products is concentrated, as is the supply of manufactured goods and public services. The process of urbanisation is associated with industrial development and growth. Communications are facilitated, and transaction costs reduced, by grouping workers into firms, while there are benefits from economies of scale and agglomeration. The main consumer markets for livestock products are found in these market centres, where the rapid growth of urban populations (Table 2) and incomes account for much of the growth in consumer demand.

Access to urban markets, by rural livestock producers, requires development of an infrastructure of communications and transport, intermediaries, market places and processing facilities. Markets link producers and consumers, usually through a chain of intermediary traders. Within the market chain, products are transported from one location to another, and processed from one form into another. All these operations must be financed as well as the 'transaction costs' of negotiating and enforcing contracts. The institutional framework has an important influence on the share of prices received by producers.

Access, and hence tradability, also differs between types of livestock and their products. Large animals may be moved large distances, on the hoof, but may lose condition as a result. Where motorised transport is available, it may well prove a cheaper alternative. Small animals, and poultry require transport but are bulky and therefore costly to move over large distances. None the less for remote rural producers, live animals are more readily tradable, than most other livestock products.

Products such as meat, milk and eggs are all perishable, while meat and milk require chilled transport if moved over large distances. Transport costs are considerably higher, per tonne, than they are for live animals. Since transport costs also vary with distance to the market, the producer prices net of transport costs are much lower in remote production areas, than in locations close to the main markets. For similar reasons the costs of new inputs, supplied from urban areas are more costly for livestock producers in remote areas. Small-scale producers are at a particular disadvantage, due to the high unit costs of moving small consignments

Peri-urban producers have a clear advantage due to their market proximity. Costs of produce marketing, and of input delivery, are lower than those for more remote rural producers. Hence, intensive milk production or landless, pig and poultry production systems often develop.

The marketing problems associated with the perishable nature of livestock products, such as meat and milk may be alleviated by chilling and hanging of meat, plucking and eviscerating broiler chickens, processing of by-products, or the cooling and pasteurising or souring of milk.

Further processing of meat may involve drying, salting or smoking, while milk can be processed into dried milk powder, butter, cheese, and yoghurts. Such processes extend the potential shelf life of the product and may facilitate transport, although the cost of refrigerated transport per tonne–kilometre is much higher than that of ordinary transport.

However, this is counterbalanced by the considerable value added, per tonne of produce, by processing. All these operations require capital equipment and are subject to economies of scale. Pecuniary economies, in the form of higher prices, also result from bulk selling. This benefit also applies to the grading and packing of eggs (FAO 2003).

While there are large numbers of small scale livestock producers, and consumers of the products, there are often very few traders or market intermediaries. The results are a lack of competition and inequality of bargaining power. This situation results from the small-scale and scattered distribution of producers, and inadequate transport and communications. The costs of setting up a trading agency are high and there may not be enough business to justify many traders becoming involved.

In the past Governments intervened, through parastatal Marketing Boards, for meat and for milk. Following structural adjustment, and identified weaknesses in their operation, many marketing boards have stopped operations. It was hoped that private enterprises would fill the gaps and provide marketing services. There has been a tendency to revert to more traditional methods of more direct marketing from producer to consumer. Co-operatives, or group activity by producers, have been successful in milk marketing, for instance in India and for a time in Kenya. Pig and poultry (broilers and eggs) marketing is often controlled by large commercial companies, which may contracts with smallholder producers. In these instances it is clear that the commercial companies have monopsony (a buyers monopoly) power in relation to the producers.

International Markets

Urban markets are also the conduits for international trade, which has increased at an accelerating rate over time. Trade in livestock products has expanded since the development of refrigerated shipping at the end of the 19th Century. Today, domestic livestock producers, in most countries, face market competition from imported products. Local producers must achieve comparable quality standards at no higher price in order to compete. Some developing country livestock producers are able to compete in world markets, so the country becomes a net exporter (for further discussion of trade in livestock products, see Upton 2001 or Upton & Otte 2004)

Although most developing country economies depended on agricultural exports at the time of independence, over recent decades the developing countries as a group have become net

importers of agricultural products, including livestock products, from the developed world. Estimates of the current net trade, in livestock products in 2002 (average 2001 – 2003) for developing regions, are given in Table 6. The balance of trade in livestock products, for the developing countries, as a group, is indicated by the data for the developed countries (last column), which provide net exports to the developing countries in all products.

