Addressing Governance Challenges in the Provision of Animal Health Services: A Review of the Literature and Empirical Application Transaction Cost Theory

John Ilukor, Regina Birner and Thea Nielsen

University of Hohenheim, Institute of Agricultural Economics and Social Sciences in the Tropics and Subtropics

Corresponding author: john.ilukor@gmail.com

Abstract: Providing adequate animal health services to smallholder farmers in developing countries has remained a challenge, in spite of various reform efforts during the past decades. The focuses of the past reforms were on market failures to decide what the public sector, the private sector, and the "third sector" (the community-based sector) should do with regard to providing animal health services. However, such frameworks have paid limited attention to the governance challenges inherent in the provision of animal health services. This paper presents a framework for analyzing institutional arrangements for providing animal health services that focus not only on market failures, but also on governance challenges, such as elite capture, and absenteeism of staff. As an analytical basis, Williamson's discriminating alignment hypothesis is applied to assess the cost-effectiveness of different institutional arrangements for animal health services in view of both market failures and governance challenges. This framework is used to generate testable hypotheses on the appropriateness of different institutional arrangements for providing animal health services, depending on context-specific circumstances. Data from Uganda and Kenya on clinical veterinary services is used to provide an empirical test of these hypotheses and to demonstrate application of Williamson's transaction cost theory to veterinary service delivery. The paper concludes that strong public sector involvement, especially in building and strengthening a synergistic relation-based referral arrangement between paraprofessionals and veterinarians is imperative in improving animal health service delivery in developing countries.

Key words: *Institutional arrangements, Animal health services, Market failures, Governance Challenges, Paravets, Community Animal Health Workers, Transaction Cost Economics*

Introduction

Providing effective animal health services to livestock keepers in developing countries has remained a challenge. Provision of these services by the government prevailed in the first decades after developing countries reached their independence. In the structural adjustment period that began in the 1980s, government provision of livestock services came under increasing criticism for high costs and limited effectiveness. A solution was seen in the privatization of those veterinary services for which no market failure was assumed to exist (Leonard, 2002; Riviere-Cinnamond, 2004; Pica-Ciamarra and Otte, 2008). An important analytical framework to justify this approach was developed by Umali et al. (1994), who applied concepts of public economics to determine the services for which a market for animal health services was expected to emerge -a market in which private veterinarians and other private service providers could flourish (see Section 2). The experience showed that this approach had its merits. High-potential areas and market-oriented livestock systems, such as the intensive dairy systems of Kenya, are indeed served by this market (Oruko and Ndung'u, 2009). However, marginal areas and poorer livestock keepers continued to lack adequate access to animal health services (Okwiri et al., 2001; Otieno et al., 2000).

Following the failures of both the public and the private sector in these areas, a new wave of reform focused on a "third sector" consisting of community-based animal health workers. In spite of initial concerns about their capacity, they became a major feature of recent reform efforts (McSherry and Brass, 2008). And indeed, this approach had its merits, too. For example, the eradication of the Riderpest -which is without a doubt the single biggest success in animal health provision in modern history—would not have been possible without the thousands of community-animal health workers who vaccinated animals in the most remote and conflict-affected areas of the developing world (FAO, 2012a).

However, the "third sector" approach is not a panacea and serious problems remain in spite of reform efforts and their successes (Oruko and Ndung'u, 2009). Foot and Mouth disease (FMD), Contagious Bovine Pleura Pneumonia (CBPP) in cattle and Rift Valley Disease in both cattle and humans have continued to inflict serious losses to livestock farmers, especially the rural poor. For example, in 2011 there were 60 outbreaks of FMD reported in Kenya, 58 in Ethiopia, 15 in Uganda, 57 in Ghana, and 161 in Burkina-Faso (FAO, 2012b). Over 15 million cattle, sheep and goats suffer from FMD annually (Rushton et al., n.d.). The overall economic costs of FMD for each country in East Africa is estimated to be US$4.5 billion annually (ILRI, 2012). In 2002, 87 outbreaks of CBPP were reported in East Africa, 54 of which occurred in Uganda, 18 in Kenya and 15 in Tanzania (Tambi et al., 2006). Estimates by Karl and Wanyoike, (2010) indicate that the 2007 outbreak of Rift Valley disease in Garrisa and Injara districts in Kenya led to economic losses of US$9.3 million in the two districts (Rich and Wanyoike, 2010) which is more than twice the budget expenditures of the two districts estimated to be US$3.5 million. These values include both direct and indirect costs such as loss in milk, and abortions as well as losses made when sick animals are sold to avoid total loss due to death and losses to traders and slaughter houses.

A recent unpublished study of livestock keepers in Northern Ghana by Mockshell (2011) showed that such losses are not only important from the perspective of national development, but are also important for household welfare especially as asource of food (milk and meat), income, draft power (transportation and animal traction) and food nutrients required for human development (Bender et al., 2006; FAO, 2011). For poor people who depend on livestock, every animal lost can be a threat to the family's livelihood and future development opportunity. Moreover, with the current European Union (EU) led *"zero tolerance"* standards on free disease regions, poor livestock keepers are missing out from the increasing global demand for food of

animal origin, which is the driving force behind the "*livestock revolution*" (Otte et al., 2004; Wymann et al., 2007).

Why do these problems remain in spite of all of the previous reform efforts? As will be discussed in this paper, a major reason can be seen in the neglect of the governance challenges that are inherent in each of the three sectors—public, private, and third—which can be involved in the provision of animal health services (Birner & Gunaweera, 2002). While "good governance" has been on the development agenda since the late 1990s (UN, 1998), governance issues have remained relatively neglected in the debate on animal health services. As noted by Vallat and Mallet (2006), good governance is key to addressing the emerging and reemerging animal disease threats. Yet, little attention has been paid to this problem. According to the World Bank (1994), good governance is characterized by predictable, open and enlightened policy making; a bureaucracy instilled with a professional character; an executive arm of government accountable for its actions; and a strong civil society participating in public affairs; and all behaving under the rule of law. This definition is of particular relevance because it emphasizes the need for transparency and accountability in policy making process and the significance of all actors performing their responsibilities effectively, in a sustainable, coordinated and coherent manner. Such actors may include political actors and institutions, interest groups, civil society, and non-governmental and transnational organizations. Sustaining coordination and coherence among actors is key to promoting suitable governance for veterinary health policies (Vallat and Mallet, 2006).

The problems inherent in public sector service provision are well known. In fact, they have been the major reason for the drive towards privatization in the 1980s. One problem is the absenteeism of extension staff: veterinarians and other staff are absent from their duty stations and fail to visit their clients since it is very difficult for the government, especially the central government, to supervise them. The problem of absenteeism of civil servants is a serious

problem for service providers in primary education and health (Chaudhury and Hammer, 2006). Another problem is sub-standard performance, which arises from the information asymmetry problem – the livestock keeper has difficulties to assess whether a negative result, such as the death of a sick animal, is due to lack of effort and skills of the service provider or due to reasons beyond his or her control (K. Leonard & D. Leonard, 1998, 1999; K. Leonard, 2002). A third problem is the propensity of public sector service providers to demand "fees" or accept favors or bribes in return for preferential treatment from veterinarians (Heffernan and Misturelli, 2000). As a consequence, poor livestock farmers have less access to their services, resulting in a problem also referred to as "elite capture" – the better off farmers are able to capture a larger share, or all, of the public spending made for the provision of these services (Birner & Anderson, 2007). Public sector service provision is also affected by a range of problems, which are not the "fault" of individual staff. Lack or delay of the government funding necessary to vaccines and equipments, low salaries and failure to pay the salary of service providers in time, are frequent problems in developing countries.

The private sector has its own challenges just like the public sector. Some challenges were well-known and addressed in the early analytical frameworks (see Section 2). Preventive services such vaccinations have positive externalities and involve collective action problems. For example, individual livestock keepers have incentives to "free-ride" and save costs by not vaccinating their animals, assuming that others vaccinate. Such problems justify government involvement. However, other governance challenges of private service provision have been underestimated, as the experience of the privatization reform has shown. Substantial market failures arise due to the high travel costs of serving livestock keepers, especially in pastoral areas and for private veterinarians who for the most part do not live close to or in marginal are. Cash constraints faced by such farmers aggravate the problem. The challenge of information asymmetry mentioned above also applies to private animal service providers. Hence, substandard

service provision may also apply in this case. Private veterinarians who sell veterinary drugs also face a conflict of interest or adverse selection and moral hazard problem, as they may be inclined to sell substandard or non-essential drugs (Leonard, 2000).

Community animal health workers - the "third-sector" providers - are subject to the same governance challenges that arise from information asymmetry, yet may be better able to overcome the problem of high transaction costs of service provision. They can demand lower fees because they live in rural areas and do not have to recover the high investment in education that a university-trained veterinarian has to make. However, the downside of this low-cost provision is that they are also less well-trained. Moreover, they are not subject to the same mechanisms of government regulation and self-regulation that characterizes the veterinary profession. In addition, if the community is expected to fund such health workers collectively, the typical free-rider problem of collective action problems may jeopardize their funding. If non-governmental organizations or donors provide funds for community animal health workers, they are subject to a similar or even greater problem regarding the unreliability of funding than their public sector counterparts. Also, people may not feel obliged to pay for their services or value their services if a donor is providing the funding

To devise institutional arrangements that can address these governance challenges, there is a need to expand existing analytical frameworks. This paper proposes a transaction costs approach to achieve this goal. Specifically, we propose a framework that is based on the so-called "discriminating alignment hypothesis" developed by Williamson (1991). The transaction costs framework, which is further explained in the next section, has been selected for four major reasons: First, acknowledging that there is no "one-size-fits-all" solution, the framework makes it possible to identify the context-specific factors that determine the comparative advantage of different institutional arrangements for providing animal health services. Hence, the framework makes it possible to move "from best practice to best fit", which has been a major insight in the

literature on governance in developing countries (Birner et al., 2009; Grindle, 2007; World Bank, 2004). Second, rather than "re-inventing the wheel", this framework is compatible with the existing frameworks (that focused on public economics) and makes it possible to build upon the rich insights that have been derived from such frameworks. Third, the Williamson's transaction costs framework has been widely used in assessing the comparative advantage of empirically observed institutional arrangements. Hence, even though the empirical research for the animal health services still needs to be carried out, the framework has considerable promise for its application to this area. The fourth reason relates to the fact that transaction costs is a broader concept than market failures (Arrow, 1969), which considers market failures as well as process based challenges in the supply and demand of animal health services

The paper is structured as follows: Section 2 develops the conceptual framework and explains how it is linked to existing frameworks. Section 3 interprets the existing literature in the context of the new framework with the goal of deriving hypotheses about the comparative advantage of different institutional arrangements for animal health service delivery. Section 4 discusses the empirical approach and presents results for the case of clinical services to test the hypotheses. Section 5 concludes.

