



## Animal Health Policies in Developing Countries – A Review of Options

U. Pica-Ciamarra and J. Otte

### ABSTRACT

Following the poor experiences of state-led and market-based delivery systems of animal health services in the last decades, developing country governments are experimenting with new and innovative policy instruments to concomitantly improve the public delivery of animal health services and to sustain efficient and equitable markets for animal health services, particularly in low-income rural settings. In this paper, a demand-supply framework is used to identify and categorise the various policy instruments available to decision makers to improve the quality and coverage of public and private animal health services in remote rural areas, including decentralisation; cost-recovery mechanisms; combined human-animal public health service delivery; sub-contracting; provision of subsidies/grants to animal health service suppliers and / or livestock keepers; institutionalisation of community animal health workers; support to membership and / or non-membership organisations. Each policy instrument has its pros and cons and its implementation requires different tasks and capacities of the public sector, as well as of the livestock keepers themselves. None of the identified policy instruments is *a priori* superior to the other, nor are they mutually exclusive. It is the task of policymakers, given the unique economic and institutional characteristics of their countries, including the specificities of the livestock sector, to identify the most appropriate combination of policy instruments necessary to establish an equitable and efficient system of animal health service delivery.

## 1. Introduction

A massive increase in the demand for food of animal origin occurred in developing countries over the last decades: consumption of meat grew at 5.6 percent per annum between 1979 and 1999 and that of milk and dairy products at 3.4 percent per year (FAO, 2003). This trend, resulting from growing per capita incomes, population growth and urbanization, is predicted to continue in coming years and be larger than for either major cereals or roots and tubers. It is expected to severely impact not only on livestock production and relative prices along the production chain, but also on the environment, public health, trade flows and, more broadly, on the world food economy (Delgado *et al.*, 1999).

The growth in the demand for livestock products and by-products is deemed might contribute to economic growth and poverty reduction (e.g. Conroy, 2003; de Haan *et al.*, 2001; Delgado, 2003; ILRI, 2000; Owen *et al.*, 2004; Seré C., 2003; World Bank, 2005) because about 70 percent of the 880 million rural poor are at least in part dependent on livestock for their livelihoods (LID, 1999; World Bank, 2007). The potential contribution of livestock to their income is however far from being fully exploited, because countless constraints prevent rural households from making the best use of their livestock assets. These include recurrent shocks, such as droughts, floods, conflicts, and chronic constraints such as shortages of animal feeds and drugs, limited water availability, insufficient financial resources, inadequate information and knowledge, and poor access to output markets (Pica-Ciamarra, 2005).

Among these constraints, animal diseases are estimated to curtail annual livestock output in developing countries by about 30 percent (FAO, 1990; Ott *et al.*, 1995), without taking into account foregone income through reduced production and consumption linkages and the negative impacts of zoonotic diseases on public health. Animal health services thus evidently fail poor livestock keepers.

Deficient animal health services reflect the evolution of the economic development paradigms, and the ensuing animal health policies, since after World War II. Between the 1950s and the 1970s, governments in a large number of countries took full responsibility of animal health service delivery and built heavily subsidised systems and networks of public livestock services. That strategy resulted in disappointing outcomes, both because of increasingly unsustainable budget deficits and the ensuing macroeconomic instability, and because governments often lacked knowledge, information and incentives to efficiently supply animal health services. In response to the failure of state interventionist policies, governments in the 1980s increasingly relied on the market for the provision of animal health services in rural areas, with their role limited to the supply of some public goods, such as food hygiene inspection and the vaccination of livestock against zoonotic and highly contagious diseases. Whereas these policies did some

good, results were largely below expectations in remote rural areas because of high transaction costs and pervasive market imperfections, with both the public and private sector providing inadequate animal health services to smallholder farmers (Umali *et al.*, 1992; de Haan and Bekure, 1991).

The last decade or so has thus witnessed a further shift in focus in animal health policies for smallholder farmers in low income rural areas. The key policy issue in these areas is no longer market versus state, but how to improve the supply of public goods, given the government budget constraint, and/or how to design and implement public policies to establish both efficient and equitable markets for animal health services, that is how to promote socially desirable market outcomes while keeping in place, as much as possible, individual incentives, respecting the law of demand and supply, and preserving the equilibrium in the government budget. This is largely an unexplored area for livestock policy makers, who are therefore experimenting with new and innovative policy instruments, such as decentralised animal health services; combined human-animal health services; sub-contracting public/private animal health service delivery; institutionalisation of community animal health workers; subsidies to private veterinarians to operate in remote rural areas; vouchers to livestock keepers to pay for animal health services.

This paper presents a critical review of the many policy instruments available to governments to improve the effectiveness, in terms of both quality and coverage, of public and private animal health services in low income rural areas. The next section reviews the rationale for public actions to establish an efficient and equitable system of animal health services, and classifies policies according to whether they impact on the supply or demand side of the market. Section three compares the various identified policy options, looking at their potentials and weaknesses and, in particular, at the role of the government in their implementation. Section four summarises the main findings and draws some conclusions

## **2. A Taxonomy of Animal Health Policies**

### **2.1 The role of the public sector in the provision of animal health services**

Animal health services can be financed and provided both by the public and the private sector. There are cases, however, in which public interventions are definitely required to preserve public health, and for smallholder farmers to access preventive and curative animal health services, as well as animal drugs (Ahuja and Redmond, 2004; FAO, 1997; Leonard, 2004; Umali *et al.*, 1992, 1994).

(a) Some animal health services are public goods, which enjoy the properties of non-rivalry (can be utilised jointly by many) and non-excludability (those who do not pay for the good can use it), and are not supplied by the private sector. For instance, an individual farmer will have no incentives to control tsetse flies in open ranges as the benefits will extend to the whole community free of charge. For the supply of public goods, therefore, someone must take charge of organising a collective action, which can be done at various levels, from voluntary cooperation in local communities to the central government in case of public goods benefiting a large number of people in society, such as the control of zoonotic diseases.

(b) Lack and asymmetries in information prevail in the delivery of animal health services, which provide incentives for opportunistic behaviour. Typically, a livestock keeper is not able to unequivocally judge the quality of the service of a veterinarian, or the effectiveness of the drugs he buys to treat his animals. Both the service and the drug are either experience or credence goods, whose value is impossible to assess ex-ante, and difficult to ascertain after consumption as the physical conditions of the animal depend on a variety of elements, including, but not only, good diagnosis and use of proper drugs. In order to correct this type of market failures, the government should develop policies increasing the quantity and quality of information to buyers, for instance by limiting business permits and licences to qualified veterinarians and drug sellers.

(c) Some livestock services generate consumption externalities, which occur when the actions of some stakeholder in the livestock production chain benefit or harm other actors, without those benefits being paid for or the damage compensated. For instance, a farmer who immunises an animal against a contagious disease, such as FMD, reduces the risk of infection for the herds of other farmers too, thereby generating a positive externality. Since the farmer is not compensated for the externality he produces, however, he might 'under-vaccinate' his herd. The result would be an under-supply of goods generating positive externalities, whereas the opposite occurs for goods generating negative externalities. In these circumstances, the government is expected to step in with collective solution, through supporting the production of goods generating positive externalities (e.g. through subsidies) and preventing the excessive supply of those generating negative externalities (e.g. through taxes).