Milk and dairy products, measured as milk equivalent, make up by far the largest item of net imports, in all regions. Net imports of 'milk equivalent' have been growing at between 2 and 4 percent annually, other than in Latin America and South Asia where they have diminished in recent years. For the meat products, there is much variation between regions. South Asia is a net exporter of ruminant meat, from cattle, sheep and goats. Latin America is a net exporter of bovine, pig and poultry meat, while East and South East Asia exports poultry meat. The Near East is the only region which is a net importer of all livestock products, while is a net importer for all livestock products with the exception of ovine meat. Net imports of ruminant meat and pig meat to East Asia, poultry meat to Africa and the Near East, and sheep meat to Latin America are all growing rapidly.

Table 6: Net trade in livestock products (1,000 metric Tonnes) in 2002 (average of 2001 - 2003).

	Sub-Saharan Africa	North Africa & Near East	South Asia	East & South East Asia (incl. China)*.	Latin America & Caribbean	Develop-ed Countries
Milk equivalent	-2,045	-6,400	-762	-8,642	-3,886	25,894
Bovine meat	-21	-351	297	-610	711	346
Ovine meat	3	-108	9	-76	-47	277
Pig meat	-38	-10	1	-77	152	138
Poultry meat	-306	-750	-3	193	1,033	1,072

Source FAOSTAT 2005 (negative values = net importer)

These broad statistics only give a rough guide as to developments in livestock trade. There is much variation between countries, within continental regions, while trade in live animals, and some minor products have been omitted. Of particular note is the trade in live ruminants from the tsetse-free but poor, Least Developed Countries of the African Sahel to Coastal West African countries and to East African States (de Haan, van Ufford & Zaal 1999). Despite the data limitations, it may be concluded that the growth of imports to many developing countries reflects a failure of domestic producers to meet the growing domestic demand. There are therefore significant opportunities for import substitution, as opposed to attempting penetration of international markets, where other countries, that are net exporters of livestock products, are already established as competitors.

Nevertheless, it is widely argued that the tariffs and non-tariff barriers imposed, by the U.S.A., the European Union and Japan, on imports from third countries, to support their domestic producers, restrict production and trade for developing country exporters and destabilise world markets. At the same time, support for developed country (OECD) producers is thought to depress world prices below their free trade levels. As a result producers in developing countries may face competition from 'artificially' cheap imports. Reduced farm support in the USA, Europe and Japan should result in slight increases in world prices for livestock products, that, while raising food costs for developing country consumers, will improve opportunities and incentives for the producers.

Health and food safety (SPS) standards are aimed at risk reduction for importing countries but may impose barriers against exports from developing countries because of the high costs of compliance. The WTO provides a forum for dispute settlement, but financial, legal and technical support may be needed by developing countries to negotiate settlements and comply with agreed standards. Separate, less stringent standards might be appropriate for inter-developing country trade. Other issues such as environmental impact of productive activity and animal welfare are likely to be increasingly important in future international trade negotiations. The main conclusion, for developing country producers, is that improved animal health care and product quality management is essential for access to major world markets.

Second Round Effects of Livestock Development

Agricultural Growth Generates Increased Non-Agricultural Employment

While agricultural expansion has a direct impact on employment and incomes in farming, the indirect impact on employment and poverty reduction comes from its stimulus to the labour intensive, non-tradable, rural non-farm sector (Mellor, 1995). It is generally found that the poorest of the poor lack land and other resources and are therefore largely dependent on wage-employment for their livelihoods. With rapid growth of agricultural output, and associated rural incomes, demand will grow for local non-tradable goods and services, discussed earlier. The products are described as non-tradable since they are delivered and used mainly within the rural community, and cannot be traded in international markets. The associated activities are highly labour intensive, but require local demand to grow in order to expand. Their expansion should provide employment for the poorest of the poor.

