Analysis of Veterinary Service Delivery in Uganda: An Application of the Process Net-Map Tool

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Abstract

As a result of continued fiscal challenges from late 1980s to date, the government of Uganda liberalized and decentralized the provision of veterinary services. As a result, many actors are involved in providing veterinary services without adequate regulation and supervision. With the resurgence of infectious diseases, increased economic and health risks especially to the rural poor, there is need to understand relational patterns of actors to ensure good governance and address emerging and re-emerging animal diseases risks. A participatory research methods mapping tool called Process Net-Map was used to map out actors and their influence in delivery of clinical and preventive veterinary services in both pastoral and intensive livestock productions systems and elicit governance challenges. Results reveal that, the important social relations in veterinary service delivery are: cooperation of the private veterinarians and paravets, private veterinarians and government veterinarians in intensive production systems and cooperation between NGOs, government veterinarians, and community based animal health workers (CAHWs) for pastoral areas. Staff absenteeism, insufficient and unpredictable budgets, weak legislation, exclusion of technical staff from decision making process and policy illogicality are the major problems veterinary service delivery. The paper contends that given the existing fiscal challenges, the key to improving animal service delivery in Uganda rest on get priorities, policies and institutions right.

Keywords: Curative services and Preventive services, Social Network Analysis

1. Introduction

Improving veterinary service delivery to combat and control emerging and re-emerging animal disease is critical measure for unraveling the benefits of increased global demand for livestock products to rural poor farmers and reducing associated animal and human health related risks (Wymann et al. 2007; Hall et al. 2004). However, continued fiscal challenges have continued to put pressure on the provision of veterinary services in most developing countries forcing governments to experiment to experiment different institutional arrangements for providing veterinary services (Pica-Ciamarra & Otte 2008). In Uganda, government adopted the structural adjustment programs in late 1980s and early 1990s. This resulted to decentralization and privatization of clinical veterinary services and downscaling of civil service (Haan & Umali 1992). Clinical services, breeding and spraying for tick control were privatized while vaccination of animals against epidemic diseases, quarantines and tsetse control were retained under the ministry of agriculture animal industry and fisheries (MAAIF). The purpose of these reforms was to reduce costs of public administration and public expenditure. Although the public administration costs as a proportion of public expenditure declined, this was offset by: First, increased costs of budget financing resulting from significant increase in interest rates caused by increased public general budgetary support and increased inflow of foreign aid (Lister, Wilson, Steffensen, & Williamson, 2006). Secondly, creation of more districts under decentralization resulted to increased public expenditure, stressed the capacity and accountability of both local and central government. Corruption and financial indiscipline has also became a serious problem that has undermined government and donor partnership (Lister, 2006) and the financing of veterinary service delivery.

As a result of the continued fiscal challenges, the government has adopted reactive rather than a proactive approach to service delivery (Rwakakamba 2008). In the veterinary sector, vaccinations are conducted when there is an outbreak rather than routine vaccination as per the policy. Regulatory policy that is supposed to guide delivery of veterinary services such as the veterinary and paraprofessionals act of 1958 and animal disease acts of 1964 are old, weak and do not provide strong incentives to guide disease control and promote ethical behavior in the provision of veterinary services in Uganda (FAO 2008). As a result, many actors of varying capacities, interests and relevance are involved in providing veterinary services without being effectually regulated (FAO 2009; Mbowa et al. 2012). All these actors have different goals, interests, and resources and face conflicting interests and yet their actions are interrelated. As a result, the veterinary markets is flooded with untested inputs especially antimicrobial agents (Mbowa et al. 2012) and even the tested inputs are being misused. This has negatively affected the efficacy animal drugs and has led to high prevalence antimicrobial resistance (AR) in both animals and humans (J. Bosco 2012; Joloba et al. 2001; Byarugaba et al. 2011; Byarugaba 2004). Vaarten argues that the clinical impacts of AR in animals is prolonged pain and suffering which results to economic or financial loses to animal owner inform of reduced production, growth and mortality (Vaarten 2012). AR can also be passed from animal to humans through food because most of this food like milk are consumed without further processing (Byarugaba 2004; Sasanya et al. 2005)

Increased economic and health risks arising from misuse of antimicrobial agents requires improvement in governance of veterinary service delivery to reducing economic lose and safeguarding animal and human health and welfare (Msellati et al. 2012). Improving governance of veterinary service delivery requires improvement in coordination between actors in the animal health sector. The existing network of actor's needs to be mapped out, problem areas and strategies need to be identified. The Process Net-Map tool was applied to systematically identify network of actors, describe and analyze the process veterinary service delivery. This was particularly important in understanding how social and power relations impact on the design and implementation of veterinary policies and the functioning of veterinary institutions. The application of the tool is described in methods and material section

Veterinary service delivery and social networks

One of the main challenges in the delivery of animal and human health service in developing countries is the principle agent problem resulting from imperfect information (Leonard 2000). Two main problems usually arise according to this theory: The first problem is that of the moral hazard problem that occurs as result of principals' (a livestock farmer) lack of information of what the agent is doing on his or her behalf. For example, a farmer is not able to determine the quality of the service the service provider or government is offering resulting to misuse of drugs and misallocation of resources. Equally important is government's inability to assess activities of its staff often resulting to financial mismanagement and corruption. The second problem is the adverse selection which results in selection of agents or service providers that are of low quality driving away service providers of good quality (Ahuja 2004; Ahuja & Redmond 2001; Cheikh Ly 2003). These two problems arise because objective of principal and the agents often contradict and it is costly or difficult for the principle to verify what the agent is doing (Eisenhardt 1989).