The existence of public goods, asymmetric information and/or externalities calls for state intervention in animal health services, and there is today consensus about which services are public, which are private, and which ones generate externalities or provide incentives for opportunistic behaviours.

**Table 1.** Nature of livestock services

	Type of economic good	
	Public	Private
Clinical Interventions		
<i>Diagnosis</i>		X*
<i>Treatment</i>		X**
Preventive interventions		
<i>Vaccination</i>		X*
<i>Tick control</i>		X*
<i>Tsetse control</i>	X	X*
<i>Veterinary surveillance</i>	X	
<i>Drug quality assurance</i>	X	
<i>Food/hygiene inspection</i>	X	
<i>Veterinary research</i>	X	X
<i>Veterinary extension</i>		X
Provision of veterinary supplies		
<i>Production</i>		X
<i>Distribution</i>		X

\* Private good with consumption externalities; \*\* private good with consumption externalities in case of contagious diseases.

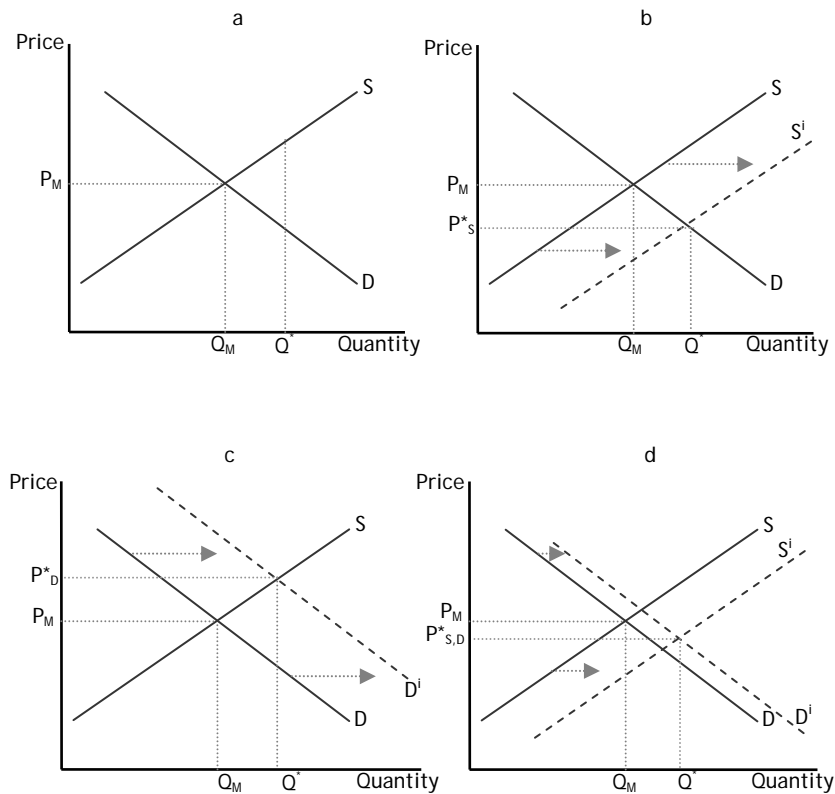
Source: elaborated from Umali *et al.* (1992).

Government activities to supply public goods reduce information gaps and externalities to promote economic efficiency. The income distribution realized through efficient markets, however, is not always socially desirable as markets can be efficiently constrained. That typically happens when economies of scale and transaction costs are brought into the picture. The former occur when average cost of production decreases with output; the latter are 'dead weight losses' that reduce the profitability of market exchanges, such as travel, time and paper costs: the implication of both is that some private services are not available in the market. For instance, despite a livestock keeper being willing to pay for both the drug to treat his animal and the service provider's fee, drugs may not be available on the market because the high-fixed cost element of production makes it unprofitable for private investors to produce them, or high transaction costs in sparsely populated rural areas make the overall cost of the veterinarian's service – including his fee, transport and time costs – prohibitively expensive. Even though markets are efficient, therefore, economies of scale and transaction costs can lead to socially undesirable equilibria in the market for animal health services, particularly in low income rural areas characterized by high transaction costs and pervasive market imperfections. Public actions are necessary to remedy these inequities.

## 2.2 Supply- and demand-side animal health policy instruments

The distinction between public and private goods, and the concepts of asymmetric information, externalities, economies of scale and transaction costs are helpful when designing animal health policies intended to serve the poor livestock keepers. They are however not sufficient to guide policy decisions for at least three reasons. (a) On the basis of efficiency or equity motives a case could be made for state intervention for all types of animal health services. (b) The fact the markets face certain problems does not in itself justify government intervention but it only identifies the potential areas for them; public policies should be implemented only if the social gains – which are often difficult to quantify as not entirely priced by the market – are larger than the costs assumed by the government (ultimately the taxpayers). (c) When public intervention is reasonable, the question remains about what is the most appropriate policy instrument for the government to apply. In other words, whereas economic theory suggests why and where the government should intervene, it provides limited hints on how livestock policies should be formulated and implemented.

A simple demand-supply framework is proposed to identify and classify the various animal health policy instruments available to policy makers to improve the effectiveness of public/private animal health services in remote rural areas. Assume that a market exists for animal health services/drugs, with the poor willing to pay and the private sector willing to supply services/drugs to the poor. This market is represented in fig.1a, where the price is measured on the vertical axis and the quantity of animal health services/drugs on the horizontal axis. The figure can be adjusted to include the supply of public goods, which is not drawn for simplicity. D is the demand curve by livestock keepers, which slopes downward given the lower the price the higher the quantity demanded; S is the supply curve, which slopes upward as the higher the price the larger the quantity of services/drugs that the private sector is willing to provide / sell. QM is the quantity effectively exchanged on the market, at price PM, and is determined by the intersection of the demand and supply curves. QM is considered either economically or socially inadequate, and Q\* is assessed as the optimal quantity of animal health services/drugs which should be available to livestock keepers, that quantity that would minimise the economic and social losses caused by animal diseases to society, such as reduced production level and increased public health expenditure.