By generating demand for these non-tradable goods and services, significant increases in agricultural production and incomes have second-round, indirect impacts in increasing rural

incomes and employment. The demand for the goods and services from the rural non-farm sector is elastic with respect to income, implying that, as farmers' incomes rise, their expenditures on products of the rural non-farm sector increase more than proportionately.

Empirical Evidence of the Benefits of Agricultural Growth

Agricultural growth and development are therefore essential pre-conditions for the relief of rural poverty, and to promote economic development. More and more empirical studies are providing support for this argument. Research has been directed at direct measurement of the relationship between agricultural growth and the relief of poverty. Studies in India by the World Bank have been based on analysis of the virtually unique set of data on poverty numbers, collected across states and over time (Ravallion & Datt,1999). These data show clearly that agricultural and rural growth reduce poverty drastically, while industrial and urban growth reduce poverty little or not at all.

Warr (2001) found that while agricultural development in India reduced the incidence of poverty, industrial growth had the opposite effect. This result also applied to South East Asia, to Bangladesh (Woden 1999) and Indonesia (Thorbecke & Jung 1996). Cross country analyses by Timmer (1997) and Bourguignon & Morrison (1998) yielded similar findings. A recent study, based on a recursive statistical model finds that research-led agricultural development generates sufficient productivity growth to yield high rates of return in Africa and Asia and has a substantial impact in reducing poverty, while productivity growth in industry and services has no or little impact (Thirtle, Lin & Piesse 2003).

Another study on African countries based on economic modelling (Dorosh & Haggblade 2003) showed the indirect effects of agricultural investment to be large. On average, inclusion of growth linkages nearly doubles the national income growth following an initial investment in agriculture. Agricultural investments are also found to generate the largest impact on the poor.

There are thus strong arguments and considerable empirical evidence that agricultural growth is generally effective in reducing poverty. Two qualifications are needed. One is that change takes time and time lags may occur between gains in agricultural productivity and the consequent fall in numbers of poor. The other qualification is that major inequalities in access to resources can prevent the reduction in poverty[3].

[3] Timmer (1997) concluded from a cross-country analysis that the impact of agricultural growth is negligible when agriculture is dominated by very large farms. Mellor (2001) has argued that agricultural growth which benefits large, land-owning farmers has little effect on employment and incomes in the rural non-farm economy since they spend their added income on imported goods and capital-intensive urban goods.

The Special Role of Livestock in Generating Agricultural and General Economic Growth

Within agriculture, growth by extending the area of land in use is constrained by the shrinking reserves of unused fertile land. Expansion of agricultural production therefore largely depends upon intensification, by increasing inputs and / or changing technology to raise output per hectare, and diversification into alternative land-saving and income generating activities. Livestock production provides an effective means of increasing intensification of land use, by supplementing income from crops, as a result of increased stocking rates or by shifting to increasingly intensive systems. Increased output of animal protein and cash income per hectare, from livestock production may be generated by shifting from grassland based systems to integrated crop-livestock mixed systems or by shifting from such mixed systems to intensive landless pig and poultry production.

Given the rapid growth in demand for livestock products, especially that for dairy and poultry products, currently occurring in many developing countries, the market potential exists for absorbing domestic output. Hence livestock production systems can potentially serve as the fastest growing enterprises within agriculture. The resultant rapid growth in farm incomes should generate employment and expansion in the rural non-farm sectors and contribute to general economic development as outlined above.