2. A Transaction Cost Framework for analyzing veterinary service delivery

As indicated above, the framework developed in this section builds upon existing frameworks. Therefore, those frameworks are briefly reviewed first.

2.1 A review of analytical frameworks

The main analytical frameworks used to determine which animal health services should be provided by the public versus the priviate sector was published in 1994 by Umali et al. (1994). Their seminal contribution was the application of the concepts of public and private goods to animal health service delivery. A public good is defined in this literature as a good that is both

non-excludable and non-rivalrous in consumption, implying that individuals cannot be effectively excluded from its use (non-excludability) and that the consumption of the good by one individual does not reduce its availability to others (non-subtractabilty). Using these conceptes, Umali et al. (1994) classified animal health services based the economic attributes of subtractability and excludability to determine whether a service is a public good or a private good. Subtractability occurs if the production or use of a service reduces the quantity of this service that is available to others, while excludability arises when only those who pay for the service benefit from it.

A veterinarian who diagnoses and treats an animal with endemic diseases has less time available to treat other animals and the benefits that arise from treating this animal only accrue to one livestock farmer. According to this reasoning, the treatment and diagnosis of a disease like Tryponamiasis is considered a private good and should therefore be provided by the private sector (see Table I below). Ahuja and Redmond (2001, 2004) expanded this framework by considering not only public goods attributes, but also externalities and moral hazard problems that are generated by a particular service. An externality is a cost or benefit that is not transmitted through prices and is incurred by a party who was not involved in the use or production of that service. Moral hazard arises when both the livestock owner and veterinarian fail to effectively monitor the effort that the other devotes to the production of the contracted service (Leonard, 2000). Ahuja and Redmond recommend that those services that exhibit public goods attributes and produce externalities should be provided by the state and that those that exhibit private good attributes and produce no externalities should be provided by private service providers (see Table 1).

Table I: Animal health services that should be provided by the private and public sector based market failures

Veterinary service	Public	Private	Economic Attribute of Veterinary Service
Clinical		✓	
Treatment & diagnosis of endemic diseases		✓	Private good
Diagnostic and treatment of epidemic diseases	✓		Public good with externality
Preventive			
Vaccination	✓		Public good (correcting free rider problem)
Vector control-ticks	✓	✓	Public good (correcting free rider problem)
Vector control-Tsetse fly	✓		Public good (correcting free rider problem)
Slaughter of animals (meat hygiene/inspection)	✓		Measure to correct moral hazard
Quarantine	✓		Measure to correct externality
Surveillance and regulation	✓		Public good
Public health	✓		Public good with externality
Production			
Research ,extension and training	✓	✓	Public private good
Breed improvement.	✓		Private good
Animal drug distribution		✓	Private good
Animal drug quality control	✓		Measure to correct moral hazard

Source: Ahuja, 2004; Umali et al., 1994

2.2 The transaction cost framework: An illustration

The framework presented in this paper is based on transaction cost theory as developed by Williamson (Williamson, 1989, 1991, 2000, 2005), and its application to agriculture, natural resource management and rural service provision by Birner & Braun (2009) and Birner & Wittmer (2004). The logic behind the application of the transaction costs paradigm is as follows: Veterinary services differ in their attributes (characteristics) and these attributes need to be identified to derive implications for the choice of governance structures. Although the literature on animal health service delivery identifies many institutional arrangements such as decentralization government structures, community animal health workers and para-veterinarians (paraprofessional) system, and cost sharing, this study considers on the three main service

delivery systems: paraprofessionals, professionals and referrals for analytical purposes. Paraprofessional system is one with service providers having experience in animal health care but no formal training. They are often called Community Animal Health Workers (CAHWs) and are found mainly in marginal areas (Peeling and Holden, 2004). Animal Health Assistants (AHAs) with certificates or diplomas in animal health or general agriculture also belong to the paraprofessional system (Schneider, 2006, 2011). Professional system is one with services providers having degrees in veterinary medicine, while the referral or integrated system is one that links government veterinarians with private veterinary professionals, paraprofessionals and farmers.

These systems differ in terms the costs, accessibility, and quality of service offered. Applying Williamson's alignment hypothesis to this area suggests that veterinary services that differ in their characteristics should be aligned with a system or an institutional arrangement or governance structure, that "differ in their costs and competencies, so as to yield transaction cost economizing result" (Williamson, 1991; pp. 277). Following Williamson's concept that transaction costs are the costs of using a specific governance structure (Williamson, 1979, pp243), transaction costs are defined here to include the costs incurred by a farmer accessing the service, failing to access the service (access failure costs), and an inadequate provision of the service (effort failure costs) such as costs relate antimicrobial resistance like repeat treatment costs for same case from a different service provider resulting from inadequate prescription and wrong diagnosis from the first service provider. In contrast, production costs include the costs of the drugs or vaccines and the cost of the labor of the service provider.

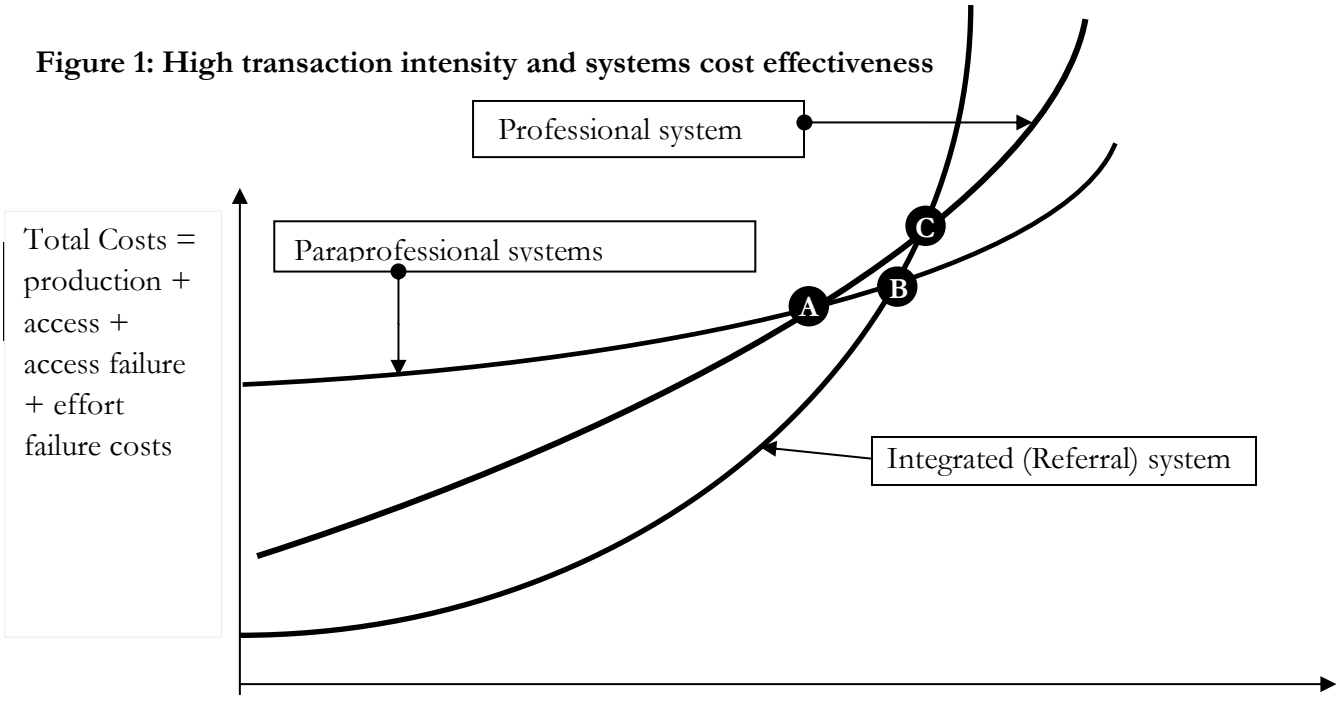
Access costs include transport costs, communication costs, opportunity costs of time spent by the livestock keepers, and, if applicable, bribes paid to access the service. Losses caused by delays in reporting a disease due to communication problems, such as (lack of access to mobile phones), are also access costs. Access failure costs include the loss due to the death of the

animal as a result of failing to access a service, the reduction in milk yield and growth rates; and any reduction in the price of selling the animal or its products that result from failure to access animal health services. Effort failure costs arise if the livestock keeper has access to the service, but faces problems regarding the quality of the treatment, which is caused by information asymmetry (Leonard, 2000). Such costs arise due to delays, poor diagnosis, prescription of the wrong drugs, or the supply of sub-standard drugs by the service provider. Like access failure costs, these costs may include the loss of the animal or loss in weight and milk production that could have been prevented if the treatment was appropriate. Effort failure costs can also arise from diverting public resources for service delivery for private gains (embezzlement). For example, a government veterinarian may purchase vaccines that are not enough to vaccinate the target number of animals, but records the target number and uses the saved funds for his own purposes. It is important to note that "effort failure costs", as defined here, only refer to costs arising due to substandard performance or wrong-doing of the service providers. An animal may die even in the case of correct treatment. Such cases would not be considered to be an "Effort failure". Based on transaction cost economics, the magnitude of these costs vary depending on service attributes and animal health delivery system.

