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Livestock, Disease, Trade and Markets: Policy Choices for the Livestock Sector in Africa

Ian Scoones and William Wolmer

June 2006

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Abstract

For many years African livestock production was seen as a poor investment for development. Assumptions about low productivity, 'backward' management systems, lack of market orientation and poor growth potentials consigned the livestock sector to the sidelines. But after years of being ignored, livestock issues are beginning to be put back on Africa's development agenda. Livestock are being recognised as essential assets for livelihoods; as key to moving out of poverty; as a way into lucrative markets; as a source of foreign exchange; as well as important cultural resources, social safety nets and means of saving. Given this renewed emphasis, this Working Paper asks: What are some of the underlying debates, assumptions and trade-offs? What competing perspectives on ways forward for African livestock development are being explicitly – and implicitly – discussed? The paper focuses on three interlocking themes – markets, trade and standards; service delivery and organisational arrangements; and science and technology priorities, examining both policy debates and field-level experiences from across Africa. The analysis suggests that, despite a common rhetorical commitment to poverty reduction, sustainable livelihoods and pro-poor policy, there are tensions within the development strategies being proposed. Today's primary policy focus is on livestock for trade and export – relating to a general concern to 'modernise' the sector, and boost production, requiring new approaches to both livestock production and management and the delivery of animal health care and veterinary services. Potentially, the paper argues, this comes at the expense of more simple initiatives to support productivity, breeding and disease management.

Keywords: livestock, science, policy, veterinary, livelihoods, animal health care, markets, trade, standards

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Contents

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1 Introduction

For many years African livestock production – and indeed agriculture more generally – was seen as a poor investment for development. Assumptions about low productivity, backward management systems, lack of market orientation and poor growth potentials consigned the livestock sector to the sidelines. But after years of being ignored, livestock issues are beginning to be put back on Africa's development agenda. Livestock are being recognised as essential assets for livelihoods; as key to moving out of poverty; as a way into lucrative markets; as a source of foreign exchange; as well as important cultural resources, social safety nets and means of saving.[1] These are of course not new findings, and indeed much work from the late 1970s highlighted just these points, rejecting earlier misconceptions about pastoralism in particular and livestock production more generally, dating as far back as Herskovitz's (1926) notion of the 'cattle complex'.[2]

Today, however, a new 'livestock revolution', fuelled by a massive growth in global demand for food of animal origin (milk, meat, eggs) (Delgado *et al.* 1999; Rosegrant *et al.* 2001), is being hailed, with important development implications for Africa. The livestock sector in the developing world is growing at a rate of up to 7 per cent per annum, much faster than the agricultural sector as a whole and by 2020 it is predicted to become the most important sub-sector in terms of added value. It is argued that Africa can and should capitalise on its enormous wealth in livestock, gain access to new markets opening up in Asia and particularly the relatively affluent and nearby Middle East, and expand exports to Europe and North America. This could be the key to the much-needed growth impetus for stagnating agricultural economies. This positive vision is picked up by many recent policy documents and initiatives. The Commission for Africa's report (2005) and the UK Department for International Development's agricultural strategy (2005) both highlight the importance of agricultural growth, and, although not highlighting livestock specifically, argue for infrastructural development and trade reform to boost access to new markets. In its flagship Comprehensive Africa Agriculture Development Programme (CAADP), the New Partnership for African Development (NEPAD) similarly argues for investments in rural infrastructure to underpin market access and the sustainable development of livestock resources. In this context, the African Union describes livestock as a 'sunrise sector'.[3]

More specific assessments of the African livestock sector have highlighted the need for a pro-poor livestock development focus (Ashley 2000[4]; ILRI 2000; Perry *et al.* 2002; Hall *et al.* 2004; Heffernan *et al.* 2003; IFAD 2004; Owen *et al.* 2005) – relating to the increasing emphasis on the role of greater market access for agricultural products from the developing world as a pathway out of poverty (Perry *et al.* 2005). A number of initiatives have been spawned in the last few years. For example, FAO is lead organisation for the pro-poor livestock facility that aims to facilitate the formulation and implementation of policies and

1 See, for example the New Partnership for Africa's Develoment (NEPAD) Comprehensive Africa Agriculture Development Programme (CAADP) companion document on livestock approved by African Ministers of agri culture in Bamako in January 2006.

2 Building on substantial field-level work among pastoral communities in Africa – not least the ILCA led systems studies (e.g. ILCA 1979). A growing body of literature highlighted the problems with conventional perspectives on livestock production and pastoralism (e.g. Swift 1977; Sandford 1983; Toulmin 1983; Scoones 1989; Fratkin 1997). These studies and reviews added up to a major shift in policy thinking on range management (e.g. Behnke *et al.* 1993), mobility (Niamir-Fuller 1999) and pastoralism more generally (Scoones 1994).

3 Commission for Africa at www.commissionforafrica.org; DFID agricultural strategy at http://dfid-agriculture-consultation.nri.org/launchpapers/NewAgricPolicyPaper_draft08_05.doc; CAADP at www.nepad.org/2005/files/caadp.php and AU-IBAR. *Africa Needs Animals*, Policy Briefing Paper No 1, at www.community.eldis.org

4 www.livelihoods.org/static/sashley_NN152.htm

institutional changes that have a positive impact on the livelihoods of poor livestock-owners.[5] In parallel, the World Bank – with support from the World Animal Health Organisation (OIE) and the FAO's Animal Health Division (AGAH) – has launched the African Livestock Platform (ALive) which is geared at promoting the livestock sector with a particular emphasis on animal health both for the reduction of poverty and for the facilitation of regional and international trade of animals and animal products produced in Africa.[6] This is linked in turn to a major effort to control and eradicate major diseases through the OIE-FAO-AGAH 'Global Framework for Transboundary Animal Disease' Programme (GF-TADS) set up in 2004.[7] In the meantime, UNDP and IUCN have launched a major network – the World Initiative for Sustainable Pastoralism (WISP) - aimed at promoting the sustainable management of pastoral lands.[8]

In the crowded and competitive world of development, this is unprecedented activity and interest for what has been seen in the recent past as a very marginal, almost no-go area. But underneath the smart rhetoric, the slick mission statements and funding promises, what are some of the underlying debates, assumptions and trade-offs? What competing perspectives on ways forward for African livestock development are being explicitly – and implicitly – discussed? Is this a return to the 1980s hey-day of pastoral development when the focus was on supporting traditional production systems for enhancing livelihoods, or are there new agendas on the table?

This paper is an attempt to probe these questions, and open up the debate by highlighting key policy trade-offs and choices. It suggests that, despite a common rhetorical commitment to poverty reduction, sustainable livelihoods and pro-poor policy, there are tensions within the development strategies being proposed. In contrast to before, today's focus is on livestock for trade and export – relating to a general concern to 'modernise' the sector, and boost production, requiring new approaches to livestock breeding, management and, significantly for the themes of this paper, health care and veterinary services. Potentially this comes at the expense of more simple initiatives to support productivity, breeding and disease management.

In some ways elements of the debate are more reminiscent of earlier periods when livestock development focused on beef (and to some extent mutton) with an emphasis on technical modernisation, market development and generating an export trade (e.g. FAO 1961). But there are also important differences from such projects of the 1960s. In today's globalised, highly competitive and stringently regulated markets, the export of livestock products is far from straightforward. In the past the control of livestock diseases was perhaps of a lesser concern compared to production and management constraints in many African systems. But today this has all changed. With a focus on export, animal health standards imposed by importing countries and through the WTO must be met. This has projected a particular constellation of interventions and policy measures to the fore, pushing others to the background.

5 www.fao.org/ag/againfo/projects/en/pplpi/home.html

6 www.oie.int/eng/press/en_040720.htm

7 www.fao.org/newsroom/en/news/2004/43252/

8 See: www.iucn.org/themes/ceesp/Wkg_grp/SL/Mobile%20Communities.htm

2 Narratives of livestock development

Hidden among the recent policy documents and statements from a range of agencies, regional organisations and national governments, there are two contrasting, but often co-existing, interpretations of key problems and suggested solutions. These 'policy narratives' (cf. Roe 1991) provide both a diagnosis and a set of measures and interventions. They also carry with them particular assumptions about the way things work, and the likelihood of future scenarios and impacts.

The first narrative is familiar and relatively unambitious. This guided many of the livestock programmes in Africa, often led by NGOs, in the 1980s and 1990s. It argues that existing livestock production systems have much going for them, and that rather than fundamental transformation they need strategic support in key areas. This includes a focus on a range of stock – from micro-stock (e.g. rabbits) and poultry, to small-stock (sheep and goats), to equines (especially donkeys) to large ruminants (cattle, camels etc.). Recognising the complex and differentiated livelihood systems existing in the diverse settings of Africa, it is argued, a range of support to different producers and types of stock is needed. This recognises that livestock serve a variety of functions – as sources of food, draught power, manure, income, savings and cultural capital, and are important to different people – men and women, poor and more wealthy – at different stages in people's demographic cycles. Direct support to local production systems includes de-stocking and restocking programmes, supplementary feeding and water management systems to help deal with the vagaries of drought; breeding programmes that improve local breeds and types of stock; veterinary care for locally important production diseases (such as tick-borne diseases, internal parasites, trypanosomiasis etc.) and infectious diseases amenable to support through para-veterinary and community-led efforts; improved utilisation of crop bi-products; and support for local marketing systems, including marketing cooperatives and provision of micro-credit facilitated by organisational support to pastoral and livestock-keepers' associations.[9]

The second narrative captures and accommodates elements of this perspective, but has a distinct emphasis on gearing the livestock sector for the export trade and, with this, fulfilling an increasingly stringent array of veterinary requirements. This narrative is central to a number of the major new initiatives introduced above. It starts from an argument that Africa has a huge untapped market potential. The vast livestock populations on the continent[10] are, it is suggested, a potentially massive source of wealth if only the markets could be accessed. This requires investment in marketing infrastructure – holding pens, quarantine facilities, road transport, feedlots, abattoirs and specialised air and sea freight facilities – and veterinary services of sufficiently high quality, reliability and trustworthiness that access to the more lucrative (US and European, but also as standards shift upwards globally Asian and Middle East) markets is permitted. Investments in market infrastructure have long been an element of ambitious livestock projects in Africa. From the colonial era, administrators saw Africa as ideal 'ranching country', the perfect competitor to the

9 Key elements of this approach are laid out in Behnke and Kerven (1994) and Scoones (ed.) (1994). Important work on risk management (e.g. Lybbert *et al.* 2004; Desta and Coppock 2004; see: http://glcrsp.ucdavis.edu/publications/parima/parima.html), restocking (e.g. Heffernan and Rushton 1998), on property rights and land tenure (McCarthy *et al.* 1999; Cotula *et al.* 2004) on para-veterinary approaches (e.g. Catley and Leyland 2001; Catley *et al.* 2002) and on pastoral associations (Sylla 1994; Douma and de Haan 1999) were some of the key elements of a new wave of livestock research and development initiatives from the 1980s (cf. Ehui *et al.* 2003; de Haan *et al.* 1997), highlighting a pro-poor and participatory approach (Conroy 2004; Waters-Bayer and Bayer 1994).

10 FAOSTAT Database http://faostat.fao.org/ (2004): Cattle – 235 million; sheep – 259 million; goats – 232 million. In Eastern Africa alone there were an estimated at 119.8 million cattle, 86.8 million sheep, 93.3 million goats and 10.7 million camels in 2001 (Belachew and Hargreaves 2003).

mid-West. In the past development efforts were centred on large-scale, state-led efforts, involving cumbersome and inefficient marketing boards and authorities. Very often they dismally failed, and pastoral areas across Africa, from Ethiopia to Niger are littered with the relics of such investments (de Haan 1994).[11]

Today, however, the emphasis is more on slimmed-down state or external development support, and the need to encourage private investment and entrepreneurship with liberalised markets and reduced red-tape. A major hurdle to meeting ambitious export related objectives is attaining international standards. These standards are set primarily by the importing country and usually guided by the Sanitary and Phytosanitary (SPS) agreement of the WTO (World Trade Organisation). The animal health standards within the SPS agreement being determined by the World Animal Health Organisation (OIE)[12] and food safety standards are determined by the *Codex Alimentarius*, jointly managed by FAO and WHO (World Health Organisation). The OIE puts an emphasis on the national or regional eradication of a list of serious transboundary animal diseases (commonly known, until recently, as the List A diseases)[13] and if national eradication is not yet feasible then the OIE advocates establishment of either disease free zones or compartments of production that are free of disease e.g. a poultry unit certified free of a given disease) – the overriding principle being that no disease means no risk.

Freedom from disease is determined according to criteria and pathways stipulated by the OIE and importing country inspection teams. This in turn requires a major emphasis on the surveillance of such trans-boundary animal diseases, with a re-gearing of veterinary service provision to meet eradication and control objectives.[14]

These two narratives are of course not mutually exclusive. Livestock are important in highly diverse settings across Africa. Different options are available for instance in the extensive pastoral zones of East Africa or the Sahel, the dualistic systems of commercial and communal farming in southern Africa, the highland agropastoral systems of the Rift Valley and the forest zones of central and west Africa (see Jahnke 1982; Winrock 1992 for typologies). Of course no one solution will fit all settings. Yet in the broad, overarching, agenda-setting strategy documents that define programmatic objectives and funding streams, these two perspectives often sit uneasily together. With today's emphasis being increasingly towards the latter narrative – of market orientation, disease eradication and meeting export standards – strategy documents put central emphasis on market development, exports and meeting SPS standards.[15] This is of course couched in the rhetoric of livelihoods, poverty reduction and pro-poor initiatives, but we must ask in more detail what this actually means.

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11 See earlier studies on livestock marketing in Africa (e.g. Shapiro 1979; Ariza-Nino *et al.* 1980; Bekure *et al.* 1982).