**Fig. 1.** The market for animal health services

To achieve the 'optimal equilibrium'  $Q^*-P^*$  in the market for animal health services/drugs, the government could formulate and design policies promoting a rightward shift in the supply curve (fig. 1b), in the demand curve (fig. 1c) or in both (fig. 1d). Countless policies, both outside and within the livestock sector, can support these shifts. Examples of the former are technology policies reducing the cost of inputs for public/private service providers; trade policies allowing the importation of drugs at competitive prices; fiscal policies lowering income taxes for service providers; institutional policies improving the efficiency of the public sector, which all promote an outward shift of the supply curve, thereby allowing the public/private sector to provide the optimal amount of services/drugs  $Q^*$  at price  $P^*_S$ . Rightward shifts in the demand curve, for which consumers would be willing to pay  $P^*_D$  for  $Q^*$  livestock services/drugs, can originate in input supply or trade policies that enhance the returns to livestock assets; minimum-wage policies that increase household income; institutional policies that reduce public market fees, etc. Infrastructural policies, such as building a new feeder road, may support an outward shift of both the demand and supply curve. These examples, which largely refer to non-livestock sector policies, illustrate how an effective system of livestock services depends on countless policies beyond the direct control of livestock sector policy makers.

Policy makers in livestock departments, however, can not only influence the way non-livestock policies are formulated, but also themselves design some livestock sector specific policies which

improve the effectiveness of public and private animal health service provision. These policies can be classified as either supply-side or demand side policies, depending on whether their prime aim is to improve the capacity of the public and the private sector to supply animal health services to farmers (fig. 1b), or to enhance the ability of livestock farmers to demand animal health services (fig. 1c). Table 2 lists the main policy instruments identified following a review of experiences in a number of countries.

**Table 2.** A market-based taxonomy of animal health policies

Supply-side animal health policies		Demand-side animal health policies	
1	Decentralisation of public animal health services	7	Support to membership organisations providing animal health services to their members
2	Cost-recovery of public animal health service provision	8	Support to non-membership organisations providing animal health services to livestock keepers
3	Combined human-animal public health service delivery	9	Public subsidies to livestock keepers to demand for animal health services
4	Sub-contracting public/private animal health service delivery		
5	Public subsidies to private animal health service providers		
6	Institutionalisation of community animal health workers		

### 3. Supply-side Animal Health Policies

Supply side animal health policies are policies that allow either the public sector to provide better services to the livestock keepers for any given level of the public budget, or policies that provide market-based incentives to the private sector to supply animal health services even in low-income rural areas characterized by high transaction costs and pervasive market imperfections.

#### 3.1 Decentralisation of public animal health services

Decentralisation is an increasingly popular policy instrument to enhance farmers' access to public goods / services, including animal health services. It involves the transfer of some responsibilities from central to lower levels of government, such as regional and district authorities. Decentralisation is based on the rationale that the central government is ill suited to supply animal health services, because it has limited knowledge of local needs, scarce information about the kind of services to be supplied locally, and is subject to high delivery costs.



Conversely, local governments are said to have first-hand information about the demands of livestock keepers, to face lower transaction costs, as well as to have incentives to respond to their requests – as far as they are accountable to them. For any given level of the public budget, therefore, a decentralised system of animal health service delivery may provide more/better services to livestock keepers (Lai and Cistulli, 2005; Munyonyo, 1999; Norton, 2004; Smith, 2001).

Decentralisation of animal health services is typically part of a broader process of institutional reforms. Livestock departments, however, retain some freedom to manage, at least to some extent, the re-organization of public animal health service delivery. Livestock policy makers should:

- (a) Consider decentralisation as a tool towards a long-term development objective, rather than a response, as has been often the case, to budget constraints.
- (b) Reorganize the delivery of livestock services according to the main decentralisation thrust, namely de-concentration, devolution or delegation. De-concentration involves shifting administrative responsibility and resources to local governments; devolution involves shifting administrative and political decision-making power to local scale entities; delegation involves shifting the responsibility of the production/delivery of specific services to some semi-autonomous organisation.
- (c) Identify which services to decentralise, according to a thorough analysis of the advantages and disadvantages of central versus local delivery of public goods, which are different, depending the form of decentralization.
- (d) Implement, monitor and evaluate the decentralisation programme, including a transition phase. Decentralisation, in fact, entails costly institutional and organisational reforms, with savings and efficiency gains coming only after some years.

Policy makers should be aware that decentralised livestock services are not necessarily associated with improved quality and wider coverage.

- Information asymmetry works two ways: the central government may not know what livestock services to provide, but local governments may not know how to provide them, typically because of limited human resources.
- Some externalities exist at the level of local governments, not differently than at farm-level. Local authorities may therefore have incentives to under-supply some public goods (e.g. vaccination against zoonoses), particularly when their budget is limited.

- While administrative autonomy can easily be achieved, financial independence is difficult to obtain, particularly in low-income settings. Administrative autonomy with little financial self-sufficiency reduces the political freedom of local authorities, and thereby their presumed efficiency vis-à-vis the central government.
- Local governments may be vulnerable to capture by local elites, and thereby supply public goods which overwhelmingly benefit the better-off.
- In some circumstances there could be inconsistency between local and national livestock sector development priorities: for instance, local governments might fund their supply of animal health services through collecting levies on inter-regional livestock movements, thereby reducing the incentives to marketing animals.

### **3.2 Cost-recovery of public animal health service provision**

Lack of resources is often quoted as the most binding constraint to the provision of public animal health services. Diverting resources from other government budget lines or increasing the overall level of taxation are possible solutions. But improved efficiency and larger coverage in the provision of public services can be also achieved through charging part or all of the cost of some livestock services to end-users. These cost-recovery strategies rely on the assumptions that smallholders are willing and able to pay for animal health services and drugs; that producers often attribute low value to freely available livestock services and over-demand them, thereby contributing to waste scarce public resources; that fee-payers are empowered citizens, as they have an unambiguous right to demand and exercise pressure for service provision to be efficient (Dinar, 1996; James and Upton 1995; Keynian *et al.*, 1997; Rivera *et al.*, 2001).

Setting up a cost-recovery component in the public animal health service delivery is all but straightforward. Policy makers should:

- (a) Identify which animal health services are appropriate for cost recovery. Some, such as vaccination against highly contagious zoonoses, should be in most circumstances provided for free (or partly subsidised) given the potential devastating impact of such diseases on society.
- (b) Decide whether a fee or a levy should be charged. A fee charges individual smallholders directly for accessing some specific animal health service, such as a cattle dipping fee; a levy is a tax charged on the livestock industry as a whole, such as an extraordinary VAT on all livestock sales. Charges should be preferably based on fees rather than levies, the latter not being correlated to specific livestock services and the associated benefits to the industry.

- (c) Establish a price/cost for the service. At the simplest level, this would require calculating the full cost of each service, including direct, indirect and capital costs. This is relatively straightforward for private goods, but in case of public goods it is necessary to calculate the benefits the farmer enjoys with respect to the general public. For instance, a farmer should contribute to a vaccination campaign against Newcastle Disease in poultry in proportion to his own private benefit, with the differential cost being paid by society.
- (d) Implement and monitor the cost-recovery programme, with a focus on the revenue generated and the impact on livestock keepers.

Whilst cost-recovery mechanisms appear appealing, their design and implementation may be extremely cumbersome for the following reasons.