Unleashing the Potential

Infrastructure, Institutions and Poverty Relief

Progress is being made in reducing the proportion of the world's people living in poverty but it is unlikely that the goal of halving this proportion by 2015 may be achieved. Much of the decline in global poverty comes from a significant fall in the numbers of poor in East and South East Asia, particularly China. In Sub-Saharan Africa, however, absolute numbers in poverty are still increasing. Given that a majority of the poor live in rural areas and derive, at least part of, their livelihoods from livestock, expanded production is needed to meet poverty alleviation goals. Yet, over the last decade, aid for agricultural development has fallen as has the proportion of the total going to livestock development.

The poor suffer not only from low consumption but also from limited facilities for health care, education, transport, telecommunications, water and electricity supplies. Improvements in the infrastructure of basic public services serve not only to increase human welfare but also make a vital contribution to economic growth and development. However, improvements in these services alone cannot generate economic growth and development. Although the drive for

privatisation and market liberalisation, of the 1980s and early 90s, has been discredited it is widely accepted that development must be built on the growth of income generated by increased rural productive activity. Agriculture, and more specifically the livestock sub-sector, is an obvious form of productive and income generating activity for rural development.

Institutional change may have a critical influence on economic development. In a 'closed' traditional village society, transaction costs are low, being based largely on relational contracting. As local economies become linked more extensively with external markets, new market institutions are needed to facilitate trade with the wider national and world economy and to enforce impersonal contracts. Historical stagnation and contemporary under-development in developing countries, are attributed to the lack of effective institutions.

The authors of a review of about 800 livestock development projects found that most had failed to bring about significant sustainable improvements in livelihoods of the poor. They conclude that "The key lesson to emerge from our review… is the importance of institutions in defining the success of pro-poor measures." (LID 1999). Benefits would accrue to livestock producers, as to all members of society, if along with improvements to the physical infrastructure of communications and transport routes, electricity and other services, the institutional infrastructure of law and order, respect for property rights and legally binding contractual agreements was strengthened.

In relation to grassland-based and mixed-farming systems, clarification and assignment of property rights in land and water supplies may bring major benefits. Legal methods of excluding non-members of the community from enjoying common property rights prevent inter-community strife and regression of rangeland use to one of open access. Secure property rights also provide incentives for investments in land conservation and improvement.

Public sector investment in the physical and social overhead capital improves the welfare of rural people and provides a basis for general economic development. However, in order to unleash the potential of livestock production to reduce poverty, support and service provision is needed in several specific areas, including markets and marketing, credit provision, breed improvement, animal health and technological and economic research and extension.

Markets and Marketing

A key area, where support is necessary for the success of livestock development projects and programmes, is that of marketing, including transport, processing and selling. As there are economies of scale in these marketing activities, large-scale operations are most likely to be cost-effective. Smallholder producers must then deal with the market agents. Because of the

high transaction costs of individual sales by small-scale producers to processing and marketing agencies, there is a need for formal contracting or vertical integration.

In negotiating contracts, small-scale producers are in a weak position, lacking market power and information on patterns of supply, demand and prices. Thus in promoting institutional development, there is a need for dissemination of market information, and encouragement of co-operative group action and participation by small-scale producers to strengthen their bargaining position. This might result, as in the case of the Indian dairy industry, in producer co-operative unions managing the processing and marketing operations. Additional benefits can be achieved by developing linkages between product markets and input supply, where product-marketing agencies are well placed to arrange the delivery of inputs.

Pig and poultry meat can be produced commercially more cheaply than other meats, so markets for these products derived from landless systems are growing rapidly. Economies of scale in processing and marketing may be derived by vertical integration of smallholder producers with large-scale urban-based processors and input suppliers or by producer co-operatives. Similar issues arise for intensive smallholder milk producers, who have formed dairy processing co-operatives in countries like India. Parastatal facilities have been shown to be slow in responding to market signals and opportunities. With the demise of these, however, these facilities are still there, and may be better put to higher capacity utilization by organized business enterprises).