12 The *Office International des Epizooties* (OIE), the World Animal Health Organisation, is responsible for setting the global standards on animal health, from the perspective of enabling international trade in livestock and livestock products. These standards are documented in the OIE's Terrestrial Animal Health Code (the OIE Code) OIE is a membership organisation of states, and each state is represented by its delegate, usually through its Chief Veterinary Officer (CVO).

13 Transboundary animal diseases that are judged by the OIE, on a global basis, to be the most important disease constraints to trade in livestock and livestock products. Up to 31 December 2004 the List A included: African horse sickness, African swine fever, avian influenza, bluetongue, contagious bovine pleuropneumonia, exotic Newcastle disease, foot and mouth disease, goat and sheep pox, highly pathogenic avian influenza (fowl plague), hog cholera, lumpy skin disease, Newcastle disease, peste des petits ruminants, rift valley fever, rinder pest, swine vesicular disease and vesicular stomatitis. As of 1 January 2005 OIE's list A and B diseases were merged into a single list of notifiable diseases.

14 Some developed countries and regions, such as the EU, and increasingly multinational companies and super markets, impose standards higher than the OIE with a resulting higher cost of compliance (Leyland, pers. comm.; Hatanaka *et al.* 2005; www.skalint.com/homepage/services/certificationprograms/eurepgap.html accessed 8 June 2004).

15 See for example: FAO (2005); Nelson (2005); Perry *et al.* (2005).

The following three sections attempt to do just this. They look in turn at some of the key strands of current policy perspectives – first examining debates around markets, trade and standards; then moving to review discussions around appropriate organisational models for service delivery; and finally highlighting the dilemmas around disease management and control priorities. Each of these strands highlight some important tensions between the two core narratives highlighted above, and the trade-offs and policy choices that result. The central aim of this paper is therefore to bring these tensions, trade-offs and choices to the fore, and open them up to more rigorous scrutiny. The final section concludes with a summary of key areas for policy debate. This suggests a more focused agenda for policy debate, if the high aims of the livestock revolution are to be realised.

3 Markets, trade and standards

If the projections are to be believed, the potentials for export sales of livestock from Africa – mostly cattle and sheep – are enormous.[16] These are enticing and seductive numbers for any cash-starved government. If only a fraction of this could be captured, and sent through formal channels and taxed at the margins, this could potentially be a major revenue earner. Such injections of cash into marginal, rural areas could, it is argued, be just the boost that sluggish African agricultural economies need. Growth linkages would flourish and trickle-down effects would revitalise local economies and reduce poverty (cf. Delgado *et al.* 1998).

There are of course a lot of big 'ifs' in this hopeful scenario. But these are not deterring the enthusiasts. Officials in livestock sections in agriculture ministries across Africa point southwards to Namibia, Botswana and South Africa (and a few years back to Zimbabwe too) as the models for successful export-led livestock systems. They argue that some southern African countries have made good use of preferential access to European markets (through the Beef Protocol of the Cotonou Agreement)[17] and that, since they have well-resourced veterinary services, they are able to meet increasingly stringent standards. Since 2000 Botswana for example has, under its Livestock Identification and Trace Back System (LITS), been placing reticular boli in its cattle herd to allow digital identification and complete traceability and disease surveillance (Stevens *et al.* 2005). Disease free zones are in place, with strictly enforced buffer and surveillance zones. In Namibia a veterinary cordon fence (the 'red line') runs the width of the country cutting it into 'infected'/disease-endemic and disease free zones. It has implemented a traceability scheme based on branding and movement permits and is in the process of upgrading it to implementing ear tagging. Namibia has also had to meet EU hygiene and slaughter standards and demonstrate freedom from residues of drugs or other contaminants (Perry *et al.* 2005). With only a few exceptions there have been no major disease outbreaks in the major commercial livestock producing areas in years.[18]

However, it is widely recognised that the persistence of 12 of what the OIE considered to be the 15 most serious (former List A) trans-boundary diseases in Africa is a major constraint in replicating the southern African success story. But the enthusiasts are still not deterred. They point to the apparent eradication of rinderpest as the example that it can be done,

16 Eastern Africa exported 2.55 million sheep, 0.83 million goats, 70,770 camels and 33,310 cattle through formal trade channels between 1997 and 2001 (Belachew and Hargreaves 2003).

17 In 1985 Zimbabwe, Botswana, Namibia, and Swaziland (all members of the Africa, Caribbean and Pacific group (ACP)), negotiated a deal with the European Union for export of boneless beef under a generous reduced tariff, preferential access arrangement. The ACP-EU Partnership is also known as the Cotonou Agreement and succeeded the Lome Convention (see www.acpsec.org/en/conventions/cotonou/cotonou_historical_note_e.htm; Halderman and Nelson 2005).

18 See, for example, OIE reports for Botswana (www.oie.int/hs2/zi_pays.asp?c_pays=30) and Namibia (www.oie.int/hs2/zi_pays.asp?c_pays=135).

and should be done with the remaining key diseases. The large investment in rinderpest control and eradication (through the Pan African Programme for the Control of Epizootics (PACE) programme, and the Pan-African Rinderpest Campaign (PARC) before it) and the strict following of the OIE pathway has meant that it has been possible to declare that rinderpest has been eradicated from Africa.[19] This is of course a huge achievement, one that some feel can be replicated if the same vision, effort and commitment is applied to other livestock diseases. The new GF-TADS joint programme of the OIE and FAO sees this as a major and achievable objective.[20] New funding for major new disease surveillance programmes – such as the PRINT programme for SADC[21] – as well as research and development efforts (see below) reinforce the view that disease eradication for 'safe trade', compliant with stringent OIE SPS requirements, is a core objective for livestock development in Africa.

The 'disease eradication for safe trade' emphasis concentrates efforts around the second of the two narratives outlined above. The package is one that combines the usual ingredients of market infrastructure development (with new additions of market information systems, price monitoring etc.) with a particular version of veterinary support, emphasising the eradication of the 'OIE list' of diseases, complying with SPS requirements, particularly disease freedom status, as well as technologically-sophisticated and reliable surveillance and reporting systems. This, it is argued, will require significant investments – in everything from satellite-assisted GIS systems for surveillance; to measures for strict movement restrictions and fencing for disease free zoning; to laboratory testing facilities and a revamped field-level veterinary service. Given the state of Africa's veterinary services, which outside one or two select countries do not meet the standards of quality that are described in the OIE's International Animal Health Code, upgrading facilities, imposing regulations and providing services to such a level will certainly require huge investment. However, the proponents argue, the returns are potentially so large, and the benefits to significant numbers of poor people so extensive, that it is worth it. Increasingly African countires have 'disease free zones formation written into their livestock development plans. USAID Ethiopia, for example, are supporting a $7 million livestock SPS project, aiming to improve Ethiopia's meat exports'.[22]

This argument has gained ground in recent years amongst a group of influential players in the development scene. The World Bank, for example, has championed the ALive programme. This approach is echoed by the FAO's Animal Health Division, the promoters of the GF-TADS programme. The EU has been an enthusiastic supporter of such initiatives, funding major investments in this area through the European Development Fund.[23] Regional bodies, such as the African Union, have also joined in, with a vision of market-led pro-poor growth defining much of NEPAD's programme, for example. And, of course, the whole *raison d'etre* of the Paris-based OIE means that it too is centrally part of this international network. The OIE's delegates include 50 African Chief Veterinary Officers who also see new funding opportunities emerging. These they argue might assist with revitalising their national veterinary services which have suffered from years of neglect and a collapse in funding, thanks in part to the economic reform policies of the 1980s and 1990s. With the major international donors, UN bodies, WTO, World Bank, African regional organisations

19 See www.oie.int/hs2/sit_mald_freq_pl.asp?c_cont=1&c_mald=5 for OIE records of rinderpest status in Africa and www.fao.org/ag/AGA/AGAH/EMPRES/grep/pace.htm for an overview of the AU-IBAR-coordinated 72 million euro PACE programme which started following the ending of the PARC programme in 1999. Despite these efforts concern remains about the 'mild' form (see FAO 2002 and see below).

20 See: www.oie.int/eng/press/en_050322.htm

21 For details on the 7.9 m euro programme 'Promotion of Regional Integration in the SADC Livestock Sector', see: www.delbwa.cec.eu.int/en/eu_and_sadc/integration_livestock.htm

22 Leyland and Catley (pers. comm.).

23 For example the PRINT programme and both PARC and PACE (see above).

and high-ranking national government officials aligning with this perspective, it has certainly been projected into the limelight as the main solution to the ills of the African livestock sector, and potentially a lot of money will follow behind it. But there are some important limitations with both the analysis and the prognosis which are worth highlighting.

First, the huge potential of an untapped livestock revolution may be somewhat overblown. It is not as if livestock trade does not already exist. The problem is that much of this is illegal, informal and beyond the clutches of customs officials, tax collectors and veterinarians. In areas where such markets operate (for instance in parts of Kenya, Ethiopia, Somalia and across the Sahel), marketed offtake is high already.[24] Shifting such trade to alternative market routes – and so veterinary control, taxation and duty collection – is not just a matter of providing services and infrastructure. In practice markets operate according to long-standing norms and social arrangements, often with politics and sometimes religion playing their part in shaping the nature and potential for market transactions. Real markets are inevitably social and political institutions and are not amenable to simple technical interventions. The lessons of the market infrastructure development projects of the 1960s and 1970s need to be remembered today, lest the same mistakes are made.

Existing livestock trade in Africa is of course difficult to document. Statistics are poor and unreliable, and informal trade dominates formal trade in many regions. Livestock are moved across borders, sold on to middle-men and traders and appear in statistics of exports in other non-origin countries. Stratified and barter systems exist which allow producers to sell their stock for fattening and selling on to others in exchange for other stock or cash, making it difficult to assess where animals came from originally and what offtake rates exist. As discussed further below there are a huge range of different marketing alternatives in existence. This is a dynamic and poorly studied area and few insights exist into the actual nature of real livestock markets and trading systems in different parts of the continent. From the scattered, often anecdotal information that does exist, it is clear that such systems are far more complex, involving far higher through-put, and have much greater market dynamism than is commonly assumed (Little 2003, 2005; Osterloh *et al.* 2003; Little *et al.* 2001; Kerven 1992). These local dynamics are replicated at regional scales. New foci for livestock trade are opening up, with for example Egypt becoming an important player in the Eastern/Horn area of Africa, facilitating links to the Middle East and other export markets.[25]

The long-predicted growth in demand from Asia has yet to have a significant impact, but with connections in other commodities growing with South and East Asia (particularly China), trade in meat products are set to grow (Dyck and Nelson 2003). In addition, particular bilateral deals and barter arrangements are part of the picture. Thus Libya and Zimbabwe were engaged for a time in beef-for-oil deals, for example. In the global livestock economy, the dominance of Argentina and Brazil is of course a cause for concern for any African producer, as the low-cost, extensive ranch production systems, combined with relatively low transport costs and high levels of veterinary control can almost always out-compete African production.[26]

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24 For example for East Africa, see Bailey *et al.* (1999); Mahmood (2001); Aklilu (2002); Solomon *et al.* (2003) and Ayele (2003) for commentaries. Estimates remain estimates, and they all vary, but the volumes are unquestionably large.

25 Egyptan traders in Ethiopia have signed several very large contracts for the supply of beef steers to Egypt. However the size of the informal export trade (see below) means that the Ethiopian partners are unable to source enough animals of sufficient quality to supply the demand. Similarly export shoat abattoirs in Ethiopia are operating at below capacity (Tim Leyland, pers. comm.)

26 Brazilian beef exports are forecasted to rise to 21 per cent of production (1.8 million tonnes) in 2006 and Argentinean beef exports will grow by 6 per cent to be greater than the European Union at 780,000 tonnes, China by 20 per cent to 90,000 tonnes and India by 9 per cent to 675,000 tonnes (other large players in 2006 will be Australia – 1.4 million tonnes; New Zealand – 615,000 tonnes; and Uruguay – 470,000 tonnes) www.fas.usda.gov/dlp/circular/2005/05-11LP/dlp05_11LP.pdf. Multilateral liberalisation under the Doha round and resumption of EU trade negotiations with Mercosur could further damage the preferential position of African exporters to the EU *vis-à-vis* South America (Perry *et al.* 2005).

Overall, then, the 'safe trade' and 'disease freedom' ideal of Namibia or Botswana – so often touted as the model which African producers must follow – where formal, regulated export markets (to the EU, and the UK in particular) combine with following standardised SPS regulations, and requiring high levels of veterinary support may look increasingly out-dated (and uneconomic) in the not-too-distant future. The riskiness of this formula is becoming increasingly evident (not least to Namibians and Botswanans) (cf. Jaffee and Henson 2005; Henson *et al.* 2000).[27] The rapid unravelling of the Zimbabwean beef industry has provided a salutary lesson. A few years of disruption to movement control, breaching of veterinary fencing, and lack of funds for vaccines, meant that foot and mouth disease (FMD) ran rampant, cutting off EU markets at a stroke. The financial and political costs of re-establishing the earlier status quo may prove too much (Scoones and Wolmer 2006; Sibanda 2005; Mavedzenge *et al.* 2006). The political fragility of the Namibian solution is all too evident. Fifteen years after Independence the country is still divided, largely along racial lines, into two: a diseased area behind the fence, where the majority of the black population live; and a disease free area on the other side, where white ranchers still enjoy the benefits of a well-funded veterinary service and access to lucrative markets (Bishi 2005). In Botswana the economic fragility of the beef enterprise is also increasingly evident. The Botswana Meat Commission has operated at a loss in consecutive years since 1998/9 (except in 2001) (Stevens *et al.* 2005). The costs of meeting EU veterinary standards has gone up and up, a pattern that looks set to continue as both safety and political concerns arising from FMD and BSE outbreaks in Europe add to consumer and regulatory precaution. For example, traceability has become a recent requirement which resulted in massive increases in production costs including the placing of a bolus in each cow and the installation of new facilities in abattoirs (Stevens *et al.* 2005). Given the economies of scale required for exports to external markets to be initiated and sustained it is also largely a small select group of wealthier producers and support industries who are vertically integrated in the production chain that are able to participate at all (Hall *et al.* 2004; Perry *et al.* 2005).