The hypotheses regarding the appropriateness or cost effectiveness of different animal health service delivery systems (governance structures) is illustrated in Figures 1 & 2 below. These diagrams illustrate a cost-effectiveness analysis (comparing the costs arising under different governance structures to produce a defined output). The rationale of Williamson's discriminating hypothesis is that governance structure (institutional arrangement) A is considered to be more cost-effective than governance structure B or C if a defined output—in this case a service of defined quality that reaches a specified number of users—can be provided by governance structure A with lower costs than B or C. Hypothetical cost curves are used to analyze the comparative advantage of different governance structures by representing the total

costs of producing the specified output under the different governance structures. Since the goal of selecting a governance structure is to minimize total costs, production and transaction costs have to be considered simultaneously. The attributes of the transactions, which influence the comparative advantage of different governance structures, are displayed on the horizontal axis, as in Figure 1 below (Williamson, 1991; p284). A set of these attributes determines the appropriateness of these arrangements and will be discussed in Section 3, based on a review of the existing literature. In a cost-effectiveness analysis, the output is held constant. However, differences in service quality or in the number of livestock keepers with access to the service can be included in the analysis. Such changes are reflected as increased costs: reducing the number of livestock keepers served with a given level of resources is equivalent to increasing the resources needed (i.e., increasing the costs) to reach a given number of livestock keepers. The same consideration applies to the quality of service: reducing the quality of service provided with a given level of resources is equivalent to increasing the effort failure costs (the costs of providing substandard service).

Figure 1: High transaction intensity and systems cost effectiveness



Source: *Adapted from Birner & Braun, (2009, p.292).*

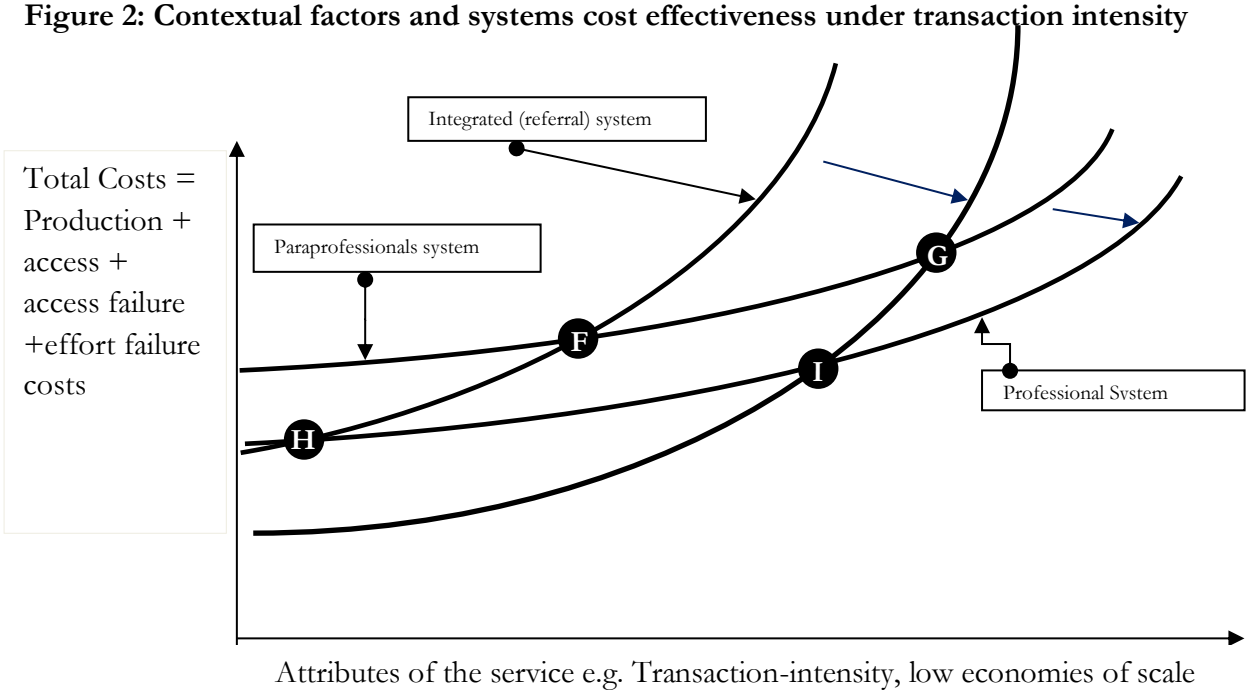
In Figure 1, the vertical axis indicates the total costs arising from the delivery of a specified animal health service, according to the above considerations. The horizontal axis displays those attributes that influence the cost-effectiveness of different institutional arrangements for service delivery. In a two-dimensional diagram, one can only consider the change in one attribute on the horizontal axis, while keeping all other attributes constant. However, the same considerations apply to all attributes that cause the same direction of change in the cost curves. As further discussed in Section 3, the attributes that matter for veterinary services include transaction and care intensity, measurability of the service, and state and community capacity. In Figure 1, we consider the attribute of transaction-intensity for illustration purpose.

Transaction-intensity refers to the extent to which a service requires a large number of activities (transactions) both with regard to time and space (Pritchett and Woolcock, 2004). For example, tick control is transaction-intensive with regard to both space and time because it has to be carried out for all animals in a region at regular time intervals. An annual vaccination campaign is also transaction-intensive in terms of space (all animals have to be covered), but not with regard to time (as it is only carried out once a year). If transaction-intensity is an important attribute for the provision of a particular veterinary service activity, one can hypothesize that the paraprofessional system has a comparative advantage over a professional or veterinarian system and a referral system. This is indicated in the slope of the hypothetical cost curve for paraprofessionals in Figure 1 above, which increases less than the slope of the cost curves for alternative governance structures as the level of the attribute transaction-intensity increases (moving from left to right on the horizontal axis). Points A, B and C are the equilibrium positions while the area above point A is a relative advantage of the paraprofessional system to professional system. Similarly, the area above point B is a relative advantage of the paraprofessionals to the referral or integrated system and the area above point C is relative

advantage of the professional to integrated or referral system. If transaction intensity is low, the paraprofessionals system has a low comparative advantage over the other systems. The area below point C will be the point of relative advantage of an integrated system to the professional system; the area below point B will be a relative advantage point of integrated system to paraprofessionals and the area below point A will be the relative advantage point of the professional system over the paraprofessionals as shown by slopes of the costs curves.

Figure 2 represents the effect of contextual factors. For example, if paraprofessionals had veterinary training their performance and service quality would improve, and transaction costs would be reduced (Mugunieri & Irungu, 2002); thus shifting downward the paraprofessional curve (shift "A"). This shift causes the relative advantage point for the paraprofessional system over the integrated system to shift from point F to H. Similarly, the governance system can be made more effective if personnel management and regulation is improved, more staffs are recruited, and infrastructure is improved. Thus most diseases are reported, diagnosed, and effective control measures are taken up immediately (Ahuja et al., 2008). Subsequently, the integrated system's curve shifts outwards and downwards (shift "B") in Figure 2 and the relative advantage point of the government system to paraprofessional shifts from point F to G. If paraprofessionals are trained and legislation is strong, the equilibrium will be attained at point I. Point I is the relative advantage point of the integrated system to professional or improved paraprofessional system.

Figure 2: Contextual factors and systems cost effectiveness under transaction intensity



Source: *Adapted from Birner & Braun, (2009, p.292)*

3.0 A transaction cost framework: insights from the literature of animal health delivery in developing countries

The previous section illustrated the use of the transaction cost framework for analyzing veterinary services delivery based on the attributes of the transactions involved. In this section, we discuss these attributes and contextual factors in more detail based on the existing literature. In this section, market failure attributes (such as externality and free rider problem) and governance attributes of animal health services (such as transaction intensity, discretion or care intensity, and service measurability) as well as contextual factors (such as community and state capacity) are discussed. Their ramifications on governance of animal health service delivery systems are examined and hypotheses regarding the appropriateness of these systems are generated. In Section 4, household survey data of clinical veterinary services in Uganda and Kenya is used to test the validity of the above hypotheses generated.

3.1 Externalities

Externalities are costs or benefits arising from a transaction that affect a different individual(s) or organization(s) other than those engaged in the transaction and are not reflected fully in prices. In other words, an externality occurs if the consumption/production of a veterinary service by one farmer or service provider affects another farmer's utility or service provider's ability to produce, without being fully and directly reflected by market prices (Merlo and Briales, 2000). For example, the benefits of a farmer vaccinating or spraying his or her animals accrue to another farmer who did not pay for that service because of reduced risk of exposure to his or her animal from neighboring farmer vaccinating his or her animals. This is an example of positive externality (Ahuja, 2004; Umali et al., 1994). A negative externality occurs when a quarantine declared by the government inflict significant losses to actors other than farmers in the value chain, such as traders, slaughterhouses, casual labourer's, and butchers (Rich and Wanyoike, 2010). If a livestock health service generates an externality, an integrated system that involves key actors like farmers, paraprofessionals, veterinarians, NGOs, local leaders and government will have a higher comparative advantage than any other system. Coase (1960) argues that the optimal solution to an externality is a negotiated solution. The role of government would be to organize and enforce the solution. Empirical evidence from most developing countries including Ethiopia, Kenya, and Uganda reveals that during vaccination exercises, paraprofessionals, veterinarians (especially those from government), farmers, local leaders and non-governmental organizations are involved (Wolmer and Scoones, 2005; Ilukor, 2012).

***Hypothesis 1*:** *If a veterinary service is characterized by an externality, the integrated system has a comparative advantage over the paraprofessionals or veterinary professionals system.*

3.2 Free rider problem

A free rider problem occurs if a member of the community or group who obtains benefits from the community or group does not contribute or bear a share of costs of the providing benefits (Albanese and Fleet, 1985). Unlike in the case of an externality, a free rider problem is generated directly by the affected agents or farmers. It is usually an acute problem in the collective provision of public goods or services (Stroup, 2000) because of low excludability and subtractability in consumption of public goods (Umali et al., 1994). Using an example by Umali (1994), farmers asked to contribute for aerial spraying to control the tsetse-flies, will shirk or avoid making such a contributions (Ahuja, 2004). Other examples of veterinary services for which the free rider problem can occur are quarantines and vaccination, if provided collectively. Due to the free rider problem, public goods and services are considered to be provided collectively, either through taxes and/or subsidies (Ahuja, 2004; Umali et al., 1994). Thus we can hypothesize that:

Hypothesis 2: *If a veterinary service is characterized by the free rider problem, the integrated system which has strong government backing has a comparative advantage over a paraprofessional, and a professional system.*

3.3 Transaction intensity

Pritchet and Woolock define transaction intensity as the extent to which a service requires a large number of transactions and face-to-face interactions (Pritchett and Woolcock, 2004). This concept relates directly to Oliver Williamson concept of frequency of transaction (Williamson, 2005). As argued by Pritchet Woolock (2004) and Birner & Linacre (2008), transaction intensity is closely linked to economies of scale. Economies of scale refer to reduction or increase in the unit cost of providing a service as a number of livestock farmers served increases. If the unit cost of providing a service increases as the number served increases, the service is said to have low economies of scale. If unit costs decreases as the number served

increases, a service is said to exhibit high economies of scale. In animal health service delivery, low economies of scale arise from the indivisibility of transportation (fixed) costs incurred by service providers irrespective of the number of animals he or she will treat (Ahuja, 2004). They also arise from spatial spreading or the distribution of clients (livestock keepers) and from the frequency with which a service is demanded (Pritchett and Woolcock, 2004; Birner and Linacre, 2008; Birner and Braun, 2009). For services such as clinical services, breeding, extension, surveillance, and diagnostic services, the paraprofessional system will have a comparative advantage over professional and referral system because it is closer to farmers other factors kept constant.