According Leonard, networks and referral systems should be able to provide self-regulating, and budget breaking incentives that are verifiable and enforceable such as outcome contingent contracts, practitioner coordinated contracts, and hierarchically-enforced contracts (Leonard & Leonard 1999). Self-regulating incentives can be achieved due to unavoidable repeated interactions and using outcome contingent contracts where farmers pay services part or full fees at the end of the transaction. Budget breaking incentives that threatens the actors income and livelihood such as strict regulation that can lead withdrawal or revocation of service providers rights to practice veterinary medicine in case of misconduct (Leonard 2002). As stated by Leonard, empirical evidence from human health care shows that referral networks are not generally present in African health care systems; professional self-regulation has been weak in Africa; outcome contingent contracts are unsuccessful because farmers' inability to measure the effort and quality of services (Leonard 2000). Nonetheless, building formal and informal links between veterinarians and veterinary paraprofessionals is useful in disease monitoring and surveillance, animal vaccination, food inspection and disease prevention and control (Schneider 2011). Schneider further notes that veterinary associations or organizations be established and strengthened to organize public

and private sector veterinary professionals into a representative and consultative forum to ensure quality and continued professional development.

Dalhlstrom and Ingram argue that social networks are useful in solving the principal agent problem because they facilitate screening of the agents (Dahlstrom & Ingram 2003) and minimizing the effect of unethical behavior among agents (Brass et al. 1998). The strength of the social network in solving the principle agent problem depends on the density of the network or the number of links between actors in the transaction and the strength of the links (Granovetter 1985). Social network analysis (SNA) is therefore a powerful approach to studying interpersonal interactions of actors in veterinary service delivery. It is useful in discerning social relationships between actors, their objectives and capabilities (Wolfe 1997; Carrington et al. 2005; Marsden 1990; Butts 2009). It has been applied is physical and social research (Borgatti et al. 2009), and recently, it has gained relevance in analyzing governance problems in health systems (Luke & Harris 2007). In the health sector, it has been used to determine network properties of health care systems in Ghana (Blanchet & James 2012) and to assess inter-organizational collaboration disease prevention and health promotions (Provan et al, 2003). Social network tools like process the influence mapping tool have been applied in uncovering governance challenges and identifying strategies to address these challenges. The tool has been applied assess governance challenges in various strategies that were designed to address services delivery and social inequality (Schiffer & Waale 2008; Raabe et al. 2010; Birner et al. 2010). It can be used to provide a deeper under understanding of the process and to analyze networks, power and influence, and the goals of actors (Schiffer & Waale 2008). This study extends this approach to analyze provision of animal health delivery in Uganda.

2.0 Materials and Methods

The study used the SNA analytic approach to analyze governance challenges in the provision of veterinary services. To capture variations in the institutional set up, social and physical factors which influence sustainability of animal health delivery system (Woodford 2004), two areas with distinct livestock production systems in Uganda were chosen. District A was selected to represent a pastoral production system and district B an intensive livestock production system. Data was collected using a combination of stakeholder discussions and interviews using the Process Net-Map tool. The application of net map tool involved three phases. In Phase 1, respondents were asked in step by step procedure to describe the process delivery, and to identify the actors involved in each step. This process provided a robust way to obtain data on established patterns of interaction between actors because it enabled participants to narrate what happens in real world. The name of the actor mentioned was written on a small card and placed on a large sheet of paper. Different colored arrows where used to represent different types of links as in figure 1 below. More actors where added whenever the participants recalled them. The arrows were marked with numbers, and the respective implementation step corresponding to each number was noted down at the border of the paper as shown figure 1. The description of the process was continued until the point was reached where the animal was treated or vaccinated.

In Phase 2, the respondents were asked to define or state the level of influence of each actor on delivery of a particular service by putting actors on so called influence towers. Checkers game pieces were used to visualize the influence in form of "power towers," that is piles of checkers game pieces that ranged in height from 1 to 8 pieces. Actors that were considered not to have any influence on the outcome were not assigned any checkers game piece. Accordingly, an actor whose power tower has eight checkers game pieces is the most influential actor and one with zero is least influential actor. Respondents were always asked to adjust the towers as they deemed necessary and to verbally provide the reasons why different actors have the influence level attributed to them. In Phase 3, the respondents were asked to identify potential problems areas which are likely to make veterinary service delivery ineffective. Table 1 displays the number of interviews that were conducted in the two main case study districts, and at the regional and national level. A total of 8 Process Net-Maps were produced for the study, and 18 interviews without Net-Maps were conducted as shown in table below. The purpose of the interviews without Net-Maps was to gain insights to veterinary service delivery in order to ensure selection of the right persons to be included in process mapping exercise. In each district, four process influence Net-Maps were conducted two in each village with farmers, local leaders, at least two paraprofessionals and a veterinarian. One Net-Map was for clinical services (endemic diseases) and the other was preventive services (epidemic diseases Control)

Table 1: Number and type of interviews in the two main case study districts

	Clinical	Disease Control	Total interviews
Total interviews	**9**	**17**	**26**
Use of Net-Map			
with Net-Maps	4	4	8
without Net-Maps	5	13	18

Source: Authors

3. Results

In this section, results for the Process Net-Map exercises for clinical service services for both pastoral and intensive livestock production systems are presented first and those for preventive services are presented later. A pastoral system in the context of this paper is livestock production system were farmers keep large number of animals mainly local breeds for cultural, food and cash purposes while the intensive system is one were animals mainly exotic and cross breeds are kept mainly for commercial purposes. Some few farmers keep local breeds as well in the intensive systems. The types of veterinary service providers in these systems vary and they include the government staff, private veterinarians and paraprofessional. In the pastorals, there is group of paraprofessionals called community animal health workers (CAHWs) who have three month training in animal health management.

The process and actors influence in the treating endemic diseases in the pastoral system

The description of process of clinical treatment of endemic diseases presented is based on interviews with Community Animal health workers, the District Veterinary Officer (DVO), farmers and animal health assistants. They identified East Coast Fever (ECF), Anaplasmosis, Heart Water, Red Water and Tryponamiasis as the most common diseases.