- Identifying and quantifying the private and public benefits of each livestock service so as to determine a fair price to charge is complex, particularly in case of services which are non-rival; for which no information/data are available; for which the fixed cost component is high, whilst the cost of serving one more livestock keeper is low.
- A delicate issue, particularly in the presence of zoonoses, is understanding whether major beneficiaries are livestock producers or consumers: if the latter were the largest beneficiaries, then cost-recovery strategies might entail a redistribution of wealth from the poor-livestock keepers to better-off consumers, or more in general an extraction of resources from the livestock keepers towards other economic sectors of society.
- Since the revenues generated by cost-recovery can be variable and smaller than predicted, the government should always be ready to step in to supply the required services to livestock farmers, especially in case of animal-related public goods. However, if livestock holders knew that some services will eventually be provided for free by the state, they would lose all incentives to pay for them.
- In many cases, poor farmers are not willing to pay for preventive animal health services, because their behaviour is driven by short-term objectives and concerns.
- Once a cost-recovery mechanism has been established, policy makers may have the incentives to reduce the transfer from the central government budget to the Livestock Department to offset any revenue from the cost-recovery programme. This would reduce the overall impact of cost-recovery schemes to efficiency outcomes.

- Despite some cost-recovery schemes having proved viable and efficient, policy makers may oppose their introduction as that can lead to reduced policy consensus due to the increased cost of services for some farmers.

### **3.3 Combined human-animal public health service delivery**

There are many similarities between human and animal diseases – as the increased popularity of the concepts of ‘one medicine’ and ‘one health’ stands to show – and between human and animal health service delivery systems. In particular, significant savings are said can be achieved through sharing the costs of production and distribution of human/animal health services and drugs, especially in remote rural areas of developing countries subject to high transaction costs. For any level of public resources allocated, therefore, combined human-animal health systems may improve the efficiency, in terms of both quality and coverage, of public service provision of animal health services (Roth *et al.*, 2003; Schelling *et al.*, 2005, 2007; Shears, 2000).

A government willing to establish a joint system of human and animal health service delivery should:

- (a) Identify priority areas where there are opportunities to establish combined human-animal-health delivery systems. Those are typically regions where resources for disease surveillance, diagnosis and control are limited.
- (b) Identify ways of collaboration between public human and animal health authorities. The simplest option would be sharing transport costs (e.g. vehicles for both doctors and veterinarians; shared cold chains) and some fixed costs (e.g. storage rooms and warehouses; laboratories for analyses). More savings could be obtained if personnel would be trained to carry out simple animal and human health tasks, such as disease surveillance/reporting and human/animal vaccination. It would be more difficult to have personnel trained in carrying out more complex tasks, such as both human and animal surgeries, and to have a common research agenda for human and animal health.
- (c) Establish criteria to share the fixed and variable costs of a joint system of service delivery between human and animal health authorities. This should include an assessment of actual costs as well as of the positive externalities generated by human and animal health services, both one on each other and on the society as a whole.
- (d) Implement and monitor the established joint system of human-animal health service delivery.

On the basis of the few documented experiences of combined human-animal health service delivery, the main challenges to establish such systems appear the following:

- It is difficult to identify 'scientific' criteria to allocate fixed/variable costs between human and animal health authorities, particularly when externalities are brought into the picture. For instance, controlling brucellosis benefits livestock keepers (more milk produced), people (reduced infections and payments for treatment) and the public sector in general (reduced hospitalization and provision of drugs). How should the cost of controlling brucellosis be shared between producers, consumers and the public sector?
- Identification of criteria for cost-sharing is particularly difficult in case of emerging diseases, about which there is still scientific uncertainty. For instance, what are the potential impacts on highly pathogenic avian influenza (HPAI) on humans? Should animal or human health authorities compensate farmers if a decision is taken to cull their poultry flocks?
- There is a lack of public health personnel trained in the complexities of the interface between human and animal health. In the short-run, therefore, the potential savings from a combined human-animal health system of service delivery are limited, as the returns to medium to long-run investments, such as for instance innovative curricula in medical and veterinary schools, take time to harvest.
- Human health issues are traditionally given higher priority than animal health issues in the policy debate and the government budget. That may create difficulties in establishing constructive partnerships between human and animal health authorities.

### **3.5 Sub-contracting public/private animal health service delivery**

Governments often provide services of sub-optimal quality because of limited information, rent-seeking behaviour, and poor accountability and incentives within the bureaucracy. It is suggested, therefore, that gains in efficiency, both in terms of quality and coverage, could be achieved through sub-contracting the delivery of some animal health services to private practitioners. In this way, all inefficiencies / disincentives within the government bureaucracy could be eliminated *ex ante*, and savings made as many public veterinarians / animal health assistants would no longer be recruited on a long-term basis. At the same time, private animal health actors should be willing to be sub-contracted by a central authority, as they would get access to a guaranteed market in terms of remuneration, which they could also exploit to expand their private business (Chapman and Tripp, 2002; Fassi-Fehri and Bakkouri, 1995; Fernet Quinet and Gautier, 2002; Leonard, 2004; Rivera *et al.*, 2000).

Sub-contracting public animal health services to the private sector requires, as a minimum, the following steps. Policy makers should:

- (a) Identify which public services can be effectively subcontracted to the private sector. In theory, the provision of all public good services can be subcontracted to private agents, but the government can also award contracts to animal health practitioners to provide private goods, particularly in remote rural areas where market imperfections loom large.
- (b) Decide to whom sub-contract animal health services, e.g. veterinarians, animal health auxiliaries, community-based organisations or NGOs. That will depend on the characteristics of the services and the actors, and the target area. For instance, NGOs may be more technically skilled than cooperatives, but the latter may be able to provide services to a larger number of smallholders.
- (c) Design a contract which identifies both the tasks and the compensation schedule for the sub-contracted actors, as well as provide them with strong incentives to compliance. In general, contracts should identify simple tasks and compensation be output-based – e.g. number of livestock vaccinated; rural abattoirs inspected – to facilitate monitoring.
- (d) Since the ineffective supply of some animal health services can produce significant socio-economic losses, the government not only should set up a monitoring system to ensure that contractual obligations are met, but also be prepared to act in case they are not. Some sort of contingency/emergency plan is to be therefore detailed and budgeted in terms of human and financial resources.

The effective design and successful implementation of sub-contracting animal health services can be challenging.

- A trade-off exists between the possible gains in efficiency through sub-contracting and transaction costs to ensure accountability. In other words, the savings achieved because of sub-contracting should be assessed against increased supervisory costs.
- There are substantial differences between regions in a country, with different densities of livestock and human population, different infrastructure facilities, different levels of per capita income, etc. This requires designing region-specific contracts for service subcontracting. One undifferentiated contract, in fact, may either provide an extra-rent to sub-contracted agents who operate in more developed zones, or inadequate incentives for those who operate in underdeveloped rural areas subject to high transaction costs.