Credit Provision

Insurance and credit are important for the development of livestock production and other types of productive activity. Medium-term credit is needed for the establishment of new livestock enterprises or for rapid expansion of an existing enterprise. Many livestock development projects involve the provision of credit in kind, as in the ‘heifer (or sow) in trust’ schemes, in which loan repayment is based on the return of calves to the scheme. Short-term credit may also be needed for temporary cover of operating costs. Since the rural poor have few productive assets, the possible loss of valuable livestock through accident, disease or theft represents a severe risk threat. In these circumstances, access to a viable livestock insurance service is highly beneficial.

Credit and insurance services have some characteristics of private goods, but private provision is hampered by severe problems of information asymmetry, moral hazard and adverse selection as well as risks of covariant risk. The latter problem arises when many producers suffer losses at the same time from a disease epidemic, or a drought, for example.

For smallholders to be able to purchase livestock or to pay a levy for insurance, credit is needed, in most instances. However, the coverage of rural finance institutions is much less effective in

Africa than in most of Asia. Some public intervention in promoting credit provision to livestock producers is desirable in most developing countries, on social grounds to contribute to poverty reduction. Furthermore, livestock insurance combined with credit would represent a safety net for farmers, which in turn would stimulate efficiency of national livestock production

Breed Improvement

Significant increases in livestock productivity may depend upon the introduction of new and exotic genetic material. In some cases new foundation stock are introduced, in others cross breeding with domestic breeds is practiced. In either case, to avoid inbreeding and maintain the improved genetic potential, continuing access to improved breeding males or their semen is essential.

Animal breeding and artificial insemination services qualify as private goods, for which the user should be expected to pay. However, provision of the facility might be seen as a public good, where the aim is to improve the genetic potential of the national herd or flock. In any case the market is generally incomplete, in that not all producers use the service, livestock are widely dispersed over a large area and communications are often difficult, while the need on a particular holding only arises on an occasional basis. Hence private provision is unlikely. Public sector involvement is necessary if improved genetic potential is to be maintained.

Although breed improvement has been widely used to improve productive performance of all forms of livestock there are associated costs to be born in mind, apart from the capital costs of acquiring the animals. They are often bred for a special purpose, e.g milk or meat (in cattle), or meat or egg (in poultry) production, so there is some loss of flexibility, they are less hardy and more disease susceptible than local breeds, they therefore require more careful management, nutrition, and disease control and the risk of losses may be increased. Hence programmes for breed improvement must be accompanied by a package of the other measures needed for unleashing the potential of livestock production.

In addition external costs may arise in that excessive concentration on a few specialised exotic breeds may result in the disappearance of local breeds and the corresponding loss of genetic material. This and other threats to the environment must be borne in mind, and precautions must be taken, whilst promoting livestock development.

Livestock Services (Animal Health & Extension)

Animal health services are important in reducing losses due to animal disease. Technologies for disease control and cure are known, but delivery problems arise. Budget-constrained

Government Veterinary Departments have achieved some control of a few critical diseases, and served the larger commercialised producers. Increasing budgetary constraints have caused cut-backs and pressures for privatisation.

The externalities of the control of epidemic diseases, however, inhibits privatisation. Private practices are only viable in areas of intensive livestock production due to high establishment costs and uncertain demand. Competition from continuing public service veterinarians within the same service area is a further disincentive. Para-veterinarians may be employed to complement professional services.

Animal health services are conveniently subdivided into curative or clinical services, preventive services, supply of drugs and vaccines, safeguarding of public health, education/extension and research and development. The public sector has an important role in the prevention and control of epidemic animal diseases, public health aspects of livestock production, research and development of both animal health and livestock production technology and the provision of advice and extension to producers.

Curative and clinical animal health services, the supply of drugs and vaccines, associated areas of research and development, and direct involvement in product marketing have the characteristics of private goods and may mostly be left to private provision. However, governments still have a role in facilitating and co-ordinating the private provision of these services, by creating the appropriate legal and institutional framework, promoting competitive conditions and disseminating information.