During process influence mapping, a total of nine actors were identified the main actors in the treatment of endemic diseases and they include: Community animal health workers (CAHWS), drug shops, Government veterinarian (DVO), Non-governmental Organization (NGOs) Stockiest, Herdsmen, Middlemen (animal traders), Men and Women, as in figure1 below.

a. Herdsman or Herdsmen

The herdsmen are mainly children of livestock keeping households and are the first people or actors to notice that the animal is sick. They typically report first to their mother and later to their father or a man of the family. They were ranked as most influential with the score of 8 because they are close to animal(s) and monitor the status of the animal and if they delay to report the animal, the animal dies.

b. Livestock owners

When herdsmen report a case to spouse of the head of family, it is a common practice for women to use local drugs first to treat the animal and if that case does not improve or respond to the treatment, they can then report to their husband's. The husbands (men) can authorize the sale of the goat or sell by him-self in order to buy drugs. Sometimes, women sell the chicken in the local markets to buy the drugs. Women's influence is mainly in use of traditional medicine and monitoring animal's welfare. They together with the herdsmen are involved in the milking, and while milking, they closely observe the animals. In addition, because of Pokot polygamous nature, animals are divided among women and each woman has her own animals to provide food for her children. The incentive to oversee the animal's welfare is high for women because even if it dies, it is woman who suffers most. Because of these reasons women where ranked as more influential than men with a score of 7 as shown figure 1 below. Men's influence is in mobilization of resources for the treatment of the animal. Although, the management of the animal's welfare rests with women, men have the authority in deciding whether to sell or not sell and that is why men were given the a score of 6. When resources or funds are mobilized, the drugs are bout and self-administered by either men or herdsmen with help of the women or woman. Rarely are services of CAHWs seeked.

c. Middlemen

The middle men were ranked as more influential than the drug shops and CAHWs because they buy animals from farmers, thus they are the source of money used to buy drugs from drug shops, and seek services of CAHWs. In addition, middlemen help farmers to dispose-off the animal when treatment fails. They buy sick animals at a lower price; treat them and later resale at a higher price. Because of these reasons, they were given a score of 6, equal to men. The challenge, however, is that some of the animals are slaughtered and consumed before seven mandate days after treatment.

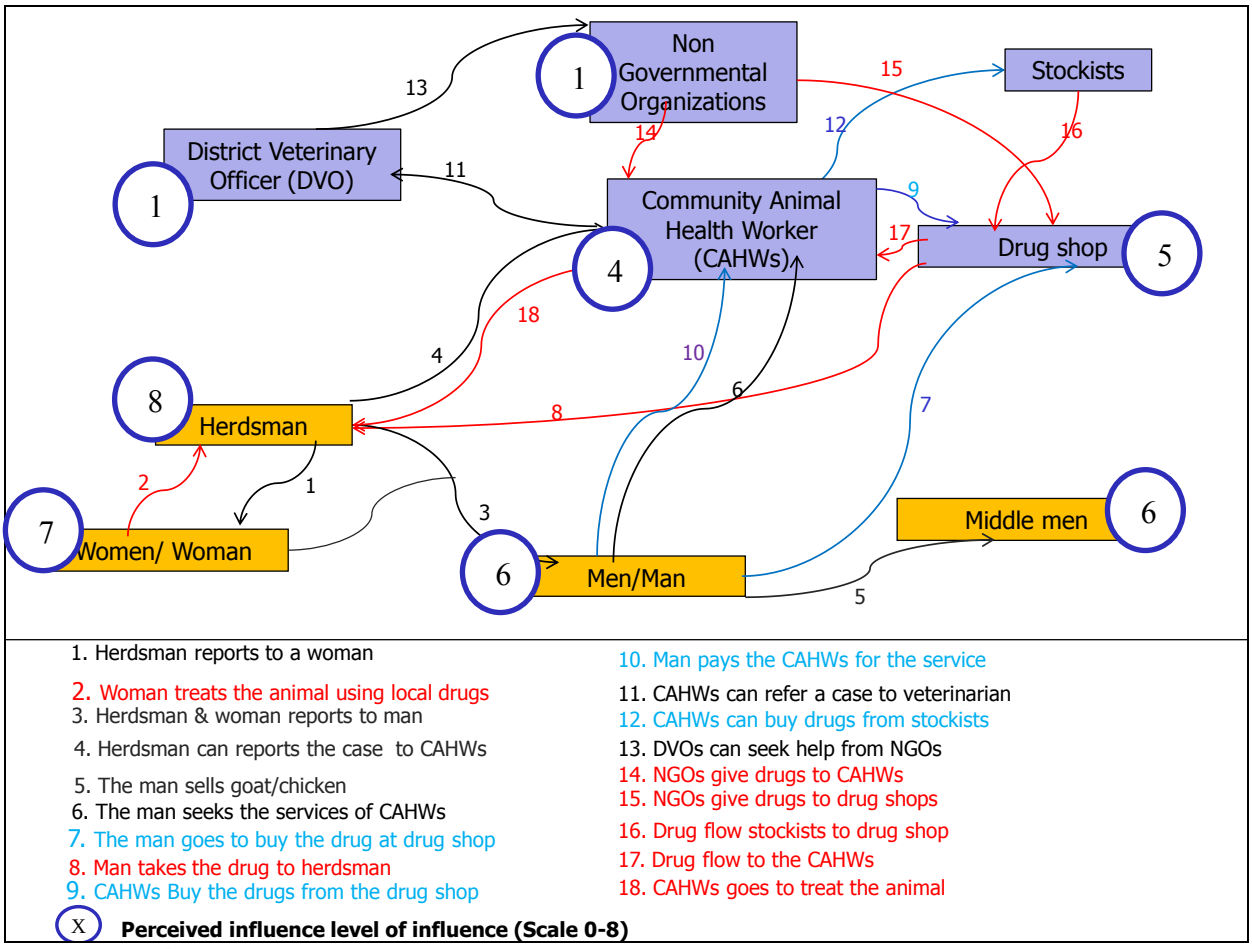
d. Drug shops and CAHWs

As mentioned above farmers mainly buy drugs from the drug shop and treat their animals themselves and seek the services of CAHWs when a case fails to respond. Consequently the drug shops were ranked as more influential than CAHWs with score of 5-4, as in figure 1 below. In some cases, the NGOs, give drugs to Community Animal Health workers who offer services to farmers at subsidized rates. When the cases that are handled by CAHWs fail to respond, CAHWs which have higher education and can speak English consult the veterinarians. Others give up, and a farmer is forced sell the sick animal. When a government veterinarian is consulted, he gives advice or can visit the site if it is accessible. When the animals fail to respond, farmers often sell off the animals at cheaper prices.