Thus, while the disease eradication for safe trade option looks like an enticing package for donors and governments alike – encompassing improved and restructured veterinary services, fences, vaccines and market infrastructure – it is perhaps not as appealing as it first appears. The complexities of real markets (both local and global), the politics of standards and their ratcheting ever-upwards, and the economic and political fragility of the 'successful' examples in Africa suggest that this may not be the only pathway for trade and markets to ushering in the livestock revolution. A number of variants and alternatives are being debated, however, which suggest very different strategies for development investment. We highlight three here.

3.1 Formalising and regulating bilateral deals

The first recognises the importance of the high value export trade for the future of livestock sector in Africa, but suggests that, instead of the conventional export routes to Europe and the US (and associated standards, barriers, hoops and hurdles), there needs to be more emphasis on setting up bilateral deals which protect exporting countries and their producers. Countries in the Horn of Africa have had long experience of trading with the Middle East, notably Saudi Arabia, often through complex networks of traders and dealers. These trading routes have contributed to pastoral economies in the region for centuries and livestock sales to the Middle Eastern states massively expanded when they became oil exporters. But over-reliance on one route, one trader, or one importing country can be risky. The ban on livestock imports from the Horn imposed by Saudi Arabia after an

27 In 1995 the re-introduction of CBPP in Botswana led to the slaughter of 320,000 cattle at a cost of US$100 million, with further indirect losses estimated at over US$400 million (Geering *et al.* 1999; www.fao.org/documents/show_cdr.asp?url_file=/docrep/007/y5510e/y5510e0d.htm; Andy Catley pers. com.).

outbreak of Rift Valley Fever (and the subsequent death of over 100 Saudis) is a recent, painful experience for producers, particularly from Ethiopia. The ban was imposed in 2000 and lasted until late 2003, and the ban on live animals persists – despite the fact that no outbreak had occurred within Ethiopia's borders. This decimated livestock trade via Somalia, and resulted in major losses in income from pastoral populations in the Somali region of Ethiopia.[28] With cheap Australian exports of sheep taking over the regional trade for a period, many in Ethiopia wondered whether the Middle East trade would return. Animals were trekked to Sudan to be re-exported, and new trade routes opened up to other Arab countries in the region, but the impact was hard-felt and ongoing.

With new trade opportunities being opened up with Egypt and now again with Saudi Arabia through meat exports, the Ethiopian authorities are in a dilemma. On one hand they cannot pass over the offers, as others will quickly take them up; but on the other the conditions may not be ideal. This is a buyers' market, and importers can set the terms. But exporters must be wary both of pricing strategies, but more particularly of terms for ceasing trade agreements, and mechanisms of recourse.[29] For the export of live animals in particular (an important characteristic of the Middle East trade where religiously-defined slaughter techniques and locations are required, particularly in relation to the Haj trade), making sure that exported animals are certified disease-free and that such certification is recognised and trusted is key. With animals often quickly re-exported to a variety of destinations, the originator exporting country will need to be sure (and others will need to believe them) that animals coming from a particular source are not the origin of any subsequent disease outbreak. This may not mean setting up testing and standard certification at the level required by the EU for example, but it will require some rigorous determination of quarantine and vaccination status prior to export, together with some form of certification (Thomson *et al.* forthcoming 2006), lest the blame for any problem later is passed back down the line. All of which requires significant investment.

3.2 Commodity-based trade

Not all trade in animal products need be so prone to risk. Live animal trade is of course the most risky, but selling processed products is far less so. Clearly low value canned meat which has been cooked presents very few food safety risks as long as basic hygiene requirements have been met. Corned beef was of course the staple for the meat trade fifty years ago, but demand is less than it was. Today the demand for higher quality cuts from European supermarkets or meat traders is where the potentially most profitable market lies. Such commodities can be completely safe for consumption, even if sourced from an area where endemic diseases are still prevalent, as long as certain processing procedures are followed (Sutmoller and Olascoaga 2003; Belachew and Hargreaves 2003). Thus for example, heat treatment, maturation, deboning and removal of lymph notes, irradiation, salting, drying and pH drop result in the killing off of most pathogens including FMD and contagious bovine pleuropneumonia (CBPP) with varying degrees of effectiveness. Importers have to have trust in the abattoirs selling the processed commodities and certification systems need to be developed. But essentially this is a question of food hygiene and good abattoir practice, not one of disease freedom. The argument of those proposing a commodity-based approach to trade (Thomson *et al.* 2004; Catley *et al.* 2005; van't Klooster 2005[30]) is that safe trade

28 See 'Rift valley fever threatens livelihoods in the Horn', Fewsnet, 19 October 2000, and subsequent bulletins, including special report 'Livelihoods and food security in Ethiopia's Somali region', 1 April 2002; Assegid Shiferaw (2005); Mohammed Razig (2005).

29 See 'Too little, too late', *Al-Ahram Weekly*, 24 February–2 March 2005 at http://weekly.ahram.org.eg/2005/731/eg4.htm and 'Saudi Arabia to reopen markets', *Addis Tribune*, 21 March 2003, www.addistribune.com/Archives/2003/03/21-03-03/Arabia.htm

30 See Wolmer and Scoones (2005) for details of the policy networks emerging around – and against – this concept.

does not require disease eradication. Rather than requiring country or zonal freedom from diseases, a commodity-based approach would require sanitary guarantees for a set of import conditions for a specific product – the standards set and risk mitigation strategies required would be commodity dependent. Such an approach, it is argued, would improve access to international markets for all countries, and especially those in the developing world. Such a system would also encourage well-organised and regulated commodity processing in developing countries and therefore local capture of value-added benefits while concomitantly reducing risk of pathogen transmission. The big problem at the moment is that disease freedom is very much part-and-parcel of meeting export standards. The OIE Terrestrial Animal Health Code, the bible as far as SPS standards and export requirements is concerned, for example lists pathways for disease eradication for four diseases (rinderpest, CBPP, FMD and bovine spongiform encephalopathy (BSE)) and provides general recommendations for the control or eradication of other OIE list disease so as to achieve acceptable levels of risk. Although commodity-based approaches are acknowledged, the assumption is that the ultimate objective is disease control and eradication, and this is a basic requirement for safe trade. The EU concurs in practice, although there is no particular reason why EU regulations should not be applied to commodity-based approaches.

3.3 Local trade and markets

The above two options – and of course the dominant 'safe trade through disease eradication' perspective – all emphasise different routes to gaining access to lucrative, high-value export markets. As we have seen this may not be the be-all-and-end-all of livestock marketing for African producers. One less-emphasised aspect of the 'livestock revolution' is the growing local and regional demand for meat and other livestock products from relatively well-off urban consumers within Africa (and potentially outside) (Kulibaba 1997; Diao *et al.* 2005). This demand is not for high-value front end cuts; instead urban African consumers demand lower value brisket meat usually on the bone, as well as offal and all parts of goats and sheep. But this is often not what marketing systems are geared to. The holy grail is the EU exported fillet, not the locally consumed kilo of brisket. This emphasis can distort production, marketing and regulatory systems in ways that may not be to the benefit of producers, or even the national economy.

A different type of animal is required for local trade, supported by a different marketing system and a level of regulation that guarantees basic food safety and a veterinary service that prevents the outbreak of seriously damaging chronic diseases (including zoonoses), but allows the persistence of low-level, low-cost endemism. Food safety regulations for local trade and markets therefore need to be geared to local needs and conditions not the precautions of an external market. This puts a different perspective on disease control and eradication. No matter what the EU or US regulation is, to enhance local milk marketing, for example, it may make more sense to invest in processing (for dried milk) or basic treatment (boiling for fresh milk), rather than attempting to eradicate bovine brucellosis with its limited impact on production, especially among indigenous, locally managed cattle (Mokaila 2005).

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Of course none of these three stylised alternatives are mutually exclusive. It may make sense to aim for a high value EU export market and limited zonal disease freedom for some exports in a highly limited and controlled area (if politically and economically viable), at the same time as setting up more well-regulated and formalised bilateral arrangements, and in parallel supporting commodity-based trade and local marketing and trade for different animals and products in different areas. However, the fact that they are not mutually exclusive in theory does not mean that in practice there are not trade-offs between them. For each requires a very different set of investments – in terms of infrastructure, veterinary services, regulatory regimes and so on. Aiming for safe trade through disease eradication is, for instance, likely to be a hugely expensive undertaking where the returns are uncertain,

and where benefits are likely to be captured by relatively few producers able to meet the demands of a high-value export trade. This may make strategic sense if there is sufficient guaranteed demand in such markets and the costs of meeting international standards are not too exorbitant. The assumption then would be that, even if this was focused on fewer producers, it would have net effects for the wider economy with associated trickle-down benefits. However re-gearing the veterinary service to comply with surveillance, reporting and meeting SPS standards may mean that it is not able to respond to the different requirements of a local marketing system. An emphasis on disease freedom and eradication strategies may also mean that investment in food safety and hygiene may not get top priority, and that infrastructure investments go into setting up elaborate disease surveillance and reporting systems not export product certification and abattoir and meat processing plant inspection and regulation to allow a commodity-based system to gain trust and thrive.

In other words, choosing one option may exclude others, and those making decisions need to have a sense of the complex trade-offs involved before going down one often path dependent (and expensive) route. In the next section we turn to look at the service delivery and organisational arrangements which follow on from these wider alternative framings of livestock development policy, and the narratives and assumptions about marketing and trade in particular that underpin them.

4 Service delivery and organisational arrangements

The administrative, organisational and funding arrangements for the livestock sector are of course highly dependent on the objectives for government (and in turn donor) support. The trade-offs discussed in the last section are therefore highly pertinent. Public investments and support services are always limited, and, with the fiscal crunch experienced by most African governments over the past few decades, this is especially so. Declining aid flows and a lack of donor interest in the livestock sector have added to the woes of livestock departments and veterinary services across the continent (Gauthier *et al.* 1999; Ashley *et al.* 1996). But what should such services be doing? What should their priorities be, and how should they be organised? What is the role for the public sector, as against private sector delivery channels? These are some of the questions being asked by both governments and donors. A number of models have been proposed by national governments, professional associations, donors and NGOs. This section probes some of these experiences and the assumptions underlying them.

Livestock departments (and sometimes whole ministries) and their allied veterinary services were established in the early part of the twentieth century across Africa, as classic government service delivery bureaucracies. In the early days, veterinary services in particular were focused on the control of major diseases. The early nineteenth century rinderpest pandemic which wiped out animals across Africa was a relatively recent memory (Phoofolo 1993).[31] East Coast Fever too was causing major problems in parts of eastern and southern Africa (Cranefield 1991). With colonial authorities wishing to establish trade links between Europe and Africa, the need to avoid serious disease outbreaks in Europe was of major concern. In the settler economies in east and southern Africa in particular ranching by European settlers was seen as a potentially important land-use, and the provision of beef to Europe was an important trade objective (Beinart 2003; Waller 2004; Anderson 2005). For example, in southern Rhodesia (now Zimbabwe) considerable state support was given to the export-oriented commercial ranching industry including numerous incentives for producers

31 On rinderpest or cattle plague, see also Spinage (2003).

and massive concessions and subsidies for monopoly exporters (Phimister 1978; Samasuwo 2003; Scoones and Wolmer 2006). There was thus significant investment in building up effective veterinary departments in certain countries, together with major investments in dip tanks, veterinary posts, field level staff, laboratory facilities and the beginnings of research programmes on major diseases.[32] This government-supported investment was intended to build the basis for a thriving, export-based livestock sector based on a large-scale ranching model.

In parallel, veterinary services (often under district or 'native' administrations) were charged with controlling diseases in the non-commercial 'communal' areas, where endemic diseases were rife. The fear was that these might detrimentally affect the high-value commercial cattle on nearby ranches. Foot and mouth disease became the focus for much attention, with elaborate movement control and 'stamping out' policies introduced (Scoones and Wolmer 2006). The control of ticks through dipping was also seen as critical in these areas. This meant that livestock disease control – and particularly the very visible policy of separating 'clean' and 'dirty' areas – became a symbol of colonial control and intervention (Waller 2004; Wolmer 2006).[33] It was much resented, particularly when severe movement restrictions were imposed, or destocking campaigns were instigated. In time, veterinary restrictions became a focus for nationalist campaigns to mobilise rural populations, including in Kenya (Anderson 2002) and Zimbabwe (Ranger 1985).

State veterinary services – with increasingly elaborate infrastructure, sophisticated back-up support and professionalised staff – were thus a key part of the colonial project. At independence they were still seen as an essential public service, and post-independence governments by-and-large continued to support them, often with significant donor assistance. While there were some shifts in emphasis, the basic style, structure and objective of livestock and veterinary services, established in the early part of the twentieth century, did not change much. The bureaucratic modalities, the professional allegiances and the structures of funding remained largely in place.

This was reinforced by a growing, internationalised livestock research establishment – such as the then CGIAR centres ILCA (International Livestock Centre for Africa) established in 1974 and based in Addis Ababa and ILRAD (International Laboratory for Research on Animal Diseases) established in 1973 and based in Nairobi – and international donor funds targeted on the livestock sector in Africa. These new centres supported a particular vision and set of priorities. This chimed with the colonial priorities of supporting a commercial, ranch-based, export-oriented livestock (read cattle) sector, which could bring financial dividends to the national economy. Although there were some important exceptions (notably ILCA's livestock systems programmes of the 1970s and 1980s), the international research and donor establishment focused on a technical paradigm for transforming what were assumed to be backward, non-commercial livestock systems. Given the dependent relations between the international system and national governments in much of Africa, it is perhaps no surprise that national policies echoed these approaches.

However, by the 1980s questions were beginning to be raised about the form of livestock service support being offered. In many instances this was not a fundamental questioning of its direction and assumptions, but more about mechanisms for and organisation of delivery. Three strands of this delivery debate are evident.