Peeling and Holden (2004) observed in poor rural areas in Kenya, Tanzania, and Philippines that most farmers were of the view that although veterinarians provide better services due to better training, they were located too far from livestock-keepers to be accessible at reasonable costs (Peeling and Holden, 2004). Empirical evidence from productive areas of Kenya show that Animal Health Assistants are the predominant service provider at the farm level because they live closer to farmers and are therefore more accessible to farmers (Ndung'u, 2002; Oruko and Ndung'u, 2009). In state of Andhra Pradesh in India, Sastry and Raju (2005) found that paraprofessionals have a comparative advantage in the provision of clinical services and artificial insemination because they live in villages with farmers. These results are also supported by Kathiravan et al. (2011) who found that the average cost for travel and waiting time for using veterinarians were higher than those of using paraprofessionals for clinical and breeding services.

> ***Hypothesis 3:*** *When a service exhibits high transaction intensity and low economies of scale, the paraprofessionals system has a comparative advantage over the referral and professional system.*

3.4 Care intensity

Care-intensive transactions or services require a service provider to be watchful, cautious and diligent (Fenoaltea, 1984; Birner and Wittmer, 2004; Pritchett and Woolcock, 2004) and relates to Williamsons concept of asset specificity (Birner and Braun, 2009). Care intensity can be measured in terms of the time spent waiting for the service provider after the first contact, the time the service provider spends with a farmer, and the number of visits (Wennberg et al., 2009). As Leonard (2000) explains, livestock keepers are more concerned with effort, accessibility and timeliness of service providers over formal qualifications. Empirical evidence from the state of Tamil Nadu in India reveals that the waiting time for private veterinarians was highest, followed by government veterinarians and paraprofessionals (Kathiravan et al., 2011). Similarly, service time for paraprofessionals was higher than government and private veterinarians, indicating that paraprofessionals tend to provide more attention to farmers' needs and interests. In addition, because paraprofessionals are located closer to farmers, they can more frequently visits and monitor an animal's response to treatment, the probability of death, the in milk produced and animal weight loss is reduced thus reducing transaction costs. Accordingly, transaction costs curves for paraprofessionals will have a flatter slope the veterinarians.

Hypothesis 4: *If a service is characterised with care-intensity, the paraprofessional system has a comparative advantage over the referral and veterinary system*

5.5 Service Measurability

Measurability refers to how difficult it is for people who contract a service to measure and predict the actions of the service provider because of uncertainty arising from limited knowledge of the person paying for the service (Brown and Potoski, 2003). The concept of measurability directly relates to the principal agent-problem that arises from asymmetric information and limited knowledge. Measurability attribute is related to Williamson's concept of

asset specificity and uncertainty in that the animal health service providers (agents) are consulted because they have specialized knowledge or skills, but the principals (livestock keepers) cannot be sure that the service providers' skills and efforts are appropriate to solve their problem (Ly, 2003). Therefore, in repeated interaction, the principals may lose confidence and trust in the quality of the services offered by the practitioners especially if the outcomes of the transactions are bad. Consequently, principals may reduce their consumption of the services and they may only be prepared to pay an amount that is less than the value of the lowest-quality services available in the market (Leonard, 2000). As a result, a so-called "lemon market" arises. This theory was developed by Akerlof (1970) who used the term "lemon" to refer to sub-standard product. Phrased differently, a lemon market refers to a situation where the providers of services that meet or exceed professional standards are driven out of the market by substandard service providers due to the problem of information asymmetry between service providers and clients.

In the provision of clinical services, for example, a livestock farmer has a limited capacity to determine with certainty the quality of care and effort that a service provider has employed (Leonard, 2000). If a farmer does not believe that the service provider is exerting sufficient effort based on previous experience or experience of someone in his or her network, he may be unwilling to pay for the service and may decide to change to another service provider. If he has limited options, he may either resort to self-treatment or selling the animal at a lower price (Mockshell, 2011) or obtaining poor quality service at a lower price. This may result in drug abuse and resistance, in animals thus increasing costs and losses to farmers as well as hospitalization costs for humans who develop antimicrobial resistance from consuming animal products from those animals (Wang et al., 2012). Clinical services and other services, such as quality control of drugs, and vaccine development, which require expert knowledge, will need to be provided veterinary professionals. However, if a service requires less expert knowledge to

assess its outcome, such as tick control, and breeding, paraprofessionals can be more cost-effective.

> ***Hypothesis 5***: *With high measurability, professionals will have a comparative advantage over paraprofessionals.*

However, most services such as disease surveillance and reporting and treating of epidemic diseases, require both local and expert knowledge. For such transactions, an integrated or referral system will have a comparative advantage. For example, farmers and paraprofessionals can observe the signs of an outbreak of Riderpest, but expert knowledge is required for an accurate evaluation. Equally, clinical services which have low economies of scale, high transaction intensity, and high measurability will require an integrated or a referral system.

> ***Hypothesis 6***: *If a service exhibits a mix of high measurability, externality, care and transaction intensity, an integrated or referral system has a comparative advantage over the professional and paraprofessionals.*

3.6 Scope of corruption (state capacity)

Scope of corruption refers to the extent to which an officer is likely to use public resources and power entrusted to him or her for personal gains. This problem is manifested in four ways: (1) demanding bribes, (2) stealing or misuse of public resources, (3) elite capture and (4) influencing peddling (Shah, 2007). In the state of Karnataka in India, where veterinary clinical services and vaccination are offered freely by the government, 33% of the users paid for the services, 16% reported paying bribes of $2 (Vivekananda et al., 2010). In Uganda, a report by the Economic Policy and Research Centre (EPRC) revealed that in a Tsetse fly control project, $20,975 was recorded to have been released to Pallisa district in 2006, but information at Pallisa district indicates that only $1,044 was received and the rest was not accounted for (EPRC, 2009). The results for 2007 indicate that funds were expended on behalf of the districts by the district

administration for provision of administrative goods and services rather than tsetse control (*ibid*). Moreover, no accountability was presented for the funds even for those expenditures.

The scope of elite capture is predominantly a problem in the decision-making process by local and central governments and is aggravated by the problem of "rational ignorance" where livestock keepers or voters do not always know what the government and its opposition are doing to serve their interests, because getting that information is costly (Downs, 1957, 2011). Vu (2007) presents two interesting examples: In Thailand government rejected vaccination against avian influenza and opted for alternatives like a ban on fowl transport and the insertion of microchips in fighting cocks which benefitted exporting firms owned by mainly politicians (Vu, 2007). The second example is a case of bird flu outbreak detected in July 2003 in Vietnam. The government never publicized it and adopted a policy of quiet containment until the situation became out of control (Vu, 2007). In Uganda, politicians have been observed intervene in providing preventive services based on the electoral schedule to please different interest groups. The director of animal resources at ministry of agriculture noted that local politicians support traders to defy a quarantines (see Otim, 2011a; Wetaka, 2011; Monitor, 2012) and veterinarians are sent on forced leave to pave way for lifting quarantines. When the president's intervention is thought, he responds after elections. For example, they had petition the president to direct local politicians not to interfere with the implementation of quarantines early 2011 but the president intervened in January 2012, after the 2011 elections (Presidents Office, 2012).

The above example provides evidence that, when scope of corruption and elite capture is high, there no clear cut solution. Nonetheless, an integrated system where professional veterinarians, civil society, and government engage with each other may be appropriate. As Sabin & Dehaven (2012) argue, a well-educated animal health workforce will be better poised to actively advance good governance practices of accountability and transparency, thus minimizing corruption. However, professional veterinarians in most developing countries work in

government. The civil society is needed to check the activities of the government officials and politicians and build the capacity of the community to demand better services (White, 1994).

Hypothesis 7: *If the scope of corruption is high, an integrated system has high comparative advantage over veterinary professionals and paraprofessionals.*

3.7 Community attributes or community capacity

Community attributes refer to social economic attributes of society or local governments that affect service delivery (Rose-Ackerman, 2007). These factors may include the ethnicity and education level of service providers and farmers, availability of infrastructure, community's collective action capacity, and the respective livestock production system. Ethnicity and education level of service providers is relevant in facilitating communication between a service provider and the farmer (Rushton, 2009) as well as building trust between a farmer and service provider (Oruko and Ndung'u, 2009). However, education levels in pastoral communities are low, and veterinarians who are hired by government are often from different ethnic backgrounds and cannot speak the same language as the farmers. In addition, veterinarians posted to these areas are often reluctant to work there (Hassan, 2003). Positions for the veterinarians are advertised, but no or few applications are received because pastoral areas have poor transport, communication, housing infrastructure, and the area is often insecure (Watson, 2008). As a result, there are very few veterinarians in such areas. Consequently, paraprofessionals have a comparative advantage in such areas relative to veterinarians because they can survive under above environment (Peeling and Holden, 2004). However, most paraprofessionals are not well educated and not trained for the job, resulting in drug abuse and increased drug resistance (Mugunieri et al., 2004). An integrated system of veterinarians and paraprofessionals may have a comparative advantage since it can avoid these problems. In fact, a veterinarians in the Karamajong region in Uganda remarked during our field work that he often ask the community

animal health workers, especially those he has trained to substitute for him when he is out of station.