e. Non-governmental organizations (NGOs)

The influence of NGO's in clinical treatment stems from training CAHWs and provision of extension services through pastoral farmer field schools (PFS). The main skills disseminated through the PFS are disease control and deworming. One of the farmers stated "The PFS provide us with Knowledge on spraying, animal health hygiene and diseases. In our PFS, we have experimented hand picking of ticks against spraying and we tested different accaricides; local herbs against the use of modern veterinary medicines; feeding animal using salt grass which is diluted during rainy season against the use of mineral links made from animal bones and soil". This mainly conducted under the supervision of the CAHWs. However, the challenge is that most NGOs programs are short lived and when the projects ends, the PFS also fail to perform. That is why NGOs were given a score of one as figure below.

A network of actors involved in clinical treatment of Endemic diseases in district A



Source: Authors

Problems and possible solutions in the treatment of endemic disease in the pastoral areas

Results from process influence mapping reveal that the key problems that are encountered in treatment and control of endemic diseases pastoral communities in Uganda are the following:

1. Delays in reporting

Three reasons explain the delays in the treatment of the animals: First, livestock keepers prefer of local medicine to modern medicine, and by the time an animal is attended to, the

disease is already out of hand. Second, even if the farmer wants to buy modern medicine, they have to sell another the animal to buy drugs. Worse still, the distance to the market to sell an animal and buy drugs is very long. The main means of transport used are walking and riding a bicycle. Farmers noted that sometimes it takes some farmers two to three days on the way to reach the drug shop. Third, as observed by one of respondents "the pastoralists' culture is such that, unless the animal falls down or fails to walk, a livestock farmer will not seek a service of service provider".

2. Drug misuse

Drug misuse occurs because of the following reasons (1) farmers tend to self-treat their animals yet most of them have no education. Farmers are not able to read the labels on drug and thus are not able to know how to apply and use the drug. (2) The low level education level of CAHWs and language differences limit the interaction between the veterinarian and CAHWs. As a result, CAHWs often overuse and administer wrong drugs based on wrong diagnosis. When the animal fails to respond farmers refuse to pay for the service and lose the incentive to seek services of community animals' workers. (3) The presence of many drug shops opened by business men without animal health qualification. Their objective is to sell drugs, they do not advise farmers on the use and administration of the drugs and sometimes they sell expired drugs (Byarugaba 2004). The happy cow drug NGO shop under the Catholic Church which often gives advice, asks farmers why they are buying drug and disease the animal is suffering is always closed.

3. Limited qualified staff

In pastoral areas, veterinarians or veterinary trained staffs are very few. In district A for example, there was only one veterinarian who is taken up with administrative work and not easily reached. In fact, all the farmers in who participated in net map analysis stated that they had never met or heard about veterinary officer. One of the CAHWs remarked: "Our problem is that we have only one veterinarian in the district and he is busy with administrative work, attending workshops and is always out of station. At times some of us have to consult him on phone". The district veterinary officer admitted that it is true that he does not get to villages communities because he is the only veterinarian in the district. The veterinarian also cited poor accommodation transport and security problems. Most areas are not easily accessible and his department does not have a car. Sometimes they spend one week to reach is work station either because roads are cut-off by water during the rainy season or it is insecure. Frequently, he delegates the government duties to community animal health workers. Occasionally he conducts consultations on phone, but since he does not know the local language, only CAHWs and farmers who are comfortable with English and have phones can consult him over the phone.

The process and influence actors in treatment endemic diseases in the intensive livestock production system (district B)

The description of the process of treatment and control of endemic disease control is based on interviews with a government veterinarian, 3 paravets, 2 private veterinarians, and 10 livestock farmers in a focus group discussion in two different villages. The main endemic livestock disease identified respondents were East Coast Fever, Anaplasmoisis and Tryponamiasis. The process influencing mapping tool generated seven key actors in the treatment and prevention of endemic diseases in intensive system as in figure three below.

a) Herdsmen

Just like in the case of pastoral areas, the herdsmen observe the sickness and reports to the livestock owners. The herdsmen were given a score of 5 which is higher than the score 4

given to the government veterinarians because they are closer to the animal and are always able to monitor the situation of the animal and report to the livestock owner. Also, during the follow ups the service provider interacts mainly with the herdsman other than the owner of the animals' see figure 2 below.

b) Livestock owner

In the intensive livestock production system, livestock is kept mainly for commercial purposes. Therefore, any outbreak is taken serious because it threatens the livelihood of the livestock owner. When livestock owners receive the reports of sick animal from the herdsmen, they always seek the services of the paravets, private veterinarian or government veterinarian. The respondents identified the livestock owners as the most important actors because they are decision makers, control finances and occasionally, they treat their animals themselves.

c) Service providers

Most commonly approached service providers are paraprofessionals because they are available and easily accessible as compared to veterinarians. If the animal is treated by the paraprofessionals and fails to respond to the treatment, paraprofessionals often refer the case to mainly private veterinarians and in rare cases to government veterinarians. In district B, it is rare for the farmers to self-treat their animals, although some farmers do self-treat especially if they feel the case is not very complicated and the drug is available. The drug shops are owned by mainly veterinarians. The paraprofessionals were regarded as the second most important actors to livestock owners with a score of 6 because they are available and easily accessible to farmers.