While research into the development of drugs and vaccines, and the provision of advice on their application, may be privately funded by the manufacturers, there remains a need for publicly funded research in many areas of animal disease prevention and control. Provision of advice is often seen as the task of Government Veterinary Services, but there is a need for close co-ordination of research and advice with those provided on animal production and general agriculture.

References

Bourguignon, F. & C. Morrison (1998). Inequality and development: the role of dualism. *Journal of Development Economics*, **57** (2) 33-57

Bruinsma, J. (ed.) (2003). *World Agriculture: towards 2015/2030. An FAO perspective*. London: Earthscan and Rome: FAO

De Haan, L., P.Q. van Ufford & F. Zaal (1999). “Cross-border cattle marketing in Sub-Saharan Africa since 1900: Geographical patterns and government induced change” in H.L. van der Laan, T. Dijkstra

& A. van Tilburg (Eds*.) Agricultural Marketing in Tropical Africa: Contributions from the Netherlands*. Aldershot, England: Ashgate

DFID (2000). Halving *World Poverty by 2015, economic growth, equity and security: Strategies for achieving the international development targets*. London: DFID Strategy Paper

Dorosh, P. & S. Haggblade (2003). Growth linkages, price effects and income distribution in sub-Saharan Africa, *Journal of African Economies* **12** (2) 207-235

FAO (2003). *Egg Marketing: A guide for the production and sale of eggs*. Rome: FAO

FAOSTAT (2005). *FAO Statistical database* at http://apps.fao.org Accessed January 2005

FAOSTAT (2003). *FAO Statistical database* at http://apps.fao.org Accessed June – December 2003

IFAD (2001). *Rural Poverty Report 2001: The Challenge of Ending Rural poverty*. Oxford University Press, for the International Fund for Agricultural Development

Kanbur, R. & L. Squire (1999*). The evolution of thinking about poverty: exploring the interactions.* Department of Agricultural, Resource and Managerial Economics. Paper No. 99-24. Ithaca, New York: Cornell University

LID (1999). *Livestock in Poverty-Focused Development*, Crewkerne, Somerset: Livestock in Development

Mellor, J.W. (2001). *Faster more equitable growth-agriculture, employment, multipliers and poverty reduction*, paper prepared for USAID/EGAD.

Mellor, J.W. (1995). *Agriculture on the Road to Industrialisation*, Baltimore: Johns Hopkins University Press.

Neumann, C. G. (2000). *Livestock development and impact on diet quality and the growth and development of children.* Agro-ecosystems, natural resources management and human health related research in East Africa: Proceedings of an IDRC-ILRI International Workshop held at ILRI, Addis Ababa, Ethiopia, 11-15 May 1998, pp100-108. International Development Research Centre, Ottawa, Canada

Norcliffe, G., D. Freeman & N. Miles (1984). 'Rural industrialisation in Kenya' in E. Chuta & S.V. Sethuraman (Eds*.) Rural small-scale industries and employment in Africa and Asia*. Geneva, 9-24

Okali, C. & J. Sumberg (1986). 'Sheep and Goats, Men and Women: Household Relations and and Small Ruminant Production in Southwest Nigeria', in J.L. Moock (ed.) *Understanding Africa's Rural Households and Farming Systems.* Boulder & London: Westview Press

PPLPI (2005). PPLPI Information Resources. Maps.
http://www.fao.org/ag/againfo/programmes/en/pplpi/maps.html Accessed Jan 2005

Ravallion, M. & G. Datt (1999). When is growth pro-poor? Evidence from the diverse experience of India's states. World Bank Policy Research Working Paper Series, 2263, Washington D.C.: World Bank.