First, economists, and particularly those associated with the International Financial Institutions, notably the World Bank, began to ask – for veterinary systems as for other

32 For example the Veterinary Research Institute at Onderstepoort in South Africa was established by Arnold Theiler in 1908, and became a key source of research information on animal diseases (cf. van Wyk 1985). See also Aspinall (1993) for a history of the British colonial veterinary service from 1944.

33 The veterinary cordon fence dividing Namibia is still disparagingly referred to as the 'red line' – a term it acquired after the South African occupation in 1961 when it served an important policing function.

areas of state activity – whether such an elaborate and expensive state-supported system could continue, given the availability of government resources. Following the 1981 Berg report, structural adjustment programmes were implemented across Africa, and the familiar 'Washington Consensus' formula was applied to veterinary services: state support was cut back; staffing levels contracted; recurrent costs squeezed; services (such as drug supply, lab testing etc.) contracted out and privatised systems based on principles of cost recovery were encouraged. Decentralised (in practice deconcentrated) services were expected to replace what were assumed to be (and often correctly so) cumbersome, inefficient and centralised state-funded or heavily subsidised services. The question for those concerned with these new markets in animal health services was how could such privatised systems of delivery operate in Africa?

A second version of the delivery debate emerged in some areas of East Africa and the Horn – often in more remote pastoral areas prone to conflict and certainly without significant veterinary services. In war-torn areas in particular, the breakdown of government services was almost complete – vaccination campaigns ceased, surveillance was absent and dipping or dosing regimes collapsed. Of course in many remote pastoral areas prone to conflict, an elaborate, state-run veterinary service had never existed to be dismantled through structural adjustment in any case. In these areas, then, the question was not what should replace a crumbling and dysfunctional state-run system of delivery, but what might be built from scratch with limited resources and under conditions of conflict?

A third strand of discussion was also significant in this period. This focused less on the organisational and financial challenges of delivery, but more on ensuring that delivery was bottom-up and demand-led. Approaches to local-level participation had become increasingly popularised in the agricultural sector, and this was also taken up by those concerned with livestock management and veterinary service provision, especially by NGOs, many operating in East Africa. Here the question was how can a delivery system be designed which meets livestock keepers' needs, especially those who are poor and marginalised?

Through the 1980s and 1990s across Africa structural adjustment reforms hit government agricultural services hard, with declining capacities for research and delivery being almost universally experienced (FAO 1999). This reached crisis levels in some places, with services being incapacitated through lack of funds, and an increase in disease outbreaks was observed in many places. Seeking out a new model for veterinary service delivery was therefore a major, and increasingly urgent, practical, institutional and policy challenge.

During this period, a series of NGO-initiated experiments in alternative models of livestock service delivery were being carried out. These focused on the training of para-professionals – community animal health workers (CAHWs) – as alternatives to the long-absent (if ever present) conventional government-supported veterinarians. Such people, it was argued, could provide a basic level of animal health care at the community level, including the supply of basic drugs (Halpin 1981; Grandin, Thampy and Young 1991; Young *et al.* 2003). Most evaluations confirmed that these were both popular and largely effective in dealing with common diseases and animal health issues. But in the context of often isolated, project-focused experiments, other wider policy issues were not initially dealt with.

While the NGOs involved saw the CAHW model as a pragmatic solution to a particular development challenge in remote pastoral areas, others took up elements of the model as one that fitted with a new vision for public service provision in alliance with the private sector. For the new public management specialists drafted in to redesign public services in the wake of structural adjustment reforms, a decentralised, cheap, semi-privatised service fitted the bill perfectly. It articulated an effective division between public goods (major disease control and surveillance) and private goods (health care of individually owned animals), and offered a model for the restructuring of livestock departments, and veterinary services in particular (see contributions in Leonard 2000).

A key issue was of course sustainability. Many of the early experiments were heavily subsidised by outside funds, but could CAHWs operate, even in poor, remote areas, on a

commercial basis? While there have been good examples of self-funded CAHW systems operating, linked to private drug suppliers (Catley 1999; Catley *et al.* 2004), business viability is sometimes challenging in the longer-term, especially if there is subsidised competition from still existing but limited state services, or project-supported efforts led by donors and NGOs (Woodford 2004). Evidence from southern Sudan, Ethiopia and Afghanistan for example, has showed however that effective systems could evolve, given appropriate start-up support (Leyland 1996; Tunbridge 2005; Schreuder *et al.* 1995; Abebe 2005). But a balance was clearly needed between local-level, decentralised CAHW efforts and oversight and regulation by the state, and the professional veterinary system. Much debate ensued about appropriate systems of official training, certification and regulation for CAHW activities, including the recognition by the OIE of the key role CAHWs can play in decentralised systems of animal health care.[34] By the late 1990s, CAHWs were increasingly promoted within professional veterinary circles as being a complement rather than an alternative to the conventional, highly qualified vet.

Thus over time, despite initial scepticism, the CAHW became central to ideas promoted by an increasingly mainstream network of institutional players, way beyond the initial grouping of NGOs. AU-IBAR, for example, hosted a series of workshops on the subject highlighting such issues as para-vet training and accreditation; participatory epidemiology and drug supply and regulation (e.g. Leyland *et al.* 1998). These and other initiatives significantly raised the profile of the CAHW model and encouraged national governments and, significantly, associations of veterinary professionals to start considering how CAHWs could complement existing (and much depleted) veterinary services.

This debate was not without contention and controversy. Many senior veterinarians, brought up in the context of well-funded and effective state veterinary departments, remained sceptical on a number of counts. First, they argued that para-vets amount to formalising and accepting lower grade expertise, with many seeing them as little more than 'quacks'. This, they claimed, would undermine the integrity of the veterinary profession and down-grade the service, thus jeopardising export potential. Second, many objected to what they saw as a creeping privatisation of a once proud national public service. While many veterinarians were happy to use government facilities do a bit of private practice on the side to supplement declining government salaries, this was largely work in urban centres on domestic pets or with a limited number of commercial clients running large concerns. How, they asked, is a veterinarian going to make a living in a remote rural area?

The role of CAHWs in major disease control campaigns and in disease surveillance, however, was a major selling point of the approach for the sceptical professional veterinary community. Having a network of CAHWs meant that they could also assist with disease surveillance and vaccination campaigns, led and regulated by a still-existing, but scaled-down government service. The use of para-professionals in the major rinderpest campaigns of the 1990s showed how effective they could be. In Afar region of Ethiopia, for example, 20 CAHWs were trained and supplied with heat-stable rinderpest vaccine in 1994. Moving on foot they vaccinated 73,000 cattle in one season and achieved 84 per cent vaccination efficiency (compared with 72 per cent vaccination efficiency of Ethiopian government teams). There were no reports of rinderpest outbreaks in the region after November 1995 and Ethiopia was able to declare provisional freedom from the disease (Catley 2004). In Tanzania recent training of CAHWs for disease reporting has increased reporting levels to the highest in the country in those districts where they operate (Allport *et al.* 2005).

Debates about CAHWs have played out in different ways in different countries. For example in Ethiopia, CAHWs have been accepted as an integral part of the veterinary service, and guidelines for training and certification have been issued (Admassu 2005; Mulualem Tarekegn 2005). By contrast in Kenya, despite years of debate and much positive experience

34 See OIE chapter 1.3.4.

on the ground, there has been much more resistance to accepting CAHWs by a small but vocal group of individuals within the vets-only associations and board (Rubyogo *et al.* 2003; Munyua 2005). In southern Sudan, where existing veterinary services were already highly fragmented, the CAHW approach took off dramatically (Tunbridge 2005). In Somalia the introduction of CAHWs was delayed for several years in southern and central areas as aid agencies relied only on vets to deliver services. However advocacy for CAHWs is now strong due to impact assessments and evaluations showing how effective they are (Hopkins 2004; PACE Somalia 2004). In Somaliland there is a long and successful history of utilising CAHWs (Catley 1999, pers. comm.). In Tanzania, the situation is somewhat vague with recent legislation apparently enabling local bye-laws to permit paraveterinary animal health care provision.[35] In southern Africa there has been a long tradition of technical animal health assistants who, in line with decentralisation and restructuring, have been rebranded as para-professionals.

Why certain policy outcomes arose in different places can be put down to the complex, and often highly political, interactions between key individuals, networks and bureaucracies, interacting with international influences (via donors, international organisations, or NGOs) and funding flows and conditionalities (cf. Young *et al.* 2003). These policy processes are necessarily highly context-dependent and particular, but a broad trend towards acceptance of CAHWs can be seen, with the confluence of field-level experience and tightening adjustment-induced constraints coming together at a critical policy moment in the late 1980s and into the 1990s.

This trend has been further reinforced of late by the increasing focus on trade and exports discussed in the previous section. AU-IBAR and others have made the case that compliance with international export requirements can only be realistically achieved in most African countries if a trained, well-regulated network of para-professionals, including CAHWs, supports this effort, allowing for more effective monitoring, quicker responses, better surveillance and the ability for information to be communicated rapidly from livestock keeper to the Chief Veterinary Officer, and on to the OIE for its global reporting system (Leyland and Catley 2002). Again the achievements of the PARC and PACE-led rinderpest campaigns in such difficult settings as Sudan or southern Ethiopia are presented as key examples of why such approaches are imperative. With Chief Veterinary Officers increasingly focused on the task of generating an export industry, this was a particularly convincing argument.

Somewhat belatedly the OIE became convinced too, and in 2004, following a key meeting hosted by AU-IBAR in Mombasa (Sones and Catley 2003), the OIE agreed to revise its Terrestrial Animal Code to reflect the importance of veterinary para-professionals and privatisation. This meant that, in arguing for support for veterinary services to ensure 'safe trade', the OIE (and allies in the FAO, World Bank and elsewhere) argued also for the formal recognition of veterinary para-professionals (the definition of which includes CAHWs) and the establishment of statutory bodies responsible for their licensing and registration in each member country. In many senses this is a big step, light years away from the perennial scepticism and professional snobbery of only a few years ago. However, the debate about the role of CAHWs raises a range of other questions.

The focus on CAHWs and their para-professional qualifications has at times obscured the wider, perhaps ultimately more important, debate about what veterinary services (para-professional or not) are for. Most CAHW work focuses on simple treatable diseases such as internal and external parasites and infections which respond to antibiotics and trypanocides. But what proportion of their time should also be devoted to disease surveillance or large-scale vaccination campaigns? And how should these different elements be paid for? Many argue that immediate and simple treatments are most amenable to cost recovery

35 Veterinary Act and Animal Diseases Act, United Republic of Tanzania, 2003.

approaches under a quasi-privatised system, while large-scale more public good interventions should be financed by the government, or donor efforts. However, others argue that if governments wash their hands of the 'simple', 'treatable' diseases and pass these on to a private delivery system, the focus of investment and policy attention thus inevitably shifts to the control of trans-boundary diseases and epidemic infections, with distorting consequences. If limited staff time and budgets are caught up in major disease surveillance and eradication campaigns they thus cannot be paying attention to more mundane production-oriented issues, for example.

While CAHW systems have been shown time and again to be able to do both, some trade-offs of this sort inevitably exist, wrapped up in competing interpretations of contrasting livestock policy narratives (see above). These may be reflected in budget priorities, promotion pathways and organisational arrangements. In some countries, for example, animal health departments are divided into sections reflecting these different functions. With the high levels of investment in disease eradication – particularly rinderpest – the availability of resources in, for example, PACE-supported units, and the prestige and perks associated, are clear to see.

In development circles decentralisation – and decentralised service delivery – is often seen without questioning as a 'good thing'. Decentralisation, the argument goes, encourages community involvement and participation at the same time as it involves reducing costs and devolving responsibilities away from the central state, and its associated red-tape and bureaucratic incompetence. It seems to be a win-win. So whether the starting point is community empowerment or structural adjustment, decentralised forms of service delivery have found widespread support (cf. Ribot and Larson 2004; Manor 1999). CAHWs have thus found favour both among NGOs advocating local knowledge and participation and among those pushing economic reform and the 'rolling back' of the state and public sector reform. For the NGOs decentralisation conjures up a devolved, participatory form of demand-led and accountable service provision (cf. Ribot 2001). For the economic reformers, by contrast, decentralisation means allocating limited state resources to oversight, coordination and regulatory tasks, with overall efficiency enhanced by the entry of private sector operators in a competitive market for decentralised service provision (cf. World Bank 1997).

The challenge for the debate about CAHWs over the last decade or so has therefore been how to ensure bottom up accountability and demand-led service provision, as well as making this efficient and cost-effective, and a potentially financially sustainable enterprise, at the same time as ensuring oversight, regulation and control by a slimmed-down and reformed state bureaucracy. Despite the negative press given to the state by both the economic reformers and the bottom-up NGO advocates (for different reasons), a key conclusion from cross-country field experience has been the continued importance of state functions, and notably veterinary supervision (including training, certification, regulation) of CAHW systems (Leyland and Catley 2002).

In an ideal decentralised system the principle of subsidiarity operates, with different levels engaged with tasks appropriate to that level in a neatly coordinated, smooth manner. But again this is rarely the case. With decentralisation from central livestock and veterinary departments, the level of coordination and regulatory capacity of state or province level administrations has been limited, with conflicts arising between down-graded central veterinary authorities and their decentralised counterparts. Such conflicts become particularly problematic when dealing with notifiable diseases which must be reported at a country-wide level. Tanzania and Uganda are as a consequence currently reviewing their approach to decentralisation of veterinary services to look at ways of bringing CAHW disease reporting under centralised control (Kasiyre 2005).[36] For, if importing countries and reporting organisations such as the OIE begin to suspect problems, then market confidence can be substantially undermined.[37]

36 And see Choseni (2005) on Zambia.

37 See Bishi (2005) for FMD in Namibia; Moerane (2005) for Avian flu in South Africa.

What role CAHW provision should play *vis-à-vis* a centralised veterinary service will of course depend on the setting, and particularly an answer to the more fundamental question of what the objectives of livestock services are.[38] Where a potential export market beckons there may be important roles for CAHWs in disease control and surveillance that producers are unlikely to pay for directly (although they may do via indirect levies on sales). In areas where significant incomes are derived from livestock or agriculture willingness and ability to pay for services may combine to allow a private service to take off on a viable basis. Studies from remote pastoral areas of Kenya and Sudan have also shown how CAHW systems are the most cost-effective in terms of benefit:cost returns, providing a service to poorer producers when others are unavailable (e.g. Okiwiri *et al.* 2001; AU-IBAR 2003, 2005). In other areas, perhaps for the most marginalised producers, ability to pay may be constrained and alternative state or project subsidised provisions will be needed, especially if there are knock-on consequences such as lowered herd immunity and disease risk if coverage is uneven.