Another important community factor is the community's collective action capacity which is often measured by membership in veterinary association and participation of community members in farmer groups, cooperatives, and service provider associations like CAHWs associations. Community groups and institutions help in establishing and strengthening social networks which serve as communication channels for new knowledge and information (Ireland and Thomalla, 2011). In this particular case, farmer can share information regarding control of diseases among themselves and with service providers. Also, service providers are able to share information with other service providers. Groups also help in redressing or reducing the scope of corruption and elite capture (Dasgupta and Beard, 2007) and enable farmers or citizens to pool their resources together to minimize production risks (Ireland and Thomalla, 2011). For example Githunguri Dairy cooperative in Kenya has overcome perceived risks of inadequate quantities of milk, the problems related to milk collection, transportation and processing and have widened their market share. This has increased farmer income and their capacity to seek services from private veterinarians and paravets (FAO, 1999). Empirical evidence from Uganda show that areas with high community collective action capacity has reduced poverty rates (Kwapong et al., 2012).

Hypothesis 8: *If the community capacity is high the comparative advantage of veterinary professional's increases relative to paraprofessionals. Paraprofessionals could only benefit by working together with veterinary professionals.*

The transaction cost approach described above shows that in terms of cost-effectiveness, the market failure theory is useful, but not sufficient in analysing institutional arrangements or systems for providing animal health services. The sufficient condition requires that both governance factors together with market failures should be considered in the analysis of animal service delivery. From the market failure literature, two attributes have been identified:

externality and free rider problem. The ramifications of these attributes for the delivery of animal health services are quite clear and discussed in Ahuja (2004) and Umali et al.(1994). For example, when a free rider and externality problem is high, the more appropriate system is the integrated system. In the case of the two governance attributes of care and transaction intensity in both space and time, the more relevant they are, the more appropriate system would be the paraprofessional system assuming that other factors are held constant. Measurability and high scope of corruption require veterinary professionals with technical knowledge. However, most veterinary professionals are work in the government, so they are susceptible to political interference. Moreover, they are poorly facilitated to perform their task. Therefore, an integrated system would be more appropriate than other systems. The approach also hypothesizes that veterinary professionals would gain a comparative advantage if community capacity to demand animal health services improves.

4.0 Empirical Analyses

In this section, the paper uses data from a household survey in Uganda and Kenya to test these hypotheses by considering a case of clinical services. The data was collected in 2012 from four districts; one district in each country was from a pastoral production system (Amudat in Uganda and North Pokot in Kenya) and the other in an intensive production system (Mukono in Uganda and Kiambu in Kenya). The sampling design employed was two-stage clustered sampling. The respondents were clustered based on districts and randomly sampled from lists of farmers who participated in routine vaccination exercise in each district in the same year. Since the target of routine vaccination exercises is all farmers keeping livestock in the district, the sampling frame was taken as exhaustive. A total of 476 livestock farmers were interviewed. The information collected relates mainly to governance and community attributes discussed above and the summary statistics of the data variables are represented in Table 2 below. The results

generally show that 52% of the farmers treated the last cases in their farms by themselves, 31% used services of paraprofessionals and only 17% used services veterinarians.

Table 2: Means and Standard Deviation of selected variables for clinical veterinary services

Variable	Description	Mean	Std. Dev.
Service System			
Veterinarian	1 if a farmer used the veterinarian service in the last case treated in his/her farm, 0 otherwise	0.172	0.378
Paraprofessional	1 if a farmer used the veterinarian service in the last case treated in his/her farm, 0 otherwise	0.309	0.462
Self-treatment	1 if a farmer treated last case in his/her farm by himself or herself, 0 otherwise	0.519	0.500
Service attributes			
Experience	A farmers experience in keeping livestock in (Years)	16.498	14.640
Education	Education level: 1=No-education, 2=Primary, 3= High school, 4=Certificate 5=Diploma ,6=Degree	1.868	0.874
Skills	1 if a farmer has knowledge on methods of treating the recently treated diseases, 0 otherwise	0.445	0.498
Records	1 if a farmer keeps farm records, 0 otherwise	0.166	0.372
Epidemic disease	1 If the recently treated animal disease in the farm is an epidemic disease, 0 otherwise	0.410	0.492
Disease frequency	Frequency with which the disease occurs in a year	6.137	12.960
TLU	Total Livestock Units in a given household	10.346	16.468
Numpp	Number of farmers present when the animal was being treated	1.679	8.076
Waiting-time	Time taken by livestock service provider to come to attend the case (Hours) including travel time	2.236	6.218
Time-spent	Time spent by livestock service provider with the farmer (Hours)	0.551	0.804
Cash objective	1 if the objective of keeping livestock is for cash, 0 otherwise	0.557	0.497
Improved livestock	1 if a farmer if a farmer keeps improved livestock , 0 otherwise	0.357	0.480
Contextual factors			
Bank account	1 if a farmer has a bank account, 0 otherwise	2.784	1.190
Credit	1 if a farmer used credit for farming purpose in the previous year, 0 otherwise	0.153	0.361
Phone	1 if the phone is the means of contact with livestock service providers, 0 otherwise	0.479	0.500
Group	1 if a farmer is a member of a livestock farmers association, 0 otherwise	0.300	0.459
Country	1 if a farmer is from Uganda, 0 for Kenya	0.431	0.496
System	1 if a farmer is from pastoral systems, 0 Intensive system	0.498	0.501
Avail_para	1 if a farmer ranked paraprofessionals as available, 0 otherwise	0.496	0.500
Avail_vet	1 if a farmer ranked veterinarians as available, 0 otherwise	0.269	0.444

4.1 Measurements

As noted by David and Han (2004) and Carter and Hodgson (2006), there are extensive measurement problems in the empirical analysis of transaction costs economics because of lack of unanimity on the measurement of variables. Because of this limitation, most empirical studies in transaction economics apply proxy variables to specific attributes (Battu et al., 2002; McMaster and White, 2013). For example, Battu et al. (2002) proxied labour specificity with job tenure, and membership in trade unions. In this study, the service of interest is clinical services. This proxy variables are used to test the hypotheses generated in the previous sections and demonstrated the application of Oliver Williamson discriminating alignment approach in animal health service delivery.

In the provision of clinical services, the treatment of contagious or highly epidemic diseases in one farm produces a positive externality because it reduces the risk of the disease spreading to other farms. As a result, disease type can be a proxy variable for externality. Transaction intensity is proxied by the frequency with which disease occurs in the farm and the total livestock units. Number of community members or neighbours present during the treatment of the animal was also considered as a proxy of transaction intensity because as Leonard (2000) noted, half of the business for service providers comes from requests from farmers in the community after reaching the on call from the another farmer. This concept relates to trust and strong social ties resulting from being known to the farmers. If you are a known service provider, when you appear in village, then others farmers will come around. In human medical care, Wennberg et al. (2009) consider time spent with a patient and time spent waiting for the service provider after first contact as proxies for care intensity. In this study, care intensity was proxied by the time that the service provider spends with the farmer, takes to respond to the case and the type of livestock kept (improved or local). Harris & Newman (1994) observed that the objective of farmers who keep improved breeds is to maximize profits through

increased milk production. Milk production efficiency is associated with increased incidence of metabolic disorders, impaired fertility and other health problems such as digestive disorders, skeletal disorders, and mastitis (Rauw et al., 1998). Managing these problems requires technical skills that farmers do not possess and therefore they would need to use service providers. However, as Rauw et al. (1998) argue, undesirable effects resulting from increased milk production efficiency require a lot of care, consciousness, and diligence. This means that a service provider should be located close to a farmer, be easily available and willing to spend a lot of time closely monitoring the welfare of the animal. For these reason, the type of livestock is a proxy for care intensity.

Measurability attributes is also proxied by type of disease and the farmer's experience of keeping animals, educational and record keeping. Epidemic disease treatment always requires special skills and resources that paraprofessionals may not possess. Koma (2003) observed that veterinary professionals in Uganda are mainly consulted to handle tasks that require special skills or when the animal fails to respond to treatment. Education and experience of a farmer reduces the principle agent problem and Williamson's bounded rationality problem. Thus, farmers with experience and better education will tend to use services of veterinary professionals (Irungu et al., 2006). Hall et al. (2004) contend that recording extension effort, such as health management, helps to reduce imperfect information and enables farmers to gain a better understanding of animal health management skills.

In clinical service delivery, proxy variables regarding the scope of corruption are difficulty to capture for two main reasons: (1) Clinical services were privatized and not provided by the government and (2)because clinical services are under the private sector, the other form of corruption in clinical service delivery is the over prescription of drugs to increase sales. This information is difficult to capture using surveys and self-reporting by farmers and service providers. The empirical test of the hypothesis generated under corruption is difficult for clinical

services based on surveys, but can be tested for other services such as vaccination, quarantines, and meat inspection, that are provided by government. In any case, the empirical examples cited in the literature review should provide appropriate insights for the hypothesis regarding corruption. However, in this study we use availability of veterinarians and paraprofessionals and the nation or country variable as a measure of state capacity. Jarman et al., (2011) suggest that the capacity country's veterinary system depends on the on availability of veterinarians and level of state engagement in the provision of veterinary services. A number of other contextual or community factors were also identified and include membership in a livestock farmer association, having a bank account, and phone ownership.

4.2 The model

The interest of this paper is to determine the service attributes and contextual factors that influence the choice of a given system in the provision of animal health services. Using the case of clinical services, the study seeks to analyse the hypotheses generated from the literature review using the Williamson discriminating alignment hypotheses. The service attributes and contextual factors are indicated in Table 2 are the independent variables, while the dependent variable is the choice of the service delivery system. Given the binary nature of such choices, qualitative choice models are appropriate for analyzing these relationships. The most commonly used models in analyzing such relationships in the new institutional econometric analysis are the probit and logit models (Sykuta, 2008). In most applications, the choice between the two models does not make a difference (Greene and William, 2007).

As noted by Sykuta (2008), the nature of questions which transaction costs economics theory addresses, presents fundamental problems to statistical modeling. These problems include the "fallacy of dichotomous choice", endogenous decision making, and self-selection. The fallacy of dichotomous choice arises when two or more systems are used instead of one. We therefore examine three separate models representing the use of different service providers: the farmer

(self-treatment), veterinary, and paraprofessional. In clinical veterinary services, this could arise in two ways: (1) a farmer can decide to consult with a paraprofessional or a veterinarian and then the farmer buys the drugs treats the animal himself, (2) a farmer uses the services of a paraprofessional and the paraprofessional consults a veterinarian before treating the animals. This poses a problem of determining outcomes of the dependent variable (choice of the system). In the case of the first problem, in this study, if a farmer treats the animal himself using modern or local medicine or if a farmer consults with a service provider and then decides to treat the animal himself, this is considered self-treatment (y=1 and 0 otherwise). In the case of the second problem, a farmer is considered to have used a service of paraprofessional or veterinarian if the paraprofessional or the veterinarian treated the animal irrespective of whether he was consulted or referred to (the dependent variable representing if the veterinarian or paraprofessional was the service used equals to one and 0 otherwise).