- Sub-contracted agents get a fixed/variable remuneration from the public sector and have preferential access to farms / holding grounds / slaughterhouses / marketplaces. They therefore act in the market for private animal health services from a privileged position, and can eventually crowd out private actors and establish privately profitable but societal costly monopolies / oligopolies. Government could either prevent agents from operating in the market for private animal health services, but that would significantly reduce the gains from sub-contracting, or can create a competitive market for public contracts through handling regular public bids for sub-contracting animal health services. The more frequent the bids, the more competitive the market would be; but the more frequent the bids, the higher the compensation schedule be for private actors to write off their initial investment, and hence the higher the costs for society.
- There are circumstances where private agents are unwilling to supply some services as that would undermine their credibility and/or spoil their private business, such as slaughtering apparently healthy but potentially infectious animals.
- Political and social concerns over downsizing public sector staff can reduce the incentives to policy makers to sub-contract animal health services to private providers, particularly in countries which are subject to recurrent animal disease epidemics.

### **3.5 Public subsidies to private animal health service providers**

Economies of scale and transaction costs may make it unprofitable for private actors to supply private animal health services in remote low income rural areas. The government can directly or indirectly (e.g. through sub-contracting) provide services in those areas, but can also attempt to activate a local market for animal health services. One way would be through granting subsidies for private service suppliers to operate in remote areas, such as preferential credit facilities and micro-business training for private practitioners to buy drugs and set up animal clinics, or allowing public veterinarians/animal health assistants to work as private practitioners outside of their working hours (DAC, 2007a, 2007b; Khanna, 2007; Shekara, 2001).

Granting subsidies to private animal health service providers in remote rural areas requires the following steps. The government should:

- (a) Identify areas where a concealed demand for animal health services exists, so that there are good prospects for a market to develop. These areas should be

- selected on the basis of human and livestock population densities as well as on prospectives for sector growth.
- (b) Identify eligible beneficiaries of the subsidy, such as private veterinarians, private animal health assistants or animal health workers, membership or non-membership organizations, as well as determine criteria for their selection, such as their technical skills and sources of income.
  - (c) Perform a socio-economic analysis to identify the most appropriate typology and amount of subsidy, such as for instance a grant, a loan at below market interest rate, or tax exemptions. As a general rule, the subsidy should be given *una-tantum* unless it is maintained on the basis of social rationales. In this latter case, however, the government should have concluded that there are good social reasons to continuously use public resources to sustain the livestock sector in those remote areas; and that the provision of supply-side subsidies is more effective than other policy alternatives.
  - (d) Set up the institutional mechanism necessary to give out the subsidy and monitor its use.

The provision of public subsidies to private animal health practitioners can be cumbersome for a number of reasons.

- Despite the evidence that smallholders are willing to pay for animal health services, in many circumstances the poor live outside of any significant cash economy and simply cannot pay for the services. In these cases, it is difficult to see how a supply-side subsidy can effectively activate a market for animal health services.
- There could be a lack of qualified private service providers willing to operate in remote rural areas. Training and education of local people may therefore be essential in the short-term for upgrading and in the long term for advancing a professional consulting industry in those areas.
- If public veterinarians / animal health assistants were allowed to work as private practitioners outside their working hours, thereby receiving an indirect subsidy by the state, a risk could be that they will overlook their public duties, such as disease surveillance/reporting and food hygiene inspection.
- Whereas the subsidy should be given *una-tantum*, different private providers must be given the option to apply for it on a continuous basis. Should this not be the case, an uncompetitive monopolistic/oligopolistic market could develop with marginal benefits, if any at all, for smallholders. The usual practice for government to fix the fees for private animal health services has proved largely



ineffective, because of limited public regulatory capacity and/or reduced market competition and incentives to private animal health service providers.

### **3.6 The institutionalisation of community animal health workers**

One of the most popular policy instruments to sustain the supply of private animal health services in remote low income rural areas is the institutionalisation of community animal health workers (CAHWs). CAHWs are local people trained in dealing with the most common livestock diseases, using a small range of simple equipments and drugs. They are considerably less expensive than fully trained veterinarians, as they have lower income expectation and face lower transaction costs because they act locally: smallholders can therefore afford their services. CAHWs can supply private services as well as be awarded contracts by governments for the provision of some public goods to smallholders (IDL, 2003; Leksmono and Young, 2002; Leonard, 2004; Ly, 2003; Peeling and Holden, 2004).

A government that aims at establishing an efficient network of para-professionals providing animal health services in rural areas should:

- (a) Give legal recognition to CAHWs, as well as identifying the services that they are qualified to provide, including traditional treatments.
- (b) Identify criteria to select potential para-professionals, possibly in consultation with local communities. These criteria usually require that CAHWs live locally; be experienced livestock herders; have already some income from other activities; be willing to set up their own business; be known and trusted by the community.
- (c) Train para-professionals. Courses usually last few days and include technical topics, such as 'the normal animal', disease prevention, disease detection and animal treatment, as well management topics that are necessary to run a small business profitably. The cost for these courses is generally modest.
- (d) Organise regular refresher courses after the initial training, not only to review the basic topics and cover new diseases and treatments, but also to provide opportunities for CAHWs to share their experiences.
- (e) CAHWs should be initially provided with a basic kit of equipment, including syringes, needles, thermometers and a small stock of basic medicines – so they can start work straightaway.
- (f) Set up institutional and legal mechanisms to facilitate cooperation between CAHWs and veterinarians, who should remain always responsible for the most sophisticated diagnosis and treatments. For instance, CAHWs could regularly

report to veterinarians, or report to animal health auxiliaries who, in turn, report to veterinarians.

CAHW initiatives have been implemented in almost 50 countries since the 1970s, with some of the major challenges being the following:

- As the law stands in several developing countries, many of the services that could be provided by CAHWs, including diagnosis and treatment of diseased animals and the prescription / application of medicines, are still considered as 'acts of veterinary medicines' which may be only provided by registered veterinarians.
- Veterinarians' lobbies can exercise political pressure for the government not to give legal recognition to CAHWs. Their argument is that CAHWs would make it unprofitable for them to work in some rural areas, thereby reducing smallholders' access to essential / quality animal health services. That is why it is key that government promote effective cooperation and partnerships between CAHWs and public/private veterinarians.
- The rudimentary training of CAHWs is sometimes considered insufficient to ensure the correct use of medicines (dosage, duration, drug), thereby increasing the risk of bacterial resistance and disease risks to both animal and human populations.
- Governments typically provide CAHWs with cheap drugs and equipment for them to start their business. The long-term sustainability of CAHWs, however, depends on either a regular distribution system or on the existence of an efficient market for these basic inputs, which rarely occur. Furthermore, CAHWs are often expected to provide services at not cost to their own community.
- Whereas CAHWs are private actors, the tendency is for governments to consider them as a social appendage of the public sector, since they provide services to the rural poor. Governments have therefore sometimes centrally fixed the fees for CAHW services, but by so doing have undermined their efficiency and economic sustainability. Some training on how to calculate fees in order for CAHWs to be able to restock sold medicines and derive a normal profit from their activities would be however useful.