Thus a highly plural nature of service provision – mixes of public and private, professional and para-professional, centralised and decentralised – characterises the current situation. No one model fits perfectly. The return to the hierarchical, centralised, state-funded veterinary service is highly unlikely given constraints on public funds and questions about both efficiency and appropriateness of such provision. But the sometimes proposed alternative of a wholly decentralised and privatised and minimally regulated system seems both undesirable and inappropriate in many settings too.

Plurality and hybridity in health systems – both for humans and animals - are it seems here to stay (cf. Bloom and Standing 2001). In any debate about the future organisation of veterinary delivery systems there is a need to recognise that the complex, hybrid, plural systems in evidence today are not an aberration from an ideal, but reality in practice. This is what has to be worked with, not ignored. In the same way, 'real markets' prevail. These are informal, involving multiple suppliers of services and products and with limited regulation (Platteau 1994 a,b). There are as a result good, bad and indifferent veterinary products, with hugely variable qualities, from (increasingly) multiple sources. There is also a widely prevalent lack of access to expert knowledge, and often lack of trust in it when there is access. While there is well-documented and highly significant 'indigenous' or 'lay' expertise which is a vital and under-recognised aspect of animal health care in Africa (e.g. McCorkle *et al.* 1996; Akabwai *et al.* 1997; Catley and Mariner 2002), this is often inadequate in making use of modern drugs and vaccines. Misuse, with resulting resistance or side-effects, can be the result if more conventional veterinary expertise is not combined with traditional knowledge and practices, as in the attempts to foster CAHWs in Africa. There are therefore multiple priorities for different needs and different clients. The users of veterinary services are not just the archetypical rancher and export producer, but a much more diverse clientele, whose priorities are often not taken fully into account.

Recognising these dynamics, there is therefore a need to consider a number of key trade-offs, questions and priorities when thinking about policies for service delivery and organisation. These include:

- What is the appropriate mix of private and public provision, recognising social and political contexts of both particular markets and states in different settings (cf. Leonard 2000, 2004a,b)?
- Can state and market/private sector led services be 'co-produced' (cf. Moore and Joshi 2002); for example can the private sector offer branding, certification and trust in products, while the public sector provides an overall regulatory framework for product safety and delivery?

38 See discussion in Leyland and Catley (2002); Ly (2003); Leonard *et al.* (2003) and Peeling and Holden (2004), for example.

- What is the appropriate form of decentralisation which provides effective services, especially in remote areas, but does not result in extreme deconcentration and incapacitation? What can be learned from the success stories of successful decentralised service delivery (e.g. Tendler 1997), and what governance arrangements are needed to make these work?
- How can consumers of services (and technologies) become more informed, and exercise rights as citizens? How can the relationship between experts (veterinary professionals) and users be reconfigured (e.g. through para-professionalisation) and enhanced (e.g. through user education, information technology support etc.) to allow a more effective service delivery? (cf. Bloom 2005)
- What is the appropriate form of regulation of service providers and veterinary product suppliers, taking into account extreme limits of capacity? What are the potentials of a negotiated, informal form of regulation (cf. Mackintosh 1999; Mackintosh and Tibandebage 2002) operating at a local level, which balances the need for basic standards and probity with feasibility and effectiveness?
- How can an overall delivery and regulatory system operate with some central oversight that recognises multiple knowledges, players and inputs (plurality), but avoids the wholly unregulated scenario where anything goes?
- What roles exist therefore for a (workable) central regulatory system and veterinary service in areas such as certification, monitoring, and standard setting?

Overall, accepting the realities on the ground and avoiding the temptation to recreate a perhaps mythical ideal of either a well-provided, subsidised, state-run system or by contrast a fully privatised, cost-recovery system, there is a need to set about rethinking service delivery and the role of professional veterinarians in a fairly fundamental way. This will require imaginative, forward-looking, but determinedly realistic institutional innovation on all fronts. Perhaps in contrast to the even more conservative systems dominating the human public health scene, there has been more experimentation and innovation in veterinary systems. Highlights include for example the success of CAHWs, the increasing importance of decentralised systems with strong private sector involvement and the recognition of the need to bridge local and scientific knowledge in delivering animal health care. However, there remains a long way to go, with just some of the challenges for delivery and regulation listed above. Reflection on the broader priorities for livestock development – and an interrogation of the underlying narratives informing these – is a central part of this task. For the organisation of delivery systems must respond to both such negotiated policy priorities and real conditions on the ground. A key part of such institutional and policy reflection and innovation of course will be a consideration of the role of science, technology and expertise, a subject we turn to in the next section.

5 Disease management and control: scientific and technological priorities

Underpinning both policies towards markets and trade and service delivery and organisation are assumptions about how science and technology can contribute to animal health care. Key scientific breakthroughs have defined the trajectories of veterinary services since the earliest development of vaccines, antibiotics, acaracides and parasite treatments. Disease eradication has been the ultimate goal, with rinderpest being seen as the iconic example of what is possible through the combined application of novel scientific applications (in this

case the availability of a thermo-stable vaccine, life-long immunity and good diagnostic tests), effective surveillance and comprehensive delivery.[39]

The rinderpest eradication programmes – under PARC (1986–99) and subsequently PACE (from 1999) – have for many shown what is possible with determined effort. The development of an effective vaccine and its subsequent use in Africa-wide eradication of the disease has been an undoubted success story. The PACE programme has a budget of over 72 million euros, working across 32 countries, and supports the development of substantial infrastructure, in terms of labs, offices, vehicles and so on.[40] Many careers have been built within these programmes, both local and expatriate, combining to make a strong advocacy for the replication of such approaches to other major animal diseases. An influential network of people therefore – ranging from field technicians to lab scientists to expatriate veterinarians to Chief Veterinary Officers to donors – advocate an eradication perspective, and the rolling out of the rinderpest experience to other diseases. This is reflected, as already noted, in the major programmes and plans of such influential organisations as the OIE, FAO, the World Bank, Institut d'Elevage et de Medecine Vetenaire des Pays Tropicaux – Centre de Coop'eration Internationale en Recherche Agronomique Pour le Developpement (IEMVT-CIRAD) and AU-IBAR.[41] This perspective has been reinforced, as discussed in earlier sections, by the renewed emphasis on capturing export markets and facilitating 'safe trade' and the restructuring of veterinary departments to reflect these priorities.

With recent developments in vaccine science, especially through recombinant DNA technologies, this science-led supply push has gained additional impetus. Such a view argues that new scientific breakthroughs, ushered in by the range of biotechnology techniques, can at last conquer the economic diseases prevailing in Africa.[42] With the appropriate level of investment, both public and private, transboundary diseases can be eradicated, it is argued. For example, the proposed ILRI-led Challenge Programme document "Reducing Poverty by Eliminating Constraints to Market Access due to Animal Diseases" envisaged an international network of collaborative research on new technologies of diagnostics and vaccines at a cost of US$92 million (ILRI 2002). This effort will require, it is argued, significant support for concerted public good science at the international level through up-stream, hi-tech research on vaccines in particular. This is something that cannot emerge from individual, isolated efforts and must require concerted efforts at the international level, with top-level science inputs from the labs of such organisations as ILRI, CIRAD, Wellcome and others. Modelled on the approach advocated by the Gates Foundation for human health, a 'global alliance' approach is recommended which links public sector science with patent-releasing and delivery incentives for the private sector. Mirroring the human health counterpart, a Global Alliance for Livestock Vaccines (GALV) was launched in 2004 for livestock health with a budget of US$110 million over ten years (Sones 2005). In 2005 the

39 Perhaps in the same way that smallpox eradication, achieved in 1979, has a similar hold on the human public health field.

40 www.fao.org/ag/AGA/AGAH/EMPRES/grep/pace.htm

41 See, for example, www.fao.org/ag/againfo/programmes/en/grep/home.html

42 See 'Biotechnology and Animal Vaccines', *IFPRI* Briefing, October 1999 (www.ifpri.org/2020/focus/focus02/focus02_03.htm); Rege (1996); Rogan and Babiuk (2005); Makkar and Viljoen (2005); MacKenzie (ed.) (2005). Much support, such as for an r-DNA heartwater vaccine, has come from US-sponsored assistance (e.g. *USAID Launches Biotechnology Initiatives with Africa: Programs Foster Improved Regulation, Research, Development*, 2 March 2001 at www.biotech-info.net/USAID.html). A public-private initiative led by ILRI and with UK government funding is also being developed for a East Coast Fever vaccine (see 'East Coast Fever Vaccine One Step Closer', *Spore* 114, December 2004; *Genomics Helps Identify Possible Cattle Vaccine* see, www.ilri.cgiar.org/data/ILRIevents/GenomeFebNews.asp, February 2004). Significant investments in bioscience capacity development have been ongoing, including a new US$21m NEPAD-backed facility linked to ILRI in Nairobi (see *Biosciences Facility for East and Central Africa Opens*, SciDev.net, 21 November 2004. ILRI itself spent around $14m per annum on biotechnology related research in 2005 (www.ilri.cgiar.org). See also: Clark *et al.* (2005); Smith (2000); Widdus and White (2003).

Wellcome Trust announced under its Animal Health in the Developing World programme a further £25 million for research, including seven major programmes focused on vaccine development for application in Africa.[43] A global strategic partnership of eight core institutions has been proposed to develop a new generation of FMD vaccines and anti-viral technologies at a cost of US$79.5million.[44]

Alongside this support for technology development, parallel funding initiatives are focused on surveillance of such diseases. Thus a €8 million capacity development and regional integration initiative for the SADC region livestock sector (PRINT) has been recently unveiled, with support from the EU and technical assistance provided by CIRAD.[45] The GF-TADS programme is developing complex early warning and reporting systems for diseases, again arguing for this investment in terms of securing market access and trade promotion in the livestock sector (see above).

Taken together these new initiatives amount to significant investments in the livestock sector in Africa. Given that livestock had been largely off the donor radar in recent times, this in many respects is to be welcomed. But it must be asked: are these investments in science and technology the right ones? What assumptions do they carry with them? Will the resulting technologies deliver the goods, given the realities on the ground? And will these investments ultimately benefit the poor, as they argue? Clearly it is too early to make any firm assessments, as these initiatives are only in very formative stages, but it is worth asking some general questions about priorities and directions. The following five sub-sections probe in turn issues of priority setting of diseases and technologies; epidemiological realities and scientific uncertainties; disease control requirements; technology delivery issues; and funding modalities.

5.1 Priority setting: diseases and technologies

There are always limited resources available for either public or private-led, global or national research and development. What should these be spent on? How should it be decided, and by whom? These are perennial questions with no easy answers (cf. Alston *et al.* 1994; Contant and Bottomley 1988). Some make the case that upstream, blue-sky research may deliver the breakthrough technology, with major unforeseen spin-offs and so pragmatic, demand-led prioritisation has little purchase, and can constrain rather than encourage. Others make the case that certain policy-driven criteria must define investments: for example, poverty reduction and geographical spread (typically for public programmes) or market potential (typically for privately funded programmes). Complex ranking and modelling techniques have been developed to justify choices (cf. Randolph *et al.* 2001). For example, in the ILRI study on 'Investing in animal health research to alleviate poverty', regional 'end-users' and experts working in veterinary services, universities, research institutions, NGOs and international organisations were used to score disease impacts on the poor in different species and production systems and list research opportunities. These resulted in the inclusion of East Coast Fever (ECF) as a disease potentially limiting livestock-based intensification (e.g. via the low adoption of improved

43 www.wellcome.ac.uk/doc_wtx025304.html

44 Leyland, pers. comm. Institutions include Pirbright Laboratories of the Institute for Animal Health, UK Plum Island Laboratories of the US Department of Agriculture (USDA), Agriculture Research Service (ARS)/Animal and Plant Health Inspection Service (APHIS), New York, USA, Australian Animal Health Laboratory (AAHL), Geelong, Victoria, Australia National Center for Foreign Animal Disease Laboratory, Winnipeg, Canada The International Livestock Research Institute (ILRI), Nairobi, Kenya. The Food and Agriculture Organisation (FAO) of the United Nations, Rome, Italy The World Organisation for Animal Health (*Office International des Epizooties*, OIE) see: http://europa.eu.int/comm/research/agriculture/pdf/footmouth_swinefever/proposal_text.pdf

45 www.delbwa.cec.eu.int/en/eu_and_sadc/integration_livestock.htm

dairy-grade cattle) and thereby justifying research into improved ECF vaccines as providing a pathway out of poverty (Perry *et al.* 2002). This prioritisation was questioned by many. How could ECF, a disease that affects perhaps one to two million animals in Africa really be seen as a top priority for disease control research with a poverty reduction objective in Africa? As Perry *et al.* (2002: 61) comment 'most of the indigenous cattle are solidly immune to this disease' and the problem of infection arises when farmers purchase susceptible exotic breeds. They conclude 'research on ECF therefore, may not be a priority for securing the current assets, but will certainly be a priority for intensification'.