Endogeneity problems arise because choice or use of paraprofessional or the veterinarian services depends on the availability of veterinarians or paraprofessionals respectively and their availability. To circumvent this problem of endogeneity, a two-step procedure described in Rothe (2009 and Dong(2010) was used to correct for the endogeneity problem. In the first stage, perceptions about the availability of service providers are estimated using a reduced form probit model that includes contextual factors or production system variables, which influence both the availability and use of the services of animal health service providers and the residuals were extracted. The estimates of the regressor and the extracted residuals were used in the second stage to estimate structural equation as control variables to the estimated equation. Both the structural and reduced form equations were estimated using maximum likelihood probit with robust standard errors. The coefficients of the first step errors for veterinarian availability ***(Errorvet)*** and paraprofessional availability ***(Errorpara)*** as shown in Table 4, were positive and significant with use of veterinarian and paraprofessional services respectively. This suggests that

availability of service providers is endogenous in the structural equation and the unobserved variables that affect use of the service provider's services also increases their availability.

Formally, the two step probit model is:

$$y_{1i}^{*} = \beta y_{2i} + \alpha x_i + \mu_i;\ \ y_{1i} = 1\ \ y_{1i}^{*} > 0, 0\ otherwise$$

$$y_{2i} = \pi z_i + \varepsilon_i$$

Where i = 1,…..,N and variable y_{1i} represents aspects that influence the choice of a service provider captured as a dummy variable which takes the value of one if the farmer used the services of a particular service provider and zero otherwise. The variable y_{2i} is vector of endogenous variables, x_i is a vector of exogenous variables, and z_i is a vector of some the variables in x_i. The equation y_{2i} is expressed in reduced form and β and α are vectors of structural parameters, while π is a vector of reduced form parameters.

According to Dong(2010) the use instrumental variable which is outside the model is generally preferrable than using using the one within functional form. However, in the absence of the good instrument, endogeneity can be controlled using a two-step approach (Rothe, 2009; Dong, 2010). In this particular case, we tested different instruments including production system and country of farmers but both the the Sargan-Hansen test and Hansen's J statistic revealed that the instruments are not valid. Therefore, a two-step approach was most suitable alternative. Another concern with regards to this study is that of sampling design chosen. Since, we used one stage clustered sampling where districts were clusters and farmers sampled using simple random sample, probit models with and without cluster weights were estimated. The standard errors of probit model without cluster weights were much larger than those of the model with cluster

weights. So, we estimated probit model with cluster weights and robust standard errors. Finally, we also checked for collinearity of variables included in the structural model. The variance Inflation factor (VIF) for all variables including the error terms from the first step regression were below 10. This suggests that collinearity was not a problem.

5.0 Results

Results from empirical analyses are presented in Tables 3 and 4. The log-likelihoods in all models exhibit robustness of the models. Table 3 contains results from reduced form estimation about farmers' perceptions regarding the availability of service providers. Results show that the availability of service providers significantly varies with system of production and country. Uganda as opposed to Kenya has a negative relation with availability veterinarians and a positive relationship relation with availability of paraprofessionals. The system variable has a negative coefficient with the availability of both paraprofessionals and veterinarians suggesting that pastoral livestock production systems have inadequate animal health service providers relative to intensive livestock production systems.

The availability of paraprofessionals was found to have a negative relationship with availability of veterinarians and the availability of veterinarians was found to have a negative relation with the availability of the paraprofessional, suggesting a competitive relationship between veterinarians and paraprofessionals. Having a phone is positively associated with the availability of the veterinarians, but has no significant association with the availability of paraprofessionals. This suggests that veterinarians are more easily available in areas with mobile network coverage while mobile phones do not affect availability of paraprofessionals because they are nearer and could be visited in person. As expected, results indicate that in pastoral areas, paraprofessionals have a comparative advantage than veterinarians. What is surprising, however, is that even pastoral systems; farmers perceive paraprofessionals as not available, as shown by a significant negative sign of the coefficient systems variable.

Table 3: A reduced form probit models for availability of veterinary service providers

	Availability Paraprofessional			Availability of Veterinarians		
Variable	dy/dx	Std. Err.	z	dy/dx	Std. Err.	z
Account	-0. 017	0.023	-0.73	-0.001	0.017	-0.58
Credit	-0. 015	0.067	-0.22	-0.007	0.051	-0.14
Phone	0. 107	0.069	1.54	0.203***	0.052	3.93
Group	0.075	0.052	1.45	0.007	0.041	0.18
Country	0. 111***	0.041	2.69	-0.123***	0.032	-3.79
system	-0.331***	0.064	-5.86	-0.295***	0.054	-5.44
Avail_para				-0.282***	0.032	-8.74
Avail_vet	-0.416***	0.050	-8.24			
Number of obs = 476				Number of obs = 476		
LR chi2(8) = 136.42				LR chi2(8) = 221.05		
Prob > chi2 = 0.0000				Prob > chi2 = 0.0000		
Pseudo R2=0.2067				Pseudo R2=0.3986		
Log likelihood = -261.71297				Log likelihood = -166.58779		

Significance level: *p<0.05, **p<0.01, ***p<0.001

The empirical results from the structural equation are presented in Table 4. The test of significance is the Wald Likelihood ratio test, which follows a chi-square distribution with 3 degrees of freedom and z test with a 5% significance level. The models for the use of a veterinarian, a paraprofessional as well as self-treatment are statistically significant *(P<0.0001)*. From Table 4, it is apparent that variables for measurability attribute such as disease type, experience, skill, education, and keeping records, are positive and statistically significant in influencing the use of veterinarian services. However, experience, skill, education, disease type, and keeping records have a negative and statistically significant influence on the use of paraprofessional services. These results suggests that possession of skills and experience, education and recording keeping positively influence the use of veterinarian services compared to paraprofessional services. These results support hypothesis 5, which states that with high measurability, the veterinarians (professionals) will have a comparative advantage over the paraprofessionals.

Table 4: A probit regression models for the use of veterinarian, paraprofessional and self- treatment system of providing veterinary services

Systems	Veterinarian		Paraprofessionals		Self-treatment	
Variables	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
Age	0.000	0.001	-0.002	0.001	0.001*	0.001
Experience	0.004***	0.000	-0.003***	0.001	0.000	0.001
Education	0.073***	0.023	-0.047	0.032	-0.029	0.015
Skills	0.033*	0.016	-0.102***	0.031	0.077***	0.017
Records	0.137***	0.029	-0.170***	0.054	0.002	0.033
Epidemic disease	0.156***	0.032	-0.122**	0.046	-0.062	0.038
Frequency	-0.003	0.003	0.001	0.001	-0.001	0.001
TLU	-0.007***	0.002	0.002**	0.001	-0.001***	0.000
Numpp	-0.001***	0.000	0.001*	0.001	0.000	0.000
Waiting-Time	0.006***	0.002	-0.001	0.002	-0.007*	0.003
Time-spent	-0.035	0.025	0.112***	0.016	-0.074**	0.026
Improved livestock	-0.100***	0.043	0.118***	0.026	-0.023	0.025
Account	0.022***	0.003	-0.038***	0.005	0.010	0.008
Credit	-0.060**	0.023	0.074*	0.033	0.009	0.017
Cash objective	0.079***	0.017	-0.102***	0.028	0.018	0.013
Phone	0.054	0.056	0.012	0.121	-0.003	0.054
Group	-0.019	0.045	-0.068**	0.026	0.018	0.016
Gender	0.014	0.018	0.014	0.014	-0.017	0.014
Nation	-0.020	0.067	0.078*	0.043	-0.014	0.018
Avail_para	0.689	0.419	0.445***	0.058	-0.414*	0.174
Avail_vet	0.370***	0.048	0.427**	0.160	-0.403**	0.050
Errorvet	0.431*	0.176	0.056	0.080	-0.175	0.104
Errorpara	-0.014	0.067	0.198**	0.068	-0.113***	0.013
N	476		476		476	
Prob>chi2	0.0000		0.0000		0.0000	
Log pseudolikelihood	-364.335		-466.568		-259.965	
Wald Chi2(3)	136.71		138.10		211.12	
Pseudo R2	0.4215		0.4276		0.6993	

Significance level: *p<0.05, **p<0.01, ***p<0.001

The proxy variables for transaction intensity, such as the number of community members (farmers) or neighbours present during the treatment of the animal and the total number of livestock units, have a significant and negative influence on the use of veterinarian services, but have a positive influence on the use of paraprofessional services. The total livestock unit decreases the probability of using veterinarian services because the probability of animal

falling sick is high (Hill et al., 2009). This translates to increased frequency of transaction and transaction costs. The number of farmers present in treatment of the animal increases probability of using a paraprofessional services because they are known to the farmers as opposed to veterinarians thus, increasing the economies of scale for paraprofessionals relative to the veterinarians. These results support hypothesis 3 which states that when a service exhibits high transaction intensity and low economies of scale, the paraprofessionals system has a comparative advantage over the referral and professional system.

Care-intensity variables, such as waiting time, were found to positively influence the use of veterinarian services and negatively influence the use of paraprofessional services, suggesting that when farmers contact veterinarians, veterinarians tend to respond more quickly than paraprofessionals. This suggests that than professionals are more responsive to farmers' needs thus countering hypothesis 4. It is also possible that the waiting time is not a correct proxy for care-intensity because it could mean that veterinarians do not have many customers and can afford to reach the farmers faster. Therefore, waiting time could be a good proxy for transaction intensity. However, the service provider's time spent with the farmer and if a farmer keeps improved animals positively influence the use of paraprofessionals but negatively influence the use of veterinarian services. These results suggest that, even if veterinarians take a shorter time to respond to farmers, they cannot provide farmers with adequate attention and care. These results confirm our hypothesis 4 that when a service has the attribute of care-intensity, the paraprofessional system has high comparative advantage over the veterinarian system.