Although there are only two active private veterinarians in district B, they were ranked as more important than the government veterinarians who are eight in total. They were given a score of 6 compared to government veterinarian score of 4 because they are able to work well with the paraprofessionals. Paraprofessionals refer cases to private veterinarians and use animal drug shops of veterinarians as contact point with farmers. They often consult veterinarians and give business to veterinarians by referring farmers to them. One veterinarian commented that "we do work with paravets because they market us especially when they refer a farmer to us but at times it makes paraprofessionals insecure."

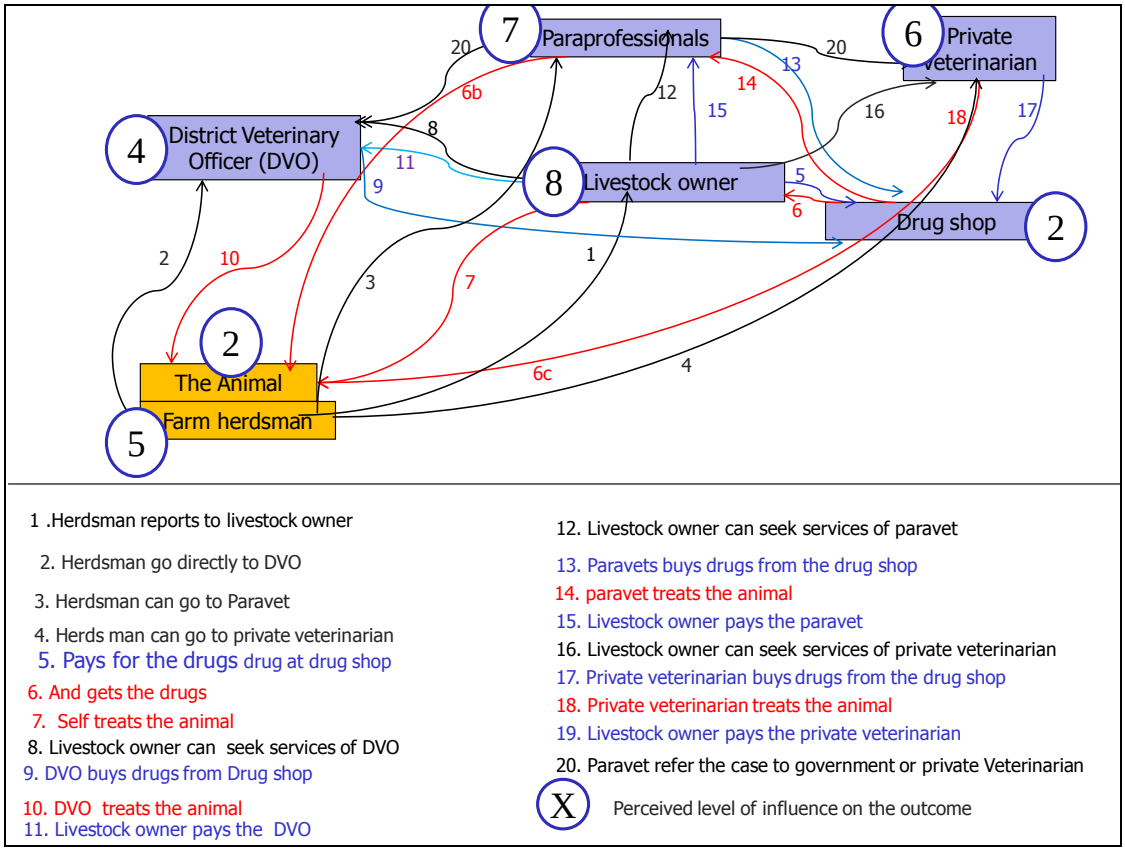
The problem with the government veterinarians is that, they are perceived to be treating paraprofessionals as subordinates and that is why there is always less interaction between the paraprofessionals and veterinarians. Secondly, most of the government veterinarians are working with the National Agricultural Advisory program as coordinators, a position which pays well and takes most of their time. They do not have time to handle cases referred to them and have no incentive work closely with paraprofessionals since they have assured income and do not need to cooperate with paraprofessionals. Most often, government veterinarians refer cases referred them to private veterinarians.

d) Animal drug retailers (drug shops)

The drug shop and animal were least influential but important actors each with the score of two. The drug shops are link between farmer and service providers. Farmers noted that if the animal is sick, they just have to go to the drug shop and they are sure to get at least one paraprofessional around the shop or a private veterinarian. In the drug shop, farmers also

get advice on drug use for those who self-treat and general animal health management if they find a veterinarian in the shop. The relevance of the animal is that it is a reference point.

Process and actors influence in the treatment endemic disease in district B



Source: Authors

Challenges to treatment of endemic diseases in district B

Results reveal that the key problems in treatment and the control of endemic disease in Mukono are as figure 4 below;

1 Drug overuse and misuse

Drug abuse problem is common among paraprofessionals and farmers. The reasons for the drug abuse problem among paravets are the following: first, the training of paraprofessionals especially by the Kayunga institute is inadequate. The institute does not have the facilities to train paravets and it is not an accredited institution. Secondly, most of these paravets are trained in crop science or general agriculture but because of the existence of the market for veterinary services, crop trained paraprofessionals have joined the veterinary market. Thirdly paravets are driven with desire to make profits and tend to over and under doze the animals in order to increase sales and revenue. Over dozing occurs if paraprofessional's belief that a farmer can afford and under dozing occurs if a farmer is not able or willing to pay for right doze. Paraprofessionals then decide to give lower doze equivalent to the fee a farmer is able to pay. One of the veterinarians remarked that "paraprofessionals always make wrong diagnosis and prescription, and overdose the animal and when the animal fails to respond, they come running to us to save their image before the farmer. For example, paravets under dose goats with Albendozole and when it fails to

respond, they come to us and when you shift the treatment to trodax the animal gets well. Then you know that animal became drug resistant".