In other words the prioritisation of work on ECF is premised on an assumption that the future lies in intensified dairy production (cf. Thorpe *et al.* 1992). This is of course the rationale for science-led investments in ECF r-DNA vaccines led by ILRI. As one of the ILRI scientists involved commented the $5–10m cost of getting a vaccine available will be nothing compared to the costs of the disease, estimated at $300m annually.[46] But such science investments tend to have a momentum of their own, with priority setting evaluations often arriving rather as *post hoc* justifications for decisions already made. The ECF work may be a case in point, as the ILRI-Institute for Genomic Research (TIGR)-Ludwig, Victoria and Oxford Universities-Merial partnership emerged from discussions in the 1990s, and has subsequently been backed by UK aid funds.[47] It is an open question if East African herders themselves would have prioritised such investments, given their experiences of the disease and the level of existing immunity. More bottom-up participatory priority setting approaches are often talked about, but too often other imperatives hold sway, and, despite the rhetoric, livestock producers are rarely meaningful stakeholders in such processes.

In practice of course a range of factors impinge on priority setting, many of which are nothing to do with 'objective' scientific criteria. The influence of individual scientists and their networks; the alliances of funding agencies; the nature (and prestige) of the scientific challenge and type of technology; the commercial opportunities and spin-offs; the need for funding in particular areas; interest by the international scientific community and media focus and policy hype around a particular disease all contribute to the mix. The lack of transparency and poor accountability in decision-making and funding mechanisms (or at least the false rigour of many formalised decision frameworks and much peer review) is, of course, well known.

It is not a surprise, then, that 'sexy' diseases like East Coast Fever or Foot and Mouth Disease (both economic diseases of commercial cattle producers, with export trade implications) or BSE and highly pathogenic avian influenza (zoonoses with potentially significant human health implications) gain more attention than say Newcastle disease (devastating of poultry production, small and large scale) or internal parasites (a major production constraint on many livestock, especially in poor multi-species systems). In the same way, it is again not surprising that recombinant DNA vaccines (the height of technological sophistication) gain more funding and scientific attention than say anti-helminth dosing. In the same way in the area of tsetse control sterile male techniques are seen as more sophisticated than simple pour-on technologies (cf. Bourn *et al.* 2001).

Very often full economic assessments are not carried out on different options, including the option of doing nothing. For example, in South Africa expensive vaccine-based attempts at

46 See 'Genomics Helps Identify Possible Cattle Vaccine', *Genome Technology*, January/February 2004. The sources for these oft-quoted numbers are rather difficult to find, but seem to assume both significant joint funding for vaccine development, and no account for either regulatory approval costs or significant research expenditures already undertaken. Losses due to ECF seem to involve ambitious extrapolations from susceptible dairy herds, and assumptions about expansion of intensified dairying.

47 See: *Africa and UK Partnering in Science for Africa* at www.ilri.org/ilripubaware/uploaded%20files/Brief3_Africa_UK.pdf (2004). Also *The Power of Public Private Partnerships to Improve Livestock Health and Reduce Poverty* (2004) www.ilri.cgiar.org/ilripubaware/, and various other press commentaries on this now high-profile initiative; Chataway *et al.* (2006, 2005).

brucellosis control in cattle have had relatively little success. They benefited a relatively small group of relatively well-off (often white) commercial dairy farmers wanting to sell milk to outlets where strict standards were applied. Dairy cattle in the former homeland areas suffered relatively little from the disease in terms of production loss (due to hardier breeds), and the limited human health risks could be offset much easier and more cheaply by recommending boiling of milk rather than disease eradication (Mokaila 2005). This example shows, along with many others, how priorities become distorted by politics (and, in this instance, the biases of the former apartheid regime) and how these can be sustained even under a different political dispensation by an argument about the need for the 'best' disease control measures, if the technologies exist.

Where more detailed economic analyses are undertaken, they sometimes indulge in extraordinarily convoluted arguments to get to a solution that was, one suspects, pre-determined. A case in point has been the argument for prioritising FMD control in Zimbabwe as a 'pro-poor' measure (e.g. Perry *et al.* 2003). While acknowledging that FMD is not a major priority or concern among smallholder communal farmers, by far the largest and poorest group of livestock keepers in the country, and that for the most part any benefits will be largely captured by the commercial beef industry and costs born by the public sector, Perry *et al.* manage to argue (admittedly before the full extent of the land reform undertaken from 2000 and its implications for the size and capacity of the commercial herd and disease incidence were fully evident) for the need to reinstate strict FMD control, using fences, movement control and disease zonation, in order to re-capture export markets which will also benefit poorer sections of the population (although not a great deal and largely indirectly). The argument for this proceeds through a series of benefit-cost analyses based on scenarios of income returns (largely forgetting the evidence, also documented in the report, of the multiple economic roles of cattle in the communal areas, cf. Scoones 1992), and assuming that an export-led scenario (requiring very expensive start-up and recurrent cost FMD control) is both sustainable (despite standards requirements from export markets) and viable (given international competition and price/exchange shifts). While there were plenty of footnoted caveats and qualifications to the analysis, the take-home policy message on priorities was clear. In the words of the report: 'Effective FMD control appears to bring very limited direct benefits to the poor. However, poverty reduction measures function best in an environment of national economic growth, a situation that FMD control appears to promote' therefore 'there is considerable merit in continued strong and sustained FMD control in Zimbabwe FMD' and this potentially 'can form the base for a more pro-poor service in animal health' (Perry *et al.* 2003: 136, 14, 132; see further commentary in Scoones and Wolmer 2006).

In sum, then, in setting the priorities for science and technology investments in animal health (or any other area for that matter) we must always be circumspect about assumptions and motives. A more inclusive approach, involving a diversity of stakeholders – including poorer livestock owners in more remote areas, is essential. This requires institutional innovation in both national and international research systems to allow more thorough deliberation around issues and options, probing the trade-offs and challenges in greater depth than is currently the norm. Some of the challenges of this are pursued in the final section of this paper. Next, we turn to the challenge of dealing with the uncertainties surrounding disease epidemiology in African livestock systems.

5.2 Diseases in context: epidemiological realities and scientific uncertainties

Very often technologies for disease control are developed in laboratory settings and on the basis of models which do not reflect the epidemiological realities of livestock diseases in African settings. The assumption too often is that science is universal and transferable between situations – from labs in the US or Europe to rural, pastoral Africa, for instance. The 'let us assume' mentality often results in serious disappointments. For example, livestock

move often over very large distances and between dispersed populations in pastoral areas. Indigenous livestock breeds in Africa are often highly resistant to endemic diseases and so act as carriers, infecting others without showing signs of disease. Livestock and wildlife interact closely in Africa and so transmission, carrier and sentinel mechanisms show much greater complexity than conventional herd models assume.[48] All these factors (and many more) mean that the key parameters of transmission, infection and immunity may differ dramatically from population to population, depending on the wider ecological, social and political contexts influencing movement, breed mixes and interactions with wildlife populations.

Attempts to get better understandings of local epidemiological conditions through participatory techniques (Catley and Mariner 2002; Mariner *et al.* 2002) have often been dismissed as poor science. But particularly in remote arid and semi-arid pastoral areas with small and mobile human populations, limited modern infrastructure and often insecurity, conventional quantitative and data driven epidemiological methods developed elsewhere in the world for sedentary agricultural areas often prove untenable. The vast accumulated knowledge about livestock diseases, epidemiological and clinical patterns and livestock systems in pastoral settings is excluded from view (Catley and Mariner 2002). Thus models developed through parameter generation from participatory exercises with local livestock owners have proven far more effective at predicting disease outcomes than more conventional approaches. For example, in southern Sudan and Somalia participatory epidemiology tools were used to model rinderpest transmission and the impact of different vaccination strategies on the probability of disease eradication (Mariner *et al.* 2002). Analysis of this is grounded in and relies upon the direct input of livestock owners' knowledge. In the same way, some field veterinarians argued strongly against the assumptions underlying the computer models used to define strategies for FMD control during the 2001 outbreak in the UK. They made the case that a more appropriate strategy, avoiding the chosen approach of slaughtering out of large numbers (via 'the 24/48 contiguous cull' strategy), would be based on the application of risk assessment to identify and remove susceptible stock (Honhold *et al.* 2004; see Campbell and Lee 2003; Woods 2004a,b). Indeed during the UK Foot and Mouth Disease outbreak modellers expressly avoided talking to farmers because they thought this would bias their models. Yet advocates of modelling incorporating 'participatory epidemiology' would argue that listening to farmers' own experience would significantly enhance the accuracy of modelling efforts and the effectiveness of disease surveillance and control measures.

Disease control in complex ecologies is never going to be an exact science. Indeed uncertainties dominate much decision-making. In the end judgement, and sometimes politics, must prevail. This is particularly the case where new disease dynamics emerge, either because of the spread of a new disease with unknown impacts or where epidemiological dynamics are uncertain. This has arisen dramatically in the case of avian flu, particularly because of the potentially catastrophic impacts on human health. Not only has a new viral strain arisen, but its transmission between poultry (and other commercialised bird species, including ostriches), wild migratory birds and humans remains unknown.[49] In South Africa, for example, the causes and implications of an outbreak of avian flu (due to the H5N2 virus) among ostriches were unknown due to lack of scientific knowledge of transmission mechanisms and the degree to which such viral strains can infect commercial or indigenous

48 See: Anderson *et al.* (1993); Bastos *et al.* (2000); Thomson (1996; 1999); Thomson *et al.* (1984, 1992, 2003); Sutmoller and Olascoaga (2003).

49 See www.oie.int/eng/AVIAN_INFLUENZA/home.htm; and www.fao.org/ag/againfo/subjects/en/health/diseases-cards/special_avian.html for up-to-date information, largely on the spread of H5N1 avian flu in Asia. See also OIE/FAO International Scientific Conference on Avian Influenza, OIE Paris, France, 7–8 April 2005; A Global Strategy for the Progressive Control of Highly Pathogenic Avian Influenza (HPAI), Food and Agriculture Organization (FAO, Rome), World Organisation for Animal Health (OIE, Paris) in collaboration with World Health Organization (WHO, Geneva); also Morris and Jackson (2005).

poultry or indeed humans (Moerane 2005).[50] A similar set of scientific uncertainties surrounds the roles of wildlife (and especially buffalo) and cattle interactions, and of vaccinated cattle in the dynamics of FMD transmission (see above; footnote 47). In the same way, uncertainties surround the relative effectiveness of vaccination or antibiotic usage as a means of CBPP control (cf. Lesnoff *et al.* 2004). A recent FAO consultation on CBPP concluded that, based on disease modelling which involved inputs from farmers (AU-IBAR 2002; Mariner *et al.* 2003; Mariner and Catley 2004) 'a new paradigm for CBPP control using antibiotics should be investigated', potentially challenging the standard view that vaccination is the only effective route. The report recommended the immediate initiation of field trials (FAO 2004: specific recommendations, para 21). This conclusion is controversial since the conventional vaccination option has many supporters, including commercial interests.[51] Yet the uncovering of alternative possibilities, probing the uncertainties that had remained 'black boxed' in the mainstream version, through novel, participatory methods provides important lessons for the whole field, independently of the outcome of any trials.

Whether a disease is eradicable (at least within feasible economic limits) is thus open to much dispute. Equally, the degree to which a disease can remain endemic with limited impact will equally depend on a huge range of conditions (breed types, movement patterns, carrier dynamics etc.). Very often the commitment to eradicate a disease (as we see in many of the bravely optimistic policy and scientific statements) is more a statement of faith and ambition, rather than a calculation based solely on fact and evidence. Perhaps the success of rinderpest eradication gave a false sense of promise. Rinderpest of course has very different disease dynamics to many of the others on scientists' priority lists. It is a very visible and highly infectious disease with high levels of mortality (with limited carrier potential across breed types);[52] immunity once gained (through vaccination or survival from infection) is life-long, requiring no further follow-up coverage. With a heat-stable vaccine developed, it was therefore a relatively 'easy' target. However, given the vagaries of disease surveillance information and failure to develop a workable strategy for rinderpest eradication in Somalia, the degree to which rinderpest has indeed been fully eradicated is open to question.[53] If after 30 years of effort and the massive expenditure of donor money and national contributions and despite its relative simplicity in epidemiological and biological terms rinderpest has not been finally eradicated, what hope for more complex diseases? Clearly eradication remains a far-off dream for many diseases, despite recent advances in technology, and many epidemiological uncertainties persist. Perhaps a more circumspect attitude is in order, one that takes local contexts and dynamics more firmly into account before commitments are made to ambitious targets and large-scale programmes. This requires a greater attention to the array of uncertainties inevitably present in any disease control challenge, something best tackled through insights from local settings.

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50 See OIE report *Highly Pathogenic Avian Influenza in South Africa*, Update Report 5, June 2004 www.oie.int/eng/info/hebdo/AIS_67.HTM#Sec2. See also Verwoerd (2000) for an overview of what is known about – and the many uncertainties surrounding – ostrich diseases.

51 Andy Catley, pers. comm. The findings of the CBPP disease modelling cited here have been sidelined in recent international meetings. A strong, well-funded group centred on CIRAD in Montpellier, France argues for vaccination as the only route. This has resulted in significant investments in funds for research and the delivery of available vaccines. In Zambia, for example donor funded vaccination contracts have been being handed out to the private sector since 1999 (Tembo 2005). This network of researchers and associated donors have argued that an alternative (again cheaper) approach involving antibiotic treatment had been long discredited. Generally vets prefer massive vaccination / eradication programmes (e.g. Dulu 2005).

52 See information on the Global Rinderpest Eradication Campaign, including maps of rinderpest-free zones at www.fao.org/ag/AGA/AGAH/EMPRES/grep/e_rinder.htm. The target is complete eradication by 2010, although the 'mild form' of rinderpest is still a cause of concern in the Somali ecosystem (see above).

53 Andy Catley, pers. comm. See, for example, *New Scientist*, 30 April 2005.

5.3 Disease control technologies and their delivery

Given the scientific uncertainties inherent in any disease control programme, it is not easy to define what is the most appropriate control technology. Again technologies are often defined by a supply push rather than a more rounded assessment of demand, efficacy and appropriateness to particular conditions. It is all well and good having an effective technology in the lab, but can it be delivered on a sustained basis to livestock keepers in remote areas in Africa?