Community capacity and particular farmers' characteristics, like having bank account and keeping livestock for cash or commercial purposes, positively influence the use veterinarian services and negatively influence the use of paraprofessional services. This suggests that a veterinarian system may not survive in pastoral areas which lack banks or financial institutions and where livestock is kept mainly for food rather than cash. Group variable was found to

negatively influence the use of paraprofessional services but no evidence exists to support that it influences the use of veterinarian services. Overall, these results support hypothesis 8, which states that; if the community capacity is high the comparative advantage of veterinary professional's increases relative to paraprofessionals. Paraprofessionals could only benefit by working together with veterinary professionals.

The country or nation variable was found to positively influence the use of paraprofessionals services, but no significant evidence exists to suggest that the country variable influences the use of veterinarian services. This is probably because paraprofessionals are more available in Uganda as opposed to Kenya as shown by the results in Table 3. The non-significant evidence for use of veterinarian services and country could mean that veterinarians involved in provision veterinary services are few in both countries. Another very important result from these models is that, availability of paraprofessionals' increases the use of the veterinarian services and the availability of veterinarians' also increases the use of the paraprofessional services, suggesting the existence of synergistic relationship between paraprofessionals and veterinarians. This result demonstrates the need to develop a referral system and the importance of the referral system in improving state capacity to provide public veterinary services.

Conclusions

Previous analytical frameworks for animal health service delivery have mainly focused on the theory of market failures. This paper has gone an extra step to include governance factors and to demonstrate the application of Williamson's transaction costs theory or discriminating alignment approach to animal health service delivery. The approach enables us to integrate insights from market failures, governance, and livestock production system attributes and provides a lens for analyzing and addressing governance challenges in animal health service delivery. Empirical results show that paraprofessionals, such as community animal health workers are desirable because the offer the needed care and attention to clients since they are

located closer to clients and thus have lower transaction costs and may be trusted more by farmers. However, for services that require technical expertise, veterinarians will be more cost effective than paraprofessionals. Moreover, a referral system may be preferable and significance in building state and community capacity to provide veterinary services.

The limitation of applying Williamson's discriminating alignment hypotheses to animal health service delivery is that veterinary services have a mix of attributes. For example, clinical veterinary services are transaction and care intensive and require high technical skills. Therefore, it becomes challenging to align a particular service to a particular system. Moreover, the contexts in which services operate vary greatly. Nevertheless, the insights we gain from this approach is that it is not enough to categorize animal health services in terms of public and private goods. Doing so ignores governance attributes that ensure continuity and sustained service delivery, as well as variation in technical competences of the service providers and the quality of veterinary services offered to livestock farmers. Such categorization of services into public and private assumes that the private sector can attract skilled service providers and that users are able to measure the quality of the services provided by these service providers. As experience has shown, trained veterinarians in most developing countries are found in the government sector. Even in the public sector, a limited number of trained veterinarians are willing to work in pastoral livestock production systems which have high livestock populations, given their remoteness. Worse still, corruption and misuse of public funds has completely undermined government capacity to provide veterinary services.

In light of these observations, a solution lies in improving paraprofessional and veterinary relations through referral arrangements. As the results indicate, the use of veterinarian services is positively related to the availability of paraprofessional services. How referrals between veterinarian and paraprofessionals can be improved is a topic beyond the scope of this paper. Nevertheless, we recognize the importance of a synergistic relationship between

veterinarians and paraprofessionals. Promotion of one system without the other reduces the use of the other system. Veterinarians are required for their technical expertise, while paraprofessionals are important because their availability to farmers. Therefore, governments of developing countries need to develop an integrated animal health care system consisting of government and private veterinarians and private paraprofessionals together. This would build state capacity and enable animal health markets to flourish.

Acknowledgement

We thank Professor David Leonard for the valuable comments during the developments of this paper. We also thank the Food Security Center at University of Hohenheim and Fiat Panis Foundation for their financial support during writing of this paper.

References

Ahuja, V., 2004. The economic rationale of public and private sector roles in the provision of animal health services. Revue scientifique et technique (International Office of Epizootics) 23, 33–45; discussion 391–401.

Ahuja, V., Rajasekhar, M., Raju, R., 2008. Animal Health for Poverty Alleviation: A Review of Key Issues for India.

Ahuja, V., Redmond, E., 2001. Economic and Policy Issues in Livestock Service Delivery to the Poor. … Poor Livestock Policy Initiative: Fostering the Policy … 6324856.

Ahuja, V., Redmond, E., 2004. Livestock services and the poor. Tropical animal health and production 36, 247–68.

Akerlof, G. a., 1970. The Market for "Lemons": Quality Uncertainty and the Market Mechanism. The Quarterly Journal of Economics 84, 488.

Albanese, R., Fleet, D. Van, 1985. Rational behavior in groups: The free-riding tendency. Academy of Management Review 10, 244–255.

Arrow, K., 1969. The organization of economic activity: issues pertinent to the choice of market versus nonmarket allocation, in: Analysis and Evaluation of Public Expenditures: The PPP System. Washington, D.C., Government Printing Office, Washington, pp. 47–64.

Battu, H., McMaster, R., White, M., 2002. An empirical investigation of Oliver Williamson's' organization of work'. Applied Economics 34, 37–41.

Birner, R., Anderson, J., 2007. How to make Agricultural Extension Demand Driven? The Case of India's Agricultural Extension Policy, in: Singh, S., Reddy, V.R. (Eds.), Changing Contours of Asian Agriculture – Policies, Performance and Challenges. Academic Foundation, New Delhi, pp. 139-180.

Birner, R., Braun, J. Von, 2009. Decentralization and public service provision—a framework for pro-poor institutional design, in: Ehtisham, A., Giorgio, B. (Eds.), Does Decentralization Enhance Service Delivery And Poverty Reduction? Edward Elgar Publishing.

Birner, R., Davis, K., Pender, J., 2009. From best practice to best fit: a framework for designing and analyzing pluralistic agricultural advisory services worldwide. Agricultural Education and Extension 15, 341–355.

Birner, R., Gunaweera, H., 2002. Between market failure, policy failure and "community failure": crop-livestock conflicts andtechnology adoption Sri Lanka, in: Meinzen-Dick, R.;Knox, A.;Place, F.;Swallow, B. (Ed.), Innovation in Natural Resource Management. The Role of Property Rights and Collective Action in Developing Countries. Hopkins University Press, Baltimore, pp. 186-206.

Birner, R., Linacre, N., 2008. Regional biotechnology regulations: Design options and implications for good governance. Internatioanl food Policy and Research Institute.

Birner, R., Wittmer, H., 2004. On the efficient boundaries of the state: the contribution of transaction-costs economics to the analysis of decentralization and devolution in natural resource management. Environment and Planning C: Government and Policy 22, 667–685.

Brown, T., Potoski, M., 2003. Transaction costs and institutional explanations for government service production decisions. Journal of Public Administration research and theory.

Carter, R., Hodgson, G.M., 2006. The impact of empirical tests of transaction cost economics on the debate on the nature of the firm. Strategic Management Journal 27, 461–476.

Chaudhury, N., Hammer, J., 2006. Missing in action: teacher and health worker absence in developing countries. The Journal of … 20, 91–116.

Coase, R., 1960. The Problem of Social Costs. Journal of law and economics 3, 1–44.

Dasgupta, A., Beard, V. a., 2007. Community Driven Development, Collective Action and Elite Capture in Indonesia. Development and Change 38, 229–249.

David, R.J., Han, S.-K., 2004. A systematic assessment of the empirical support for transaction cost economics. Strategic Management Journal 25, 39–58.

Dong, Y., 2010. Endogenous regressor binary choice models without instruments, with an application to migration. Economics Letters 107, 33–35.

Downs, A., 1957. An economic theory of political action in a democracy. The Journal of Political Economy 65, 135–150.

Downs, A., 2011. Why The Government Budget Is Too Small in a Democracy. World Politics 12, 541–563.

Economic Policy and Research centre, 2009. Agriculture Sector Public Expenditure Review Phase three: Efficiency And Effectiveness Of Agricultural Expenditures.

FAO, 1999. Lessons in dairy development – Case studies. Animal Production And Health Division.

FAO, 2012a. Lessons learned from the eradication of rinderpest for controlling other transboundary animal diseases. Proceedings of the GREP Symposium and High-Level Meeting, 12-15 October 2010, 15th ed, Lessons learned from the eradication of rinderpest for controlling other transboundary animal diseases. FAO Animal Production and Health Proceedings, Rome Italy.

FAO, 2012b. Foot-and-Mouth Disease situation.

Fenoaltea, S., 1984. Slavery and supervision in comparative perspective: a model. Journal of Economic History XLIV, 635–668.

Greene, W.H., William, H., 2007. ECONOMETRIC ANALYSIS, Sixth Edit. ed. Pearson Education , Inc., Upper Saddle River, New Jersey.

Grindle, M., 2007. Good enough governance revisited. Development policy review 29, 199–221.

Hall, D., Ehui, S., Shapiro, B., 2004. Economic analysis of the impact of adopting herd health control programs on smallholder dairy farms in Central Thailand. Agricultural Economics 31, 335–342.

Harris, D., Newman, S., 1994. Breeding for profit: synergism between genetic improvement and livestock production (a review). Journal of animal science 72, 2178–200.

Hassan, A., 2003. Restructuring of veterinary services through consolidation of private veterinary practice and introduction of new approaches for integration of target groups in the, in: Compendium of Technical Items Presented to the International Committee or to Regional Commissions. pp. 157–166.

Heffernan, C., Misturelli, F., 2000. The delivery of veterinary services to the poor: Preliminary findings from Kenya. program of animal health. ….

Hill, A.E., Green, A.L., Wagner, B. a, Dargatz, D. a, 2009. Relationship between herd size and annual prevalence of and primary antimicrobial treatments for common diseases on dairy operations in the United States. Preventive veterinary medicine 88, 264–77.

ILRI, 2012. Enhanced control of Contagious Bovine Pleuropneumonia (CBPP) in sub Saharan Africa through development of better diagnostics and vaccines [WWW Document]. animal diseases CBPP diagnostics disease control livestock vaccines-International Livestock Research Institute.

Ilukor, J., 2012. Analysis of Animal Health Service Delivery in Uganda : An Application of the Social Network Approach, in: Resilience of Agricultural Systems Against Crises.