## 4. Demand-side Animal Health Policies

Demand side animal health policies are those public actions which allow end-users to more effectively articulate demand for animal health services. All development policies that lead to increased income of smallholders would serve this objective, but the focus here is on policies which specifically aim at enhancing the capacity of farmers to demand livestock services, particularly in low-income rural areas characterized by high transaction costs and pervasive market imperfections.

### 4.1 Support to membership organisations

One public policy instrument to stimulate the demand for animal health services, for any given level of smallholder income, is through supporting the formation of membership based organisations (MOs). MOs include producers' associations, cooperatives, and community-based organisations, which rely on membership contributions. MOs are said to generate sufficient economies of scale either to regularly contract the services or to employ on a long-term basis a private provider of animal health services (FAO, 1997; Holden *et al.*, 1996; Kurup, 2002; ILO, 1996; Omore *et al.*, 1997; Owango *et al.*, 1998; Stringfellow *et al.*, 1997).

Promoting the establishment of livestock-based MOs requires a two pronged approach, including policies favouring the development of MOs in general, and policies which allow them to provide animal health services to their members. A government should:

- (a) Develop a MOs policy – including legislation, institution building, supervision, promotion, research, advisory services, education and training, financial services and commercial regulations – which favours the establishment of cooperatives, associations, community based organisations and other typologies of MOs.
- (b) Specify whether MOs will be substituting or competing with private service providers, and whether they will be awarded contracts by the government for provision of some public goods service.
- (c) Pass legislation and regulations allowing MOs to both contract out/employ private service providers on a continuous basis and, in case, to buy and sell animal vaccines and drugs to their members.
- (d) Revise the extension policy framework so as to provide regular training to MOs on both animal health and management issues.

The development of MOs depends on cultural pre-conditions and involves countless social, economic and political factors. The constraints which hinder the establishment of livestock-focused MOs are many, the main possibly being the following:

- Small size, homogeneity and face-to-face contacts are central to successful MOs, but the smaller the size of MOs the lesser the economies of scale that can be achieved to effectively demand for animal health services.
- MOs often lack professional and financial resources to provide quality animal health services to their members. In some cases, for instance, they impose pre-defined service packages, which are not necessarily the most appropriate for all members.
- The poorest livestock keepers are often not members of MOs, possibly because they lack financial resources, time and education. Also, when membership fees are low enough for the poor to become members, the MO may be financially unsustainable.
- Livestock-focussed MOs have generally been established to support marketing of high-value products, and only at a later stage started providing animal health services to their members. This suggests that, unless there are good profit motives, the incentives for smallholders to establish MOs are few unless livestock services are one of the many benefits MOs provide to members.
- MOs have been sometimes contracted by the government to supply public animal health services. Mixing private and public good functions, however, may lead to undesirable social outcomes, for instance because public resources can be used to improve the provision of private rather than public goods.

## **4.2 Support to non-membership organisations**

Non-membership organisations (NMOs), mainly non-governmental organisations (NGOs), rely on voluntary donations from non-beneficiaries to sustain their activities, and ultimately transfer some wealth from one to some other groups in society. In developing countries, NMOs are involved in delivering livestock services to livestock keepers and some have been also sub-contracted by public authorities to supply public goods (Holden *et al.*, 1996; FARM-AFRICA, 2002; 2003). The ultimate objective of livestock NMOs, however, is neither to play the role of private animal health service providers nor that of the government, as they typically operate through projects of a limited duration in time. Their long-term objective is to increase smallholder income and hence their capacity to effectively demand and access animal health services on a continuous basis.

A government willing to promote livestock-focussed NMOs should:

- (a) Have a policy and institutional framework in place which facilitates the work of NMOs, such as preferential fiscal and labour policies.

- (b) Define criteria to select those NMOs which will be allowed to provide animal health services as well as buy and sell animal vaccines and drugs – in general, without access to essential factor inputs, NMOs will be unable to provide effective animal health services.
- (c) Define criteria to select those NMOs which will be allowed to train and supervise CAHWs.
- (d) Identify areas where NMOs will be entitled to carry out their activities. In theory, they should operate in marginal livestock areas where there is a concealed demand for animal health services but little potential for a market to develop; should they operate in already developed areas, the risk is that they will crowd out private providers, thereby creating more harm than good to the local economy.
- (e) Ensure that there is consistency between NMOs work and government policies, as well as between the multiple ways through which NMOs provide animal health services to poor livestock keepers.

Despite NMOs being genuinely committed to poverty alleviation, there are a number of issues that government should consider when supporting their activities.

- NMOs tend to be beneficiary-oriented in response to clearly identified constraints which, being identified at the micro rather than at the sector level, are not necessarily the most appropriate to promote livestock sector development. There could be cases, for instance, where the best strategy would be for smallholders to concentrate on other sources of income, rather than deriving more income from their livestock.
- NMOs usually place special emphasis on financial participation of beneficiaries in their programmes to ensure the establishment of self-sustainable systems of animal health service delivery. Efforts to ensure sustainability have been however largely mixed, especially as NMOs tend to operate in extremely marginal areas where the ability to pay of smallholders is almost nil.
- The members, boards and staff of NMOs usually belong to local elites and have often no interests in common with the beneficiary group. Their main interest is frequently to satisfy donor requests and create continuous workspace for the organisation and the staff.
- Despite some NMOs making excellent contributions to animal health service delivery, the amount of space government gives to NMOs in any given country is determined first and foremost by political considerations, rather than by their capacity to contribute to livestock sector development.

### 4.3 Public subsidies to livestock keepers

One instrument to stimulate the demand for livestock services is through providing smallholders with vouchers, which allow them to purchase specific quantities and types of inputs from trained providers. That would contribute to healthier animals, improved production and productivity, increased household income and capacity to sustain a market for animal health service delivery (Ausi, 2007; Castañeda, 1998; Gregory, 2006).

A government aiming to introduce a system of subsidized input vouchers to smallholders should:

- (a) Identify criteria to select the farmers / livestock keepers who will be entitled to receive input vouchers.
- (b) Establish the value and the characteristics of the vouchers, which are not equivalent to cash as governed by rules established to meet specific objectives. For example, distribution may be restricted to certain groups of pastoralists; made contingent on the use of specific livestock species and breeds; and exchange of vouchers among beneficiaries may be prohibited.
- (c) Setting up a system for financing the distribution of the vouchers, and for moving them through the supply chain to qualified service providers and/or drug sellers.
- (d) Establishing a mechanism for managing the cash redemption of vouchers accepted by service providers / drug sellers.
- (e) Design an exit strategy. In general, voucher programs should be designed to run for a limited number of years, during which subsidies are gradually removed while smallholders and service providers are expected to make a transition towards an economically sustainable cash market for animal health services.

The provision of vouchers to livestock keepers is a delicate policy instrument.

- It is extremely costly and complicated to finance a system of input vouchers, which implies a transfer from the central government to hundreds of beneficiaries.
- It is also costly and difficult set up and manage an efficient targeting mechanism in order not to distribute vouchers to well-off farmers. In some circumstances, it might be more appropriate to provide subsidies to a limited number of private service providers.
- Despite vouchers being in most cases recipient-specific, a secondary market has often developed where vouchers are sold and exchanged, and eventually redeemed at a lower redemption value.