2 Poor management of government veterinarians.

Another serious problem identified by the respondents is poor personnel management. The personnel management can be explained in terms of limited opportunities for promotion in local government. These are limited because of the following reasons: it depends on the availability of funds, and is it influenced by local politicians. Merit and academic qualification is not given priority as long as the applicant has a bachelor's degree in veterinary medicine. Veterinarians noted that it is common in Uganda to find the District Veterinary office (DVO) with a bachelor's degree and his subordinates' (veterinary officers) with master's degrees. This has created challenges in supervision veterinarians by the DVO. As a consequence, most DVOs do not assign duties to his subordinates' and staff are often absent from their duty stations. One of the government veterinarian stated that "I left my district to come to offer private services in another district because I have a master's degree and my boss has a bachelor's degree in veterinary medicine. He does not assign me responsibilities. So I decided to make myself productive, I get a government salary for free, I am in good terms with my boss and my business is doing well".

3 Low salaries and poor facilitation

Most government veterinarians have joined the National Agricultural Advisory Services (NAADS) due to better remuneration in NAADs where personnel are paid 400 Euros per month compared to the 135 Euros paid the under local government. The NAADs program was established by an Act of parliament, the NAADS Act, 2001[1] to spearhead the transformation of extension services from public sector supply driven to private sector demand driven. To fully operationalize the NAADS programme, coordinators were appointed at various levels including at district and sub county level. However, NAADs is viewed to be a crop biased program and the veterinarians working in NAADs rarely practice veterinary medicine. The reason why most veterinarians have crossed to NAADs is because of poor pay and yet NAADs program pays high wage, allowances and facilitates field activities compared paid with local government. One of the veterinarians who joined NAADs stated that "If I did not join NAADs, I would have left government and moved to private service".

4 Weakness in regulation

As shown in the process influence maps, the veterinary board is not shown anywhere and yet it is supposed to be main actor regulating and controlling the activities of service providers and use of drugs. For example, while most drugs in urban areas like in Mukono are licensed and owned by veterinarians, the persons selling in the drug shop are not always trained. Most veterinarians use relatives who have no basic training in the animal health. The weakness in regulation according respondents is because of old laws with incentive that do not deter unethical behavior.

The process and influence of actors in the prevention of epidemic diseases in the pastoral system (district A)

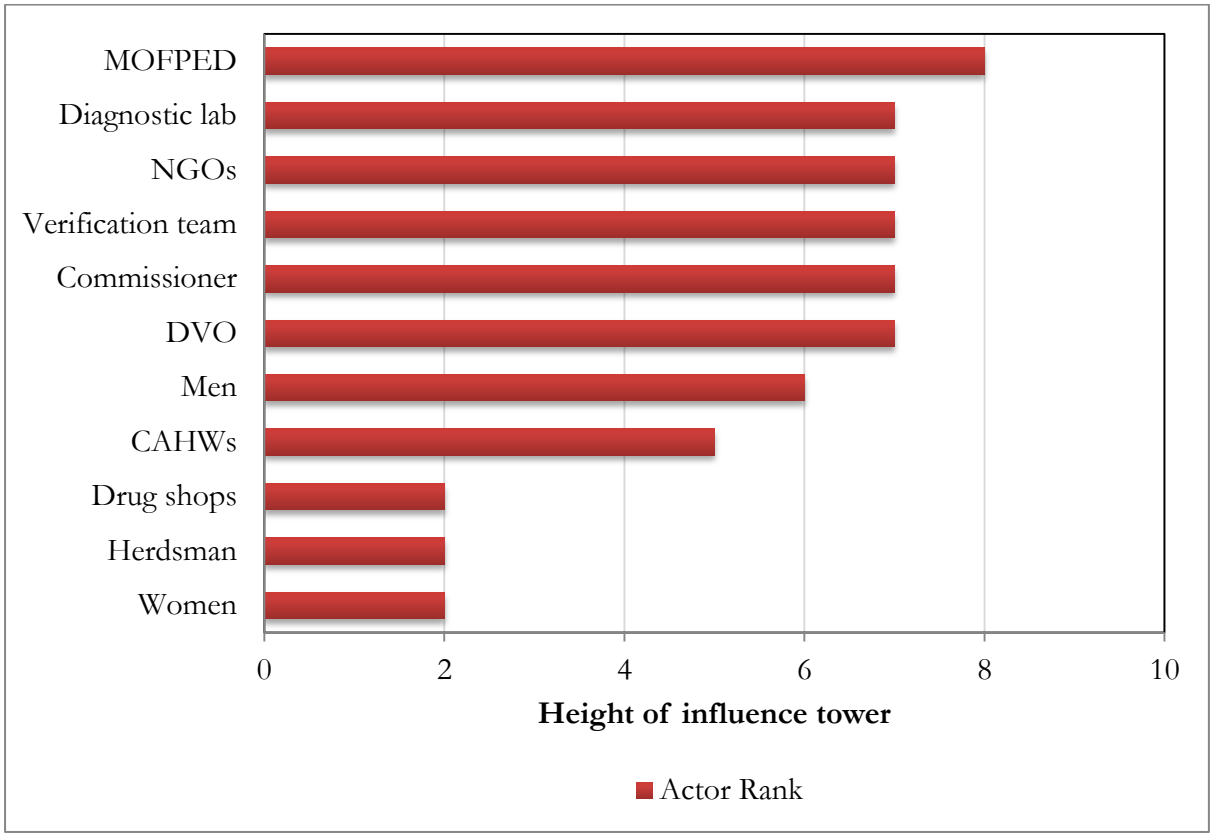
[1] The NAADS Act, 2001
http://www.kituochakatiba.org/index2.php?option=com_docman&task=doc_view&gid=921&Itemid=36