Reardon, T., K. Stamoulis, A. Balisacan, M.E. Cruz, J. Berdegue & B. Banks (1998). 'Rural Non-farm Income in Developing Countries: Importance and Policy Implications' in *The State of Food and Agriculture 1998*. Rome: Food and Agriculture Organisation

Seré, C. & H. Steinfeld (1996). *World Livestock Production Systems: Current Status, Issues and Trends*. Fao Animal Production and Health Paper 127, Rome: FAO

Shapiro, B.I., J. Haider, A, Wold & A. Misgina (2000). *The intra-household economic and nutritional impacts of market-oriented dairy production: evidence from the Ethiopian highlands.* Agro-ecosystems, natural resources management and human health related research in East Africa: Proceedings of an IDRC-ILRI International Workshop held at ILRI, Addis Ababa, Ethiopia, 11-15 May 1998, pp109-123. International Development Research Centre, Ottawa, Canada

Tangka, F. K., M.A. Jabbar & B.I. Shapiro (2000). *Gender roles and child nutrition in livestock production systems in developing countries: a critical review.* Socio-economics and policy research working paper; no. 27, Nairobi: International Livestock Research Institute

Thirtle, C., L.Lin & J. Piesse (2003). The Impact of Research-Led Agricultural Productivity Growth on Poverty Reduction in Africa, Asia and Latin America*, World Development* **31** (12) 1959-1975

Thorbecke, E. & H. Jung (1996). A multiplier decomposition method to analyse poverty alleviation. *Journal of Development Economics* **48** (2) 279-300

Thornton, P.K., R.L. Kruska, N. Henninger, P.M. Kristjanson, R.S. Reid, F. Atieno, A. Odero & T. Ndegwa (2002). *Mapping poverty and livestock in the developing world*. Nairobi, Kenya: International Livestock Research Institute (ILRI)

Timmer, C. (1997). *How well do the poor connect to the growth process?* Harvard Institute for International Development, CAER II Discussion Paper No. 17, Cambridge MA: Harvard Institute for International Development.

UN (2001). *Road map towards the implementation of the United Nations Millennium Declaration*. Document A/56/326. New York.

Upton, M., S. Mbogoh, J. Rushton, S. Islam & L. Mtenga (2005). "Marketing to promote trade and development" in E. Owen, A. Kitalyi, N. Jayasuriya & T. Smith (Eds.) *Livestock and Wealth Creation: improving the husbandry of animals kept by resource-poor people in developing countries.* Nottingham University Press

Upton, M. (2004*). The role of livestock in economic development and poverty reduction.* Pro-Poor Livestock Policy Initiative Working Paper 10, Rome: FAO http://www.fao.org/ag/pplpi.html

Upton, M. & J. Otte (2004). "The impact of trade agreements on livestock producers". Chapter 4 in E. Owen, T. Smith, M.A. Steele, S. Anderson, A.J. Duncan, M. Herrero, J.D. Leaver, C.K. Reynolds, J.I. Richards, & J.C. Ku-Vera (Eds.). *Responding to the livestock revolution: the role of globalisation and implications for poverty alleviation.* British Society of Animal Science. Publication 33, Nottingham University Press

Upton, M. (2001). *Trade in Livestock and Livestock Products: International Regulation and Role for Economic Development*. Livestock Policy Discussion Paper No. 6, Rome: FAO

Warr, P.G. (2001). *Poverty reduction and sectoral growth: evidence from Southeast Asia*. Paper presented at the WIDER Development Conference on Growth and Poverty, Helsinki

Woden, Q. (1999). *Growth, poverty and inequality: a regional panel for Bangladesh*. Policy Research Working Paper 2072, Washington D.C.: World Bank

World Bank (2001). *Global economic prospects and the developing countries 2002*. Washington D.C.

Disclaimer & Contacts

PPLPI Research Reports have not been subject to independent peer review and constitute views of the authors only. For comments and / or additional information, please contact:

Joachim Otte
Food and Agriculture Organization - Animal Production and Health Division
Viale delle Terme di Caracolla, 00153 Rome, Italy
E-mail: joachim.otte@fao.org

Martin Upton
Department of Agricultural and Food Economics,
University of Reading, Reading RG6 6AR, UK
E-mail: m.upton@reading.ac.uk

For more information please visit the PPLPI website at: http://www.fao.org/ag/pplpi.html