Indeed discussions about alternative options to disease control often get wrapped up in much larger debates, with deep historical and institutional roots. Certain groups – often associated with powerful individuals and institutions – push for one technology over another. In the same way, certain strategies of disease control become embedded in institutions, reinforced by education and training programmes, funding partnerships and so on, often transferring ideas and approaches developed in another time and place to different contexts.

For example in tsetse vector control two (among a number) 'schools of thought' stand out (Allsop 2001).[54] On the one hand, there is the International Atomic Energy Authority's programme of sterile male control. This involves taking the main local species of *Glossina*, breeding them in large numbers, irradiating them and releasing the males with the intention of reducing the overall population (Feldmann and Hendrichs 2003). This has attracted significant funding, including the construction of a major new facility in Ethiopia initially to produce 250,000 sterile males per week aimed at eliminating tsetse from the southern rift valley.[55] Others argue that this approach is both expensive and ineffective. They point to much simpler combined techniques involving insecticide treated traps and the use of insecticides applied to animals (Williams *et al.* 1992). This they argue is more cost-effective and appropriate to most African settings (apart from perhaps the island of Zanzibar, the much trumpeted example of where, for reasons which should be obvious, the sterile male technique worked (Tambi *et al.* 1999). As the head of the Sudanese department in charge of tsetse control put it 'It is all well and good in Zanzibar, but look at my area [pointing to a map]. Releasing sterile flies all over southern Sudan doesn't make sense!'[56]

Approaches to disease control may have well-established historical roots, and may be more of a response to institutionalised 'tradition' – what we always do – rather than any assessment of appropriateness. The long-running debate in Europe between vaccination as against stamping out (for FMD and other diseases) is a good example. After the disease's first appearance in 1839, FMD control measures in the UK, for instance, emerged in 1869 when legislation restricting the movement and marketing of FMD-infected animals was introduced in the wake of the devastating 'cattle plague' of 1865–7 and by the early twentieth century stamping out became the policy of choice (Woods 2004b). These became established in both law and institutional practice, and became a central tenet of veterinary practice and education. This contrasted with continental Europe which increasingly had control policies centred on strategic vaccination (Woods 2004b). During the FMD outbreak in 2001 these two contrasting perspectives came to the fore, with different advocates across Europe (including within the UK) arguing the different lines, usually in line with their geographic origins. These European debates have relevance in Africa, since, as

54 For divergent perspectives see *Points of View – A Testing Time for Tsetse Eradication* at www.new-agri.co.uk/02-6/pov.html (2003) and *A Trio of Instruments for Tsetse Control* at www.new-agri.co.uk/04-1/develop/dev03.html (2004). For the major international programmes positioning themselves variably in relation to these options, see the FAO-led Programme Against African Trypanosomiasis (PAAT) at www.fao.org/ag/againfo/programmes/en/paat/home.html; the IAEA/FAO sterile insect technique approach at www-naweb.iaea.org/nafa/ipc/index.html and the African Union led Pan-African Tsetse and Trypanosomosis Eradication Campaign (PATTEC) at www.africa-union.org/Structure_of_the_Commission/depPattec.htm.

55 www-tc.iaea.org/tcweb/publications/factsheets/ethiopia.pdf

56 Interview, Khartoum, March 2005.

discussed above, the colonial veterinary systems were set up very much in line with their colonial originators' visions. Thus British colonies' veterinary policies and practice had a very British flavour, with French colonies reflecting distinctly French practices.[57] Today, depending on the people in post in senior positions, international organisations may reflect these divisions too.[58]

Strong networks of actors, supported by well-funded and well-connected international institutions and deep historical connections, can often sway debates about appropriate measures for disease control in ways that are not always to the benefit of poorer countries and their livestock producers. Commercial interests in drug and vaccine sales, as well as the need to show the public-good, poverty-reducing quality of research programmes in biotechnology science or atomic energy, often drive such debates, swamping alternative views and perspectives. While it may well be that CBPP vaccines or sterile male techniques may be the most effective and appropriate control technologies in particular settings, this needs to be demonstrated through rigorous and appropriate comparison, not just on the basis of forceful claims and funding might.

5.4 Disease control requirements: zones, fences and cordons sanitaires

Technologies for disease control – whether vaccines, chemicals or drugs – must be complemented by often complex and difficult-to-implement control measures if they are to work over the long term. These involve strict movement controls and the establishment of zones (e.g. disease free, surveillance and buffer) to manage disease spread, and control it effectively in case of an outbreak. This often involves a whole paraphernalia of (often widely resented and frequently avoided) measures: fencing, movement permits, veterinary quarantine stations and check points, road blocks, spot checks, surveillance systems and so on. Short of complete (global) eradication (the rinderpest model), there is always going to be some potential for renewed infection and outbreak, particularly in proximity to wildlife reservoirs, so restrictions on movement and close monitoring of stock and disease status is essential. This has to be guarded against stringently, especially if the efforts to gain herd immunity through vaccination have been gained at great cost.

The recent experience of Zimbabwe is again instructive. With the breakdown of movement controls, and associated political, economic and administrative disruption, during the period of land reform between 2000 and 2001, a number of FMD outbreaks occurred. These were initially limited to Matabeleland province, but spread rapidly. With no foreign exchange to import vaccines (and compounded by veterinary staff, fuel and vehicle shortages) in 2001–02 the outbreak could not be controlled, and by 2003, 354 outbreaks were recorded, stretching way into the centre of the formerly FMD-free beef export zone.[59] By 2004 only 86 new focal points were recorded, but reinstituting movement control given the transformed agrarian landscape following wholesale land reform looked a far-fetched possibility (Scoones and Wolmer 2006; Mavedzenge *et al.* 2006).

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57 One exception to this rule was found in the British Cape Colony. Gilfoyle (2003) reveals how British quarantining and slaughter-out policies proved practically unfeasible, intolerably expensive and politically controversial and stimulated a home-grown inoculation campaign.

58 The current collaboration between ALive, FAO-AGAH, CIRAD and OIE reflects linkages between French vets – with Anglophone organisations like Pirbright, UK, Geelong, Australia and Plum Island, USA seemingly outside the network (Tim Leyland, pers. comm.).

59 Even before the major disruptions in Zimbabwe accompanying land reform the country's ability to control FMD effectively had declined resulting in sporadic outbreaks in the non-export zones. Thus in 1997 there was one outbreak (involving 655 cases, and 971,754 cattle were vaccinated). Again in 1999 there were two out breaks (29 cases, with 460,692 vaccinated in 1999 and a further 339,675 in 2000 when no outbreaks were recorded). In 2001 the outbreaks accelerated, with 18 SAT 2 outbreaks (involving 4710 cases and 979891 animals vaccinated). In 2002 there were – 8 SAT 1, 2, 3 outbreaks (10,847 cases, 1,500,000 vaccinated) and in 2003 a massive 354 SAT 1, 2 outbreaks (20,295 cases, the first deaths (97) and 4,144,070 animals vaccinated) (see www.oie.int/hs2 for details).

Southern African countries have prided themselves in their effectiveness at establishing and maintaining disease free zones (especially from FMD). In Namibia this has involved the establishment of a strict dividing cordon fence between the northern communal areas and the southern commercial farming districts in existence since 1908. This 'red line' has become the basis of Namibia's ability to secure EU export contracts for its beef industry, but maintaining the line, both economically and politically has become more and more of a challenge – as traceablity standards and costs rise ever upwards and the 70 per cent of the population living north of the line remains unable to market its livestock to the south (resulting in depressed prices) or make use of the lucrative EU export market (Bishi 2005; see above).[60] In the same way Botswana has gone to great efforts to maintain FMD free zones.[61] In South Africa, FMD outbreaks in Limpopo Province in mid 2004 caused great concern especially as this included some buffer and surveillance areas. A total ban on movement from the quarantine zone was instituted and a vaccination programme launched.[62]

All these disease control efforts, combined with selective zonal disease eradication, have come at a significant price, both in terms of the livelihoods of livestock keepers and in terms of regional cross-border tensions.[63] For disease freedom means disease freedom according to EU inspection officials and any transgression can result in the loss of major market opportunities. Movement control and fence lines were often, as discussed earlier, important elements of colonial control policies, and resented by many as a result. In the colonial era they were often implemented with extreme force, with cattle (sometimes herders) shot if they crossed the line. But post-independence veterinary officers have been more reluctant to implement such policies as stringently as their predecessors. Deals, bargains, bribes and turning a blind eye have meant that many lines have become sieves, with movement control more an aspiration than a reality. Arguments about epidemiological units and herd immunity levels do not go down well with politicians or well-connected businessmen eager to trade over veterinary control lines. And with the declining capacity of veterinary departments to police such measures, it is often easy to by-pass the regulations completely by moving livestock at night, cutting fences or going around the check post.

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60 Namibia has a designated zone accepted by the OIE from 1997, see: www.oie.int/eng/info/en_fmd.htm. The 'imbalances' that this creates has attracted press commentary, particularly as no FMD outbreak has occurred in this area since the 1960s, see: 'Beef Industry Faces Imbalance – the imbalances of the past continue in the country's beef industry and as a result farmers north of the so-called 'redline' veterinary cordon fence feel still marginalised in terms of meat marketing on international markets', *The Namibian*, 23 June 2005. See also 'Namibia Ready to Tackle FMD', *The Namibian*, 4 April 2001.

61 The government announced a new strategy to eliminate FMD in Botswana in 2005, fearful of a repeat of the 2002–03 outbreak and its effect on the country's export market, resulting in estimated losses of US$38.4m. The country was again declared FMD-free by the EU in August 2003, although the effects are still being felt ('Botswana Farmers Still Recovering from FMD – Botswana's cattle owners are still trying to come to terms with two successive outbreaks of FMD that resulted in the destruction of thousands of livestock to contain the virus, *The Namibian*, 18 January 2005. For details of the new strategy, see: *Botswana: Govt Unveils Plan to Control FMD*, IRIN News, 2 March 2005: www.irinnews.org/report.asp?ReportID=45877. In May 2006 a further outbreak of FMD in southeast Botswana led to the closure of abattoirs and the recall of meat en route to Europe and South Africa. *Botswana: Foot-and-mouth Threatens Beef Industry*, IRIN News www.irinnews.org/report.asp?ReportID=53088&SelectRegion=Southern_Africa&SelectCountry=BOTSWANA (accessed 7 June 2006).

62 See *FMD in South Africa. Virus Type SAT2 in FMD Controlled Area (Follow-up Report 4*, October 2004 (www.oie.int/eng/info/hebdo/AIS_21.HTM#Sec3). The readjusted control zones are at www.nda.agric.za/vetweb/images/MapFMDTemp.jpg. For regional disease status as reported to the OIE for Botswana, Namibia and South Africa at www.oie.int/hs2/zi_pays.asp?c_pays=30; pays=135; pays=217 between 1996 and 2004. See global status of FMD on the website of the European Commission for the Control of FMD at www.fao.org/ag/againfo/commissions/en/eufmd/eufmd.html

63 With the FMD outbreaks in Botswana blamed on incursions from Zimbabwe, the erection of an electric fence along the border exacerbated tensions: see *Botswana: With Xenophobia Rising, Electrified Border Fence Hailed*, IRIN News, 23 February 2005.

5.5 Technology delivery: feasibility, replicability and sustainability

Getting technologies to users on a sustainable basis is often as big a challenge as developing the technology in the first place. There have been many, many examples of effective technologies which remain on the shelf of public labs or unreleased by private companies because the potential for delivery (through market or public delivery mechanisms) was not there.

What are the key conditions that allow for technology uptake of disease control technologies? First there is the nature of the compound. In many settings where cold chains are absent or ineffective, heat stability is a key requirement. Often such compounds must be kept for long periods,[64] sometimes in poor storage conditions at high temperatures, so they must be seriously robust. Such products should require limited costly back-up infrastructure too, with limited need for continuous refrigeration or the building of large factories (for sterile male production or vaccine manufacture for example).

The economics of delivery very often requires high volume, low margin markets. Products must be in high demand for a viable marketing system to thrive without subsidy. If traders and drug store owners are to make a profit, this is most likely to come from popular products where small profit margins can be reaped. For demand to persist, especially among poorer livestock owners, products must be cheap – not just in international terms, but in relation to local purchasing power – and available in small batches. Studies have shown that in remote pastoral areas, this is possible. Livestock owners are both willing and able to pay, and drug suppliers and local animal health workers (perhaps the same person, or with a CAHW working with a local store owner) are able to make a living out of providing the service with no on-going subsidy (although in most cases start-up training was provided through external support (see above; Grace and Leyland 2001). The market is for fairly basic, run-of-the-mill products; it is therefore questionable whether more sophisticated (and so expensive) bio-engineered products would have the same market.

For delivery in remote areas with relative slow turnovers, long shelf life is essential too. This means that traders, dealers and veterinarians can keep a product for a sufficient period without losing stock due to date expiry (or, more likely, using expired products). A drug, chemical or vaccine must also be easy to apply. If large numbers of livestock must be covered, it cannot be a complex operation requiring high levels of skill. If the product is to be administered by the owner or CAHWs, then application methods must be easy and there must be no side-effect complications.

There has been much debate (see above) on the organisation of delivery systems – public, private, or hybrids. This has an implication for the type of technology that will be viable in any setting. In public systems with high levels of subsidy, anything goes; but in essentially privatised systems (increasingly the most frequent route to receiving veterinary services in Africa) the key factor is profitability. But assessing viability and sustainability is more than looking at simple gross margins. With small-scale suppliers in remote areas, business risk and credit must be taken into account. Where credit markets are weak or non-existent the up-front costs and ability to pay back product suppliers is a critical factor. Cyclicity and risk is also important. In certain periods there may be high demand for products (when the local economy is booming, or when a disease outbreak is occurring), but in other periods there may be little business (when drought strikes, or when no major diseases are evident). A mix of products and services within the business (and not just veterinary delivery) is thus key to offset such risks and smooth income and profit cycles. In other words, the broader business and market setting is perhaps as important as the technology.