- In many cases, small farmers are not able to participate in market-oriented arrangements and need support / capacity building to effectively deal with private animal health service providers.
- To capture the full benefit of market development, voucher programs should be in place for an extended period of time, such as 5 years or more, but the financial commitment of governments is typically of shorter duration.
- Input vouchers can generate economic distortions as they force livestock holders to buy some specific services whereas it would be possibly more appropriate for them to pursue other investments. However, where the lack of purchasing power is pervasive, vouchers can be considered as temporary interventions necessary to promote long-term livestock sector development.
- In particularly underdeveloped areas, voucher programs which are not complemented by supply-side development instruments, are unlikely to trigger a self-sustainable market for animal health services.

## 5. Conclusions

Animal diseases are one of the most binding constraints in the early stages of livestock sector development. Following the failure of the state-interventionist policies in the 1960s and the 1970s, and the disappointing outcomes of more than one decade of market liberalisation and privatisation of animal health services in remote, low income rural areas, governments in developing countries have started developing policies which aim to (a) enhance the capacity of government to provide animal health services given the current budget constraint; (b) promote the establishment of both efficient and equitable markets for animal health services in low-income rural settings.

This paper proposes a demand-supply classification and analysis of the policy instruments available to policy makers to improve the effectiveness, in terms of both quality and coverage, of public and private animal health services in low income rural areas, characterized by high transaction costs and pervasive market imperfections. The various policy instruments were classified depending on whether they sustain the supply of or the demand for animal health services. Policy instruments supporting the supply of animal health services included: (i) decentralisation of animal health services; (ii) cost-recovery of public animal health service provision; (iii) combined human-animal public health service delivery; (iv) sub-contracting public/private animal health services; (v) provision of subsidies to private animal health service suppliers; (vi) institutionalisation of community animal health workers. Policy instruments sustaining the demand for animal health services included: (i) support to membership

organisations; (ii) support to non-membership organisations; (iii) distribution of input vouchers to livestock keepers.

These various policy instruments were reviewed with a focus on government actions to design and apply them, as well as with an analysis of their possible drawbacks. None is superior to the other, nor are they mutually exclusive. For instance, a decentralised local government may award contracts to community animal health workers for the provision of some public goods to livestock holders; the central government can require that NMOs providing animal health services in remote rural areas follow a cost-recovery strategy when delivering their services; input vouchers can be granted to poor livestock keepers to pay for services provided by CAHWs. It is therefore up to policy makers, given the unique economic and institutional characteristics of their countries, including the specificities of the livestock sector, to identify the most appropriate combination of policy instruments necessary to establish an equitable and efficient system of animal health services in underdeveloped rural areas. The concise analysis of the various policy instruments presented in this paper is hopefully a valuable input to this task.

## 6. References

- Ahuja V., Redmond E. (2004) Livestock Services and the Poor. *Tropical Animal Health and Production*, 36:247-268.
- Auisi R. (2007) *Mozambique: Agriculture Input Fairs – A Chance to ‘Live in Dignity’*. Inter Press Service News Agency, 10 August.
- Castañeda T. (1998) *The design, implementation and impact of food stamp programs in developing countries*. Mimeo, World Bank.
- Chapman R., Tripp R. (2002) *Case Studies of Agricultural Extension Programmes Using Privatized Service Provision*. Agricultural Research and Extension Network, UK.
- Conroy C. (2003) *Livestock Sector Growth and Poverty, with particular reference to India*. Mimeo, Natural Resources Institute, Greenwich.
- DAC (2007a) *Guidelines for administering subsidy under agri-clinics agri-business centres scheme (ACABCs)*. Department of Agriculture & Cooperation. Ministry of Agriculture, Government of India. New Delhi.
- DAC (2007b) *Operational guidelines of SFAC scheme for agribusiness project development*. Department of Agriculture & Cooperation. Ministry of Agriculture, Government of India. New Delhi.
- de Haan C., T.S. van Veeb, B. Brandenburg, G. Gauthier, F. Le Gall, R. Mearns, M. Siméon (2001) *Livestock Development. Implications for Rural Poverty, the Environment, and Global Food Security*, World Bank, Washington D.C.
- Delgado C. (2003) Rising Consumption of Meat and Milk in Developing Countries Has Created a New Food Revolution. *Journal of Nutrition*, 133, pp. 3907S-3910S.
- Delgado C., M. Rosengrant, H. Steinfeld, S. Ehui. C. Courbois (1999) *Livestock to 2020: The Next Revolution*. Food, Agriculture, and the Environment Discussion Paper, 28, International Food Policy Research Institute, Washington D.C.



- Dinar A. (1996) Extension commercialisation: how much to charge for extension services. *American Journal of Agricultural Economics* 78:1–12
- FAO (2003) *World Agriculture towards 2015/2030. An FAO Perspective*. FAO, Rome.
- FAO (1997) Principles for rational delivery of public and private veterinary services with reference to Africa. Report of a technical consultation, 25-27 March 1997. Food and Agriculture Organisation of the United Nations, Rome.
- FAO (1990) *Cost/Benefit Analysis for Animal Health Programmes in Developing Countries*. FAO Expert Consultation, 10-14 September, Rome.
- FARM-AFRICA (2003) *Delivering affordable and quality animal health services to Kenya's rural poor*. Nairobi, Kenya.
- FARM AFRICA (2002) *Animal health: best practices from FARM-Africa's Pastoralist Development Project in Kenya*. Nairobi, Kenya.
- Fermet Quinet E. and J Gautier (2002) Mali: Contracting for Livestock Production Extension with Private Veterinarians, in Rivera W. M. (ed.) *Contracting for Agricultural Extension: International Case Studies and Emerging Practices*. Wallingford, Oxon, UK ; New York : CABI Publication.
- Fassi-Fehri M.M., Bakkouri M. (1995) *Profile of Veterinary Services in Morocco*, FAO, Rome.
- Gregory I. (2006) *The Role of Input Vouchers in Pro-Poor Growth*. Background Paper for the Agriacn Fertilizer summit, Abuja, Nigeria, 9-13 June.
- Holden S., Ashley S., Bazeley P. (1996) Improving the Delivery of Animal Health Services in Developing Countries. A Literature Review. *Livestock in Development*, Crewkerne.
- IDL (2003) *Community-based animal health workers: threat or opportunity?* The IDL Group, Crewkerne, UK.
- ILO (1996) *COOPREFORM: Participatory Cooperative Development Policy Making – A Manual*. International Labour Office, Geneva.
- ILRI (2000) *ILRI Strategy for 2010. Making the Livestock Revolution Work for the Poor*. ILRI, Nairobi.
- James, A.D. and Upton, M. (1995) Cost Recovery for Veterinary Services. *Journal of International Farm Management*, 1,125-133.
- Keynian G., Olin M., Dinar A. (1997) Cofinanced Public Extension in Nicaragua. *The World Bank Research Observer* 12(2): 225-247.
- Khanna R.M. (2007) 25 per cent subsidy for setting up Agriclincs. *The Tribune*, 12 March, Chandigarh, India.
- Kurup M.P.G. (2002) Package of improved livestock services through cooperatives: a case study of the Mahsana District Milk Producers' Union Ltd., Gujarat, India. In Rangnekar D., Thorpe W., *Smallholder dairy production and marketing – opportunities and constraints*. Proceedings of a South-South workshop held at the National Dairy Development Board (NDDDB), 13-16 March 2001, Anand, India.
- Leksmono C.S., Young J. (2002) Community-based animal health workers and institutional change: the DELIVERI Project in Indonesia. *PLI Notes* 45:13-16.
- Leonard D.K. (2004) Tolls from the new institutional economics for reforming the delivery of veterinary services. *Rev. sci. tech. Off. int. Epiz.* 23(1): 47-57.
- Lai K.C., Cistulli V. (2005) *Decentralization and Agricultural Development. Decentralization of Agricultural Services*. FAO Easypol. Module 013. FAO, Rome.
- LID (Livestock in Development) (1999) *Livestock in Poverty-Focused Development*. Livestock in Development, Crewkerne, UK