Results from the process influencing mapping generated thirteen actors involved in the treatment and prevention of epidemic diseases among the Pokot pastoral communities. The key services in the treatment and prevention of epidemic diseases are disease surveillance, reporting and vaccination. As in the case of endemic diseases and in figure 3 below, women and herdsmen are the first to notice the disease and report it to the men. If the disease is strange, unfamiliar to them or they are not able to handle, they report to community animal health workers. The community animal health workers then report to government veterinarian (DVO) and the NGOs staff. The government veterinarian will report to Italian cooperation laboratory (C&D) and the National Animal Disease Diagnostics and Epidemiology Centre (NADDEC) laboratory. After receiving reports from the veterinarians, C&D meets with veterinarians and community animal health workers to seek assistance in mobilizing communities to sample sick animals. Samples including blood, stool, skin scrapings, and lymph nodes among others are tested at C&D laboratory and results are presented to donor partners, and the local governments who are responsible for dissemination of the results to the communities. Sometimes, because of inefficiency in dissemination of the results, radio programs are organized by C&D and government veterinarians are invited to disseminate the confirmed results to livestock owners.

When the results from the surveillance are in, quarantines are issued by the commissioner through the DVO and vaccinations are conducted for diseases where vaccines are available. Vaccines for epidemic diseases are always procured by government and occasionally by NGOs and the Food and Agriculture Organization (FAO) through the government. The government through the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) gives vaccines free of charge but does not always provide the local government with logistical support for conducting vaccination campaigns. The NGOs therefore come in to provide transport, fuel, training and mobilization of personnel (CAHWs) and livestock farmers. They register communities, provide the cold chains and meet all the costs for carrying out the vaccination campaigns. DVOs perform coordination and supervisory role in vaccination and actual vaccination is done by CAHWs.

The respondents identified the Ministry of Finance Planning and Economic Development (MFPED) as the most important and influential actor in control of and treatment of epidemic diseases because it is “Mr. Money” was given a score of 8 as in the figure 3 below. The respondent noted that the problem in vaccination and surveillance always comes from financing of these services. Active surveillance is not always done because of financial problems. The budgeting and financial releases are handled using “a fire fighting” approach. Money is only released when there is an outbreak as opposed to routine vaccination. The second most influential actors are NGOs like FAO and Italian Cooperation with the score of 7 because of the financial power see figure 3 below. The government veterinarians, Commissioner, and verification team were ranked as equally important as NGOs especially in coordinating these activities and technical guidance. The men were ranked more important than the CAHWs with score of 6 mainly because they help in restraining animals; they also control finances in case they are asked to cost share and above, all they the ones who identify and report the disease out breaks. The CAHWs were given score of 5 because they are involved in mobilizing farmers and conducting vaccination. The middlemen, drug shops, herdsmen, and women are the least influential because vaccines are procured by government and the service is offered by either NGOs or governments. Women and herdsmen role is always limited to identification of the diseases and middlemen and drug shop are important spreading information about disease outbreaks.

Actors' Influence in the prevention of epidemic diseases in the pastoral areas



Problems in control of epidemic diseases in Pokot pastoral communities

The key challenges identified in implementation provision of disease control services such as vaccination and quarantine are; Limited number veterinarians and adequate vaccines, political interference and .

1) Inadequate vaccines and budgetary allocations

Vaccines needed for vaccination exercises are never available insufficient quantities to apply them to all animals in the respective region. This according to the respondents is because of inadequate budgetary allocation to preventive service delivery. As result some animals are not vaccinated which later re-infect other animals. One veterinarian stated that "the persistence of FMD in Teso region in 2010 even after the implementation of vaccination exercise was because of inadequate vaccines. Out of the 50,000 units of the vaccine required for vaccination, only 10,000 were availed, rendering the containment of FMD disease difficult." Since vaccines are never sufficient, local governments depend on NGOs to implement successful vaccination campaigns. As remarked by one of government veterinarians, "NGOs are indispensable to government and under the current situation; if NGOs pull out the government position is very weak. In recent massive vaccination exercises of goat plague (PPR) and CBPP for cattle in Karamoja region, most of the logistical and financial support was provided by NGOs and government could only contribute vaccines." The government NAADS program does not finance veterinary services yet livestock is the main agricultural sector in Karamoja".

2) Resource capture by veterinarians

The second problem noted by respondents was the capture of funds meant for paying community animal health workers (CAHWs) by the veterinarians. Respondents stated that, some veterinarians are corrupt when funds are allocated for a particular activity they mobilize the CAHWs to help to work later refuse to pay them or pay them a fee less than what they are supposed to receive. This results in to a poor response of CAHWs to vaccination exercises, creates a poor working relationship between veterinarians and CAHWs, and worsens the problem of shortage of staff.

3) Political interference

The third problem is local political interference, mainly in the implementation of the quarantine services. Participants noted that, when quarantines are instituted, the veterinarians cannot enforce them because when markets are closed, the politicians make "a lot of noise" and some of them lift the quarantine on their own without seeking for approval from MAAIF. In Bukedea district for example, local politicians sent the veterinary officer on forced leave and lifted the quarantine. The main reasons why politicians lift the quarantines are to avoid loss in revenue that would be generated when livestock markets are open. Secondly, they feel that they to avoid political loses or gain political support by lifting quarantine regulations that are unpopular. Farmers need to sell livestock for school fees and other needs. The implementation of quarantine is perceived to affect the farmers' welfare and is seen as a sign of failure of politicians to provide services. To avoid political fallout, politicians are incentivized to lift up quarantines. Apparently, the need for quarantines is not well understood.