Private or public suppliers of veterinary products must be sure of their quality and effectiveness if their reputation is to be sustained, and the trust with customers and service users is

64 Although private practionners do often recognise that demand tends to be highly seasonal and stock accordingly (Andy Catley, pers. comm.).

to be assured. Regulation of veterinary products is thus a key area of policy. While most African countries have various types of drug regulation on the statute books, these may have little impact on the ground. There are a growing number of drug suppliers – from the standard, often multinational, producers in Europe or North America to an increasing array of Asian (Chinese and Indian in particular) producers, to local franchises of both. In addition there is a large and unregulated black market of pirated products which may carry replicas of the same brands and packaging of the familiar high quality products, but are actually often placebos or poor imitations at best.

With such a diversity of products available in an effectively unregulated market, what should be done? There are strong incentives for both local suppliers and for livestock owners to make sure the best product is available, but with massive price undercutting of previously inflated monopoly pricing of more conventional suppliers, Asian (and some pirated) alternatives look promising. But how effective are these products? And how can good products be distinguished from ineffective ones? Without testing facilities and a network of regulatory agents, this task must fall to local suppliers and consumers.

Learning to read bar codes, being able to spot pirated copies and carrying out local experimentation of different products are all becoming part of the practicalities of technology delivery. Trust in the supply chain is key, but with underhand business deals, bribes and other types of corrupt practice supply systems – and trust relations – can be quickly destroyed. While state regulatory capacity is likely to remain limited and weak, it is important that some form of external arbiter and control mechanism does exist. New quasi-privatised systems, dominated by multiple supply chains and diverse branded and unbranded technologies, require some form of regulatory effort. Rather than pretending that a US or European style drug and vaccine control system is possible (as is usually assumed in the legislation), there is a need to develop regulatory systems for technology delivery that fit local circumstances and demands.

5.6 Funding and ownership: public, private and partnerships

A key question relating to all of the themes addressed in the sections above is how should technology generation be funded, and who should do it? This raises the familiar argument as to whether veterinary products are public or private goods, and whether public goods in particular are international or national goods. There are good arguments in all directions. It is widely accepted that transboundary disease control possesses key aspects of an international or global public good challenge. This is the argument of many of the international agencies which are pushing with renewed effort on this front. But for whose real benefit are these initiatives? The arguments are usually framed in terms of assuring 'safe trade' (see above), but trade is usually assumed to be private, or at least a national, affair. And the impacts of exported diseases will be most keenly felt in the high value production systems of Europe and North America, not directly in Africa. For many other disease control measures the private focus is clearer. For these diseases it is the livestock owner who will suffer as a private individual if the disease affects production. But what if it is spread to others through non-treatment, particularly to animals owned by poorer producers who cannot afford private treatment? Surely this too is a case for public intervention to assure herd immunity or disease control (and better eradication) for the public good.

Clearly there is no easy answer. Answers come less through philosophical musings on the nature of goods, but more through the pragmatics of financing and ideological positions around the way delivery systems should be structured and paid for. As earlier sections have discussed, there was a time when veterinary services were seen very much as part of the public sector system – from technology development through to delivery. This has changed, and many hybrid arrangements exist in different places depending on often very arbitrary choices, decisions and histories.

The financing of the full costs of research, development and production of any veterinary product by an African government is today out of the question. The cost of setting up a production plant for a relatively simple vaccine such as FMD runs to millions of dollars. In southern Africa, Botswana has such a plant owned by the Botswana government (with a hefty subsidy and guaranteed government purchase) and affiliated with the French company, Merial.[65] But there are few other examples.[66] Upstream research and development too can be exorbitantly expensive. The process from molecule search to product development to trials and testing is a multi-year undertaking with uncertain outcomes. Costs can be as high at US$10m for a single product, and these figures are going up with the complex recombinant DNA vaccines which require more sophisticated R and D costs and more elaborate safety testing.

It is this basic economics that has driven an interest in linking up with the private sector in the development of new animal disease control and health care products. Given the complexities of such arrangements, this is usually envisaged at an international scale, with public (or philanthropic) money being invested in a major effort focused on key diseases or conditions with the hope of widespread impact. Lying behind such efforts are the assumptions that the private sector has the resources and capacity to produce products that the public sector cannot; that the private sector has a number of products which have been developed partially, but did not find a market and that with public support they can be made available; and that the private sector will make such products available at a reasonable price and free of patent restrictions, especially in poorer parts of the world such as Africa (outside companies' main markets and where public relations advantages can be reaped).

The model of a 'public-private partnership' is highly appealing therefore. It seems the best of both worlds, a rare win-win solution, and a potential solution to the major resource and capacity constraints faced by the public sector, particularly in Africa. A number of such initiatives have been proposed, taking the lead in particular from the major 'Global Fund' 'deliverable technologies' initiatives of the Gates Foundation.[67] But what are the limitations of such models? The assumptions listed above are of course big ones. On-the-ground testing of these is yet to happen, and there may be practical hitches along the way. For example, the assumed wealth of on-the-shelf technologies in the private domain may involve some wishful thinking. They may exist, but are they useful and deliverable in remote, poor African settings? Patent release is all well and good, but it may involve complex legal deals involving multiple parties (holding patents to different elements of the process or product), taking up much time and legal wrangling.[68] Major companies are unlikely to release patent protection, particularly at a time of increasing global competition, in areas where there is at least some market potential. So if there is no market potential, then how are product suppliers and delivery agents supposed to make a profit? Investing large amounts of public money in the private sector as part of a partnership does not always square with the assumptions of how public money should be used. Is this not just a subsidy to the private sector who are not geared to producing products for low value markets and

65 South Africa has capacity backed by significant research (see Ondersterpoort Veterinary Institute: www.arc.agric.za/institutes/ovi/main/intro.htm), including international collaboration on new FMD vaccines (www.ars.usda.gov/is/pr/2002/020312.htm). The Pan African Veterinary Vaccine Centre (PANVAC) at Debre Zeit in Ethiopia is also supposed to have a regional mandate for production, testing and regulation.

66 'BVI extends partnership with Merial' 2 November 2004, *Mmegi Business Week*; 'PS commends BVI for preventing FMD outbreaks', Daily News, 30 October 2001, www.gov.bw/cgi-bin/news.cgi?d=20011030. For information on the Botswana Vaccines Institute, see: www.bvi.co.bw/glanceprofile.htm

67 www.gatesfoundation.org. See discussion of GALV (above) in the context of the much feted African Agricultural Technology Foundation (www.aatf-africa.org; see discussion of livestock vaccines approach in 'Eradicating hunger through technology brokering' www.unido.org/file-storage/download?file_id=35242); and Clark *et al.* (2005).

68 Witness, for example, the famous golden rice patent deal involving 70 patent holders across 32 different institutions (Potrykus 2001).

poorer people? Surely it is only the public sector – with priority setting focused on poverty reduction priorities – that can deliver the type of technologies that are really in demand? Following this line the notion of 'partnership' is a misnomer: it is more public subsidy of private (and often hugely profitable) enterprise. And is this not a distortion of the wider (private) market? Why should a company in Europe be subsidised through such programmes and not their cheaper competitor in China or India?

Many questions are raised therefore about the broader governance of science and technology (Leach and Scoones 2006). A number of such issues are highlighted by this discussion: linking upstream research and development funding to downstream delivery issues; making sure priority-setting exercises are really in the interests of the poor and ensuring that technology ownership arrangements do not exclude poorer producers from benefiting from new technologies.

6 Conclusion: making policy choices, assessing trade-offs

The previous sections have highlighted a range of policy choices and trade-offs in the livestock sector in Africa, particularly around marketing, disease control and animal health care. With livestock issues in Africa back on the development agenda, there is much talk of pro-poor policy and sustaining pastoral livelihoods at the same time as supporting 'safe trade' and gaining access to export markets. But as the discussion in this paper has shown there are not always neat win-win solutions; there are always trade-offs and so choices to be made in setting priorities and making policy. The main aim of this paper has been to lay bare some of these, exposing some of the fudges and contradictions of current policy discussion.

As earlier discussion has noted it may not always make sense to pursue a disease eradication policy at all costs in order to aim for often highly uncertain export trade markets; instead the investments (which are often considerable and distorting of research, delivery and marketing systems) may best be directed to other priorities. A key lacuna in current policymaking processes in the livestock sector in Africa is ineffective (or inappropriate) priority setting processes. These often get diverted, distorted or blinkered by particular interests or sets of assumptions. Choices do not emerge from simple rational exercises, driven by scientific or economic modelling. Instead, such calculations must encompass a range of other additional, and too often obscured, factors – social/political; long-term/short-term and local/non-local.

There is an enormous amount of policy talk about what constitutes a 'pro-poor' policy. But much of this descends into confusion and circularity as everything it seems is brought into the fold. Nearly everything can be justified as 'pro-poor', as long as you include some (often wildly heroic) assumptions about how benefits trickle down, link and multiply. What is needed, instead of these sometimes vacuous and generic statements, is a more rigorous framework for asking what intervention is likely to have a wide, sustained impact on poverty reduction and livelihood improvement.

Figure 6.1 offers a preliminary outline of such a framework, drawing on the discussions in earlier sections of this paper. Three thematic priorities are discussed in line with the previous sections of this paper – marketing and trade; delivery and organisational and science and technology. These are looked at in relation to the two broad (and of course overlapping) policy narratives identified – a livelihood and local production focus and a trade and export market focus. The final column offers a list of trade-offs and policy choices arising, all areas requiring further deliberation.

Figure 6.1 Prioritising policy choices and recognising trade-offs: an outline framework for animal health care and disease control policy in Africa

	Narrative 1: Livelihood and local production focus	*Narrative 2: Trade and export market focus*	*Trade-offs and policy choices: key areas for deliberation*
Marketing and trade priorities	Local and regional markets for multiple species, based on locally-defined standards. Infrastructure to encourage local and regional trade, and policies and institutions that support local entrepreneurship and production.	International, high value export markets, requiring transboundary animal disease control/eradication and compliance with OIE/EU/US and international food retailers' standards. Investment in export zones, quarantine systems, registered abattoirs and certification systems.	What markets and trading partners are most likely to offer, the highest, most reliable returns in the long term (accounting for costs of access)? Does disease eradication make sense, and if so for what diseases, through what mechanisms? Who should pay?
Delivery and organisational priorities	Decentralised private network of paravets and drug traders/ suppliers. Public support for poverty-oriented livelihood strategies. CAHWs as front-line health workers, working with reliable and accessible vet product suppliers.	Decentralised private network of paravets and drug traders/ suppliers with centralised system of disease reporting and control. CAHWs for eradication campaigns and surveillance.	What should the respective roles of centralised and decentralised vet services be? Who should pay for these services – what mix of public and private support makes sense? Should expertise be focused on meeting local demands and needs or national (export and trade) priorities?
Science and technology priorities	Production diseases of multiple livestock species. Disease management, including of endemism. Delivery of low cost, appropriate vet products, focused on easily treatable, high-impact diseases.	OIE list of transboundary diseases, affecting especially high value, export animals. Disease eradication and surveillance and reporting systems. Campaigns, including mass vaccination etc. Genomics-based and biotechnology products prioritised.	Where should limited public R and D funds be spent – on dealing with production diseases of multiple livestock species in poorer areas or on List A diseases? Should such efforts be through public funds and at what level (national, international)? What role can the private sector realistically be expected to play?

The issues and questions in Figure 6.1 are illustrative, stylised and certainly not comprehensive. Clearly the type of questions asked and trade-offs and choices encountered will depend on the setting and context. As discussed in the opening sections of this paper, African livestock systems are enormously diverse. Policy issues will be dramatically different for the highly dualistic economies of southern Africa where a regulated, market-oriented commercial sector exists which has the possibilities of meeting European standards, as against the mixed pastoral economies of east Africa and the Horn, where different priorities and different market opportunities may exist.

As a consequence, a number of factors are likely to affect what a 'pro-poor' livestock and animal health policy will look like. These will include:

- The structure of the economy - dualistic systems with a commercial sector (e.g. Namibia, South Africa) versus a fully pastoral economy (e.g. Mauritania) versus a live stock sector in both pastoral and agricultural areas (e.g. Ethiopia, Kenya).
- The political context – for example the political viability of maintaining a distinct commercial sector in southern Africa or the lack of political voice and influence of pastoralists in agriculture-dominated polities.
- The relationships between livelihoods and livestock – for example as a commercial product for sale, or as a multiple input into livelihood systems.
- Geography and the politics of markets – market access may depend on proximity (e.g. to the Middle East), past connections (e.g. colonial links), religion (e.g. Islamic markets) or politics (e.g. deals between political allies).
- The quality and effectiveness of existing infrastructure – including roads, abattoirs, holding pens, processing plants, air freight/ports and so on.
- The capacity of public veterinary, regulatory and certification services. For example: to deliver ambitious and expensive disease control and eradication programmes, including maintaining fence lines, surveillance systems etc.; to regulate new drugs/veterinary products; to certify animal products for export (and be trusted to do so); to accommo date or resist para-profressionalisation or to train staff in participatory epidemiological techniques.
- The capacity of the private sector to invest in R and D or market/delivery infrastructure, deliver services in remote areas and to (largely) self-regulate to maintain trust and so export markets.

Answering the question of what should be the components of a 'pro-poor' disease control and animal health policy in a particular place is therefore not easy, and always context-dependent. In whatever setting, it must tackle head-on the trade-offs and policy choices listed in the third column of Figure 6.1. Any policy process must therefore grapple with numerous imponderables, uncertainties and simple ignorance (Stirling 2005). It is not easily amenable to a scientific, objective answer; instead it must be opened up to a wider – always contested, usually political, inevitably interest-laden – deliberation. The aim of this paper has not been to provide definitive answers, but to open up the discussion, and avoid the tendency to close debates down, by hiding or ignoring assumptions, and failing to test options against local realities.

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