- Ly C. (2003) The Economics of community based animal health workers. In the IDL Group (ed.) *Community based animal health workers – threat or opportunity*. The IDL Group, Crewkerne, UK.
- Munyonyo R. (1999) Decentralization in Uganda: Theory and Practice. African Research and Documentation Centre, Uganda Martyrs University.
- Norton R.D. (2004) *Agricultural Development Policies. Concepts and Experiences*. FAO, Rome & John Wiley & Sons, Chichester.
- Omoro A., Staal S., Thorpe W. (1997) *The role of membership organizations and the gap they fill in private veterinary service delivery*. FAO Electronic Conference on Principles for Rational Delivery of Public and Private Veterinary Services.
- Ott S.L., Hillbers Seitzinger A., Hueston W.D. (1995) Measuring the national economic benefits of reducing livestock mortality. *Preventive Veterinary Medicine*, 24: 203-211.
- Owango, M., Lukuyu B., Staal S.J., Kenyanjui M., Njubi D., Thorpe W. (1998) Dairy cooperatives and policy reform in Kenya: effects of livestock service and milk market liberalisation. *Food Policy* 23(2):173-185.
- Owen E., T. Smith, MA Steele, S. Anderson, A.J. Duncan, M. Herrero, J.D. Leaver, C.K. Reynolds, J.I. Richards, J.C. Ku-Vera (eds.) (2004) *Responding to the Livestock Revolution*, Nottingham University Press, Nottingham.
- Peeling D. Holden S. (2004) The effectiveness of community-based animal health workers, for the poor, for communities and for public safety. *Rev. sci. tech. Off. int. Epiz.*, 23 (1): 253-276.
- Pica-Ciamarra U. (2005) *Livestock Policies for Poverty Alleviation: Theory and Practical Evidence from Africa, Asia and Latin America*. PPLPI Working Paper No, 27, FAO, Rome.
- Rivera W.M., Kalim Qamar M., Van Crowder L. (2001) *Agricultural and Rural Extension Worldwide. Options for Institutional Reform in the Developing Countries*. FAO, Rome.
- Rivera W.M., Zijp W., Alex G. (2000) *Contracting for Extension. Review of Emerging Practices*. The World Bank, Washington D.C.
- Roth F., Zinsstag J., Orkhon D., Chimed-Ochir G., Hutton G., Cosivi O., Carrin G., Otte J. (2003) Human health benefits from livestock vaccination for brucellosis: case study. *Bulletin of the World Health Organization*, 81(12): 867-876.
- Seré C. (2003) Not by Bread Alone: The Next Food Revolution. In Fischer T. (ed.) *The Livestock Revolution. A Pathway from Poverty? in Brown A.G. (ed.) The Livestock Revolution: A Pathway from Poverty?* Record of a Conference by the ATSE Crawford Fund, Parliament House, Canberra.
- Shears P. (2000) Communicable disease surveillance with limited resources: the scope to link human and veterinary programmes. *Acta Tropica*, 76: 3-7.
- Schelling E., Bechir M., Abdoulaye M.A., Wyss K., Randolph T.F., Zinsstag J. (2007) Human and Animal Vaccination Delivery to Remote Nomadic Families, Chad. *Emerging Infectious Diseases*, 13(3): 373-378.
- Schelling E., Wyss K., Bechir M. Doumagoum Moto D., Zinsstag J. (2005) Synergy between public health and veterinary services to deliver human and animal health interventions in rural low income settings. *British Medical Journal*, 331: 1263-1267.
- Shekara P. (ed) (2001) *Private Extension: Indian Experiences*. National Institute of Agricultural Extension Management, Hyderabad, Andhra Pradesh.
- Smith L.D. (2001) *Reform and Decentralization of Agricultural Services: A Policy Framework*. FAO Agricultural Policy and Economic Development Series, FAO, Rome.
- Stringfellow R., Coulter J., Lucey T., McKone C., Hussain A. (1997) Improving the access of smallholders to agricultural services in sub-Saharan Africa: farmer cooperation and the role of the donor community. *ODI Natural Resources Perspectives*, 6.

- Umali D.L., Feder G., de Haan C. (1994) Animal Health Services: Finding the Balance Between Public and Private Delivery. *World Bank Research Observer* 9(1): 71-96.
- Umali D.L., Feder G., de Haan C. (1992) The Balance Between Public and Private Sector Activities in the Delivery of Livestock Services. *World Bank Discussion Paper* 163. The World Bank, Washington D.C.
- World Bank (2007) *World Development Report 2008. Agriculture for Development*. Washington D.C., World Bank.
- World Bank (2005) *Managing the Livestock Revolution. Policy and Technology to Address the Negative Impacts of a Fast-Growing Sector*, Report No. 32725-GLB, Agricultural and Rural Development Department, World Bank, Washington D.C.
- World Bank (1998) *Zimbabwe - Agricultural Services and Management Project (ASMP)*. Project Appraisal Document, Washington D.C., World Bank.

## 7. Disclaimer & Contacts

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

**Ugo Pica-Ciamarra**

Food and Agriculture Organization - Animal Production and Health Division  
Viale delle Terme di Caracalla 00153 Rome, Italy  
E-mail: [ugo.picaciamarra@fao.org](mailto:ugo.picaciamarra@fao.org)

**Joachim Otte**

Food and Agriculture Organization - Animal Production and Health Division  
Viale delle Terme di Caracalla 00153 Rome, Italy  
E-mail: [joachim.otte@fao.org](mailto:joachim.otte@fao.org)

Or visit the PPLPI website at: [www.fao.org/ag/pplpi.html](http://www.fao.org/ag/pplpi.html)