Ireland, P., Thomalla, F., 2011. The Role of Collective Action in Enhancing Communities' Adaptive Capacity to Environmental Risk: An Exploration of Two Case Studies from Asia. PLoS currents 1–16.

Irungu, P., Omiti, J.M., Mugunieri, L.G., 2006. Determinants of farmers' preference for alternative animal health service providers in Kenya: a proportional hazard application. Agricultural Economics 35, 11–17.

Jarman, D.W., Liang, J.L., Luce, R.R., Wright, J.G., Stennies, G.M., Bisgard, K.M., 2011. Veterinary public health capacity in the United States: opportunities for improvement. Public health reports (Washington, D.C. : 1974) 126, 868–74.

Kathiravan, G., Thirunavukkarasu, M., Selvam, S., 2011. Time, costs and farmers' perceptions: the case of livestock service delivery in Tamilnadu. Veterinary World 4, 209–212.

Koma, L., 2003. Can private veterinarians survive in Uganda? African Changing for Health and Veterinary Services 145–165.

Kwapong, N., Ilukor, J., Hanisch, M., Nkonya, E., 2012. Making Rural Services Work for the Poor: Micro-level Evidence from Rural Uganda. Journal of World Rural Observations 4, 3–12.

Leonard, D., 2000. Africa's changing markets for health and veterinary services: the new institutional issues. Macmillan Publishers Ltd.

Leonard, K., 2002. When both states and markets fail: asymmetric information and the role of NGOs in African health care. International Review of Law and Economics 22, 61–80.

Leonard, K.L., Leonard, D.K., 1998. Institutional Solutions to the Principal-Agent Problem in African Health Care. SSRN Electronic Journal.

Leonard, K.L., Leonard, D.K., 1999. Asymmetric Information and the Role of NGOs in African Health Care. SSRN Electronic Journal.

Ly, C., 2003. Management and Impact of Auxiliaries on pastoral Production and Veterinary Service Delivery in Senegal, in: Leonard David (Ed.), African Changing for Health and Veterinary Services. Macmilan Press Ltd, London and St maartins Press New York, London.

McMaster, R., White, M.J., 2013. An investigation of Oliver Williamson's analysis of the division of labour. Cambridge Journal of Economics 1–19.

McSherry, B., Brass, J., 2008. The political economy of pro-poor livestock policy reform in Kenya. Intergovernmental Authority on Development Livestock Policy Initiative.

Merlo, M., Briales, E.R., 2000. Public goods and externalities linked to Mediterranean forests: economic nature and policy. Land use policy 17, 197–208.

Mockshell, J., 2011. Perceptions , Constraints and Factors Influencing Livestock Service Delivery in Northern Ghana. University of Hohenheim Institute of Agricultural Economics and Social Sciences in the Tropics and Sub-tropics.

Monitor, 2012. Local leaders authorise sale of pork despite quarantine. The Monitor Publications, Uganda's daily news paper.

Mugunieri, G.L., Omiti, J., Irungu, P., 2004. Integrating community-based animal health workers into the formal veterinary service delivery system in Kenya. Agrekon 43, 89–100.

Mugunieri, L.G., Irungu, P., 2002. 2020 Vision Network for East Africa Animal Health Service Delivery Systems in Kenya ' s Marginal Areas Under Market Liberalization.

Ndung'u, W.L., 2002. Assessing animal health delivery for tick and tick-borne disease control in smallholder dairy systems of Kenya : an application of new institutional economics Assessing animal health delivery for tick and tick-borne disease control in smallholder dairy sy.

Okwiri, F., Kajume, J., Odondi, R., 2001. An assessment of the economic viability of private animal health service delivery in pastoral areas in Kenya. … Union/Interafrican Bureau for Animal ….

Oruko, L., Ndung'u, L., 2009. An analysis of animal healthcare service delivery in Kenya, in: Kirsten, J.F., Dorward, A.R., Poulton, C., Vink, N. (Eds.), Institutional Economics Perspectives on African Agricultural Development. International Food Policy Research Insitute, pp. 257–272.

Otieno Oruko, L., Upton, M., McLeod, A., 2000. Restructuring of Animal Health Services in Kenya: Constraints, Prospects and Options. Development Policy Review 18, 123–138.

Otim, R., 2011. Livestock quarantine seals off pockets of Teso residents. The Monitor Publications, Uganda's daily news paper.

Otte, J., Nugent, R., Mcleoad, A., 2004. Transboundary Animal Diseases : Assessment of socio-economic impacts and institutional responses.

Peeling, D., Holden, S., 2004. The effectiveness of community-based animal health workers, for the poor, for communities and for public safety. Revue scientifique et technique International Office of Epizootics 23, 253–276; discussion 391–401.

Pica-Ciamarra, U., Otte, J., 2008. Animal Health Policies in Developing Countries–A Review of Options. Pro-Poor Livestock Policy Initiative.

Presidents Office, 2012. President warns leaders on crop and animal disease control [WWW Document]. Press Release The state house of Uganda. URL http://www.statehouse.go.ug/media/press-releases/2012/01/04/president-warns-leaders-crop-and-animal-disease-control

Pritchett, L., Woolcock, M., 2004. Solutions When the Solution is the Problem: Arraying the Disarray in Development. World Development 32, 191–212.

Rauw, W.., Kanis, E., Noordhuizen-Stassen, E.., Grommers, F.., 1998. Undesirable side effects of selection for high production efficiency in farm animals: a review. Livestock Production Science 56, 15–33.

Rich, K.M., Wanyoike, F., 2010. An assessment of the regional and national socio-economic impacts of the 2007 Rift Valley fever outbreak in Kenya. The American journal of tropical medicine and hygiene 83, 52–7.

Riviere-Cinnamond, A., 2004. A Public Choice Approach to the Economic Analysis of Animal Healthcare Systems. Pro-Poor Livestock Policy Facility Working Paper.

Rose-Ackerman, S., 2007. International handbook on the economics of corruption. Edward Elgar Publishing Inc.

Rothe, C., 2009. Semiparametric estimation of binary response models with endogenous regressors. Journal of Econometrics 153, 51–64.

Rushton, J., 2009. The Economics of Animal Health and Production. CABI Head Office.

Rushton, J., Knight-jones, T., Leeuw, P. De, n.d. The impact of foot and mouth disease 1–27.

Sabin, E.A., Dehaven, W.R., 2012. Veterinary education : a basis for good governance leading Defining regional core veterinary competencies. Rev. sci. tech. Off. int. Epiz., 31, 519–531.

Sastry, N., Raju, S., 2005. Animal Health Workers in Andhra Pradesh: Service Delivery, Supplies, Support & Supervision. Pro-Poor Livestock Policy Initiative 1–6.

Schneider, H., 2006. Capacity building for veterinarians and veterinary paraprofessionals. FAO Animal Production and Health Proceedings.

Schneider, H., 2011. Good governance of national veterinary services. Revue scientifique et technique (International Office of Epizootics) 30, 325–38.

Shah, A., 2007. Tailoring the fight against corruption to country circumstances, in: Performance Accountability and Combating Corruption, …. pp. 229–250.

Stroup, R., 2000. Free riders and collective action revisited. INDEPENDENT REVIEW-OAKLAND- 4, 485–500.

Sykuta, M., 2008. New institutional econometrics: The case of contracting and organizations research, in: Brousseau, É., Glachant, J.-M. (Eds.), New Institutional Economics A Guide Book. Cambridge University Press, Cambridge, UK, pp. 122–141.

Tambi, N.E., Maina, W.O., Ndi, C., 2006. An estimation of the economic impact of contagious bovine pleuropneumonia in Africa. Revue scientifique et technique (International Office of Epizootics) 25, 999–1011.

Umali, D., Feder, G., Haan, C. De, 1994. Animal health services: finding the balance between public and private delivery. The World Bank Research Observer 9, 71–96.

UN, 1998. Un news: Secretary-General's Report on Work of the United Nations. Go-Between: United Nations Non-Governmental Liaison Service 1–24.

Vallat, B., Mallet, E., 2006. Ensuring good governance to address emerging and re-emerging animal disease threats: supporting the Veterinary Services of developing countries to meet OIE international. … scientifique et technique-Office international ….

Vivekananda, M., Sreedharan, S., Belavangala, M., 2010. Social Audit of Public Service Delivery in Karnataka.

Vu, T., 2007. Rethinking the Traditional Concept of Livestock Services: A Study of Response Capacity in Thailand, Malaysia and Vietnam. Pro-Poor Livestock Policy Initiative.

Wang, H., McEntire, J.C., Zhang, L., Li, X., Doyle, M., 2012. The transfer of antibiotic resistance from food to humans: facts, implications and future directions. Revue scientifique et technique (International Office of Epizootics) 31, 249–60.

Watson, D.J., 2008. Community farmer field school animal health facilitators: hybridizing private animal health care and capacity building in remote pastoralist areas. ILRI (aka ILCA and ILRAD).

Wennberg, J.E., Bronner, K., Skinner, J.S., Fisher, E.S., Goodman, D.C., 2009. Inpatient care intensity and patients' ratings of their hospital experiences. Health affairs (Project Hope) 28, 103–112.

Wetaka, A., 2011. Traders Defy Cattle Quarantine. Uganda Radio Network.

White, G., 1994. Civil society, democratization and development (I): Clearing the analytical ground. Democratization 1, 375–390.

Williamson, O., 1979. Transaction-cost economics: the governance of contractual relations. Journal of law and economics 232–261.

Williamson, O., 1991. Comparative economic organization: The analysis of discrete structural alternatives. Administrative science quarterly 36, 269–296.

Williamson, O., 2005. The economics of governance. The American Economic Review 95, 1–18.

Williamson, O.E., 1989. Transaction cost economics, in: Schmalensee, R., Willig, R.D. (Eds.), Handbook of Industrial Organization. Elsevier, pp. 135–182.

Williamson, O.E., 2000. The new institutional economics: taking stock, looking ahead. Journal of Economic Literature 38, 595–613.

Wolmer, W., Scoones, I., 2005. Changing animal health policies. The AgriCultures network 23–25.

World Bank, 1994. Governance: The World Bank's Experience. World Bank Publications.

World Bank, 2004. Building State Capacity in Africa. World bank and Oxford University Press, Woshington, DC:

Wymann, S., Sommer, R., Wenger, R., 2007. The Livestock Revolution : An Opportunity for Poor Farmers ? InfoResources 1–16.