The process and influence of actors in prevention of epidemic animal diseases in the intensive production system (district B)

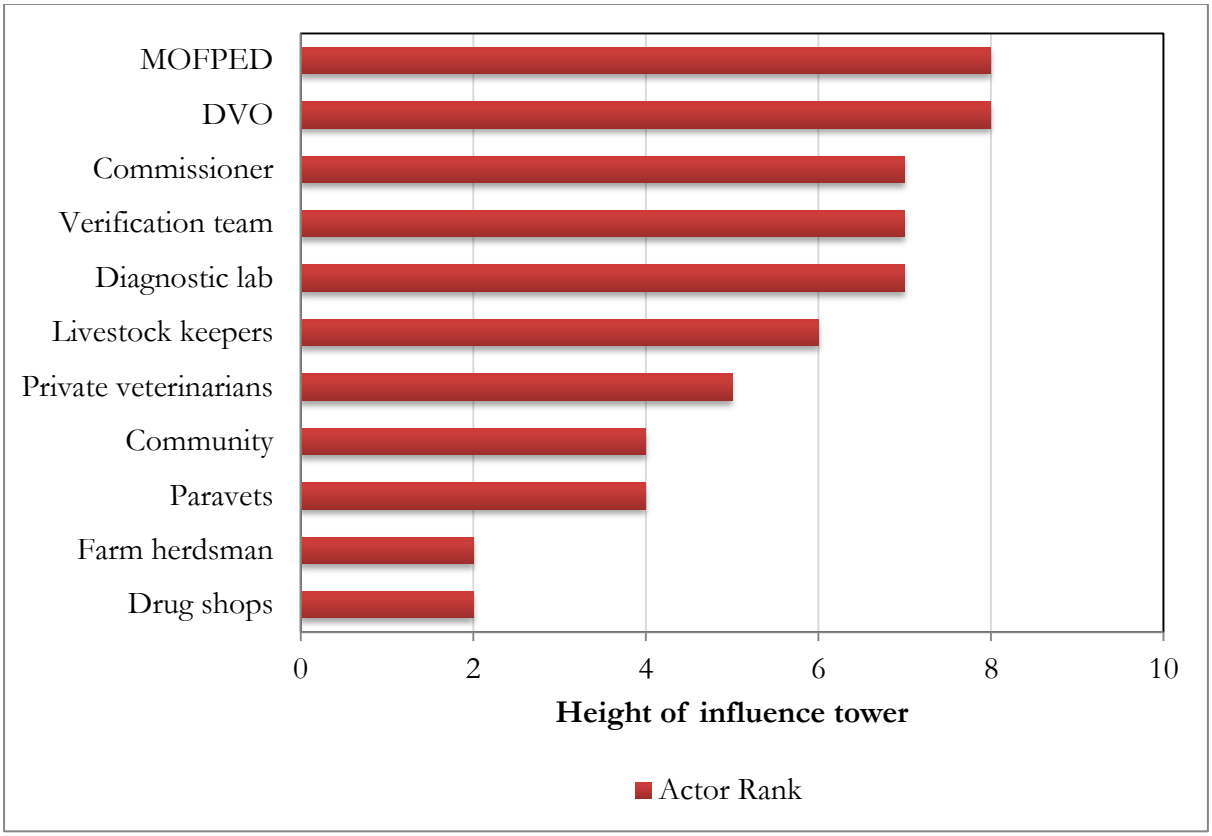
A total of 12 actors were identified as influential actors in control of control epidemic disease in Mukono district. In the case of epidemic disease outbreaks such as Foot and Mouth disease, the farmer will report to the paravet or the private veterinarian and who will then report to the DVO. The latter will then report the outbreak to the Commissioner Livestock Health and Entomology (CLH&E) of the Ministry of Agriculture, Animal Industry and Fisheries. On receiving such a report the CLH&E will mobilize a team from the National Animal Disease Diagnostics and Epidemiology Centre (NADDEC) to go to the affected district and carry out an epidemiological investigation and also collect samples for confirmatory diagnosis. The samples collected are tested at the NADDEC laboratory and once a confirmation is done, the team will report the results to the CLH&E indicating the action to be undertaken. Based on the results, quarantine will be instituted by the CLH&E in case of epidemic diseases as an immediate control measures. This will be followed by a vaccination campaign for diseases where the vaccines are available. Once the disease has been controlled, the DVO of the affected district is required to officially request the CLH&E to lift the Quarantine. The CLH&E usually sends a team from the ministry to take samples to confirm the absence of the disease. Based on the results the CLH&E issues a letter lifting the quarantine.

Although it is the responsibility of the central government to provide vaccination services, farmers often seek vaccination services from private veterinarians who get the vaccines from private firms like ERAM limited, quality chemicals and other pharmaceuticals. In case of routine vaccination organized by government, the paravets and private veterinarians are given vaccines and farmers are charged a fee to cover their labor and transport costs. Fees vary depending on the disease for example 1000ugx for rabies (US$0.3), 1500ugx (US$0.45) for

FMD and 2500ugx (US$0.9) for Lumpy skin disease. The farmers involved in exercise noted that all service providers (a government veterinarian, private veterinarian and paravets) charge the same price. Vaccination is often done at the farmer's home or farm.

Just like in the case of the pastoral system, respondents identified Ministry of finance as the most influential actor in control of and treatment of epidemic diseases and they gave the ministry of finance a score of 8 as shown in Figure 4 below. The reason is that the ministry is "Mr. Money". The respondent noted that the problem in vaccination and surveillance always comes from financing of these services. Active surveillance is not always done because of financial constraints. The second most influential actors ranked as equally important are District Veterinary Officer (DVO), the Commissioner Livestock Health and Entomology under MAAIF and the National Surveillance Team because of their coordinating role and technical guidance and were given a score of 7. The livestock owners (farmers) were ranked more important than the paravets and private veterinarians because there are close to the animal and can easily recognize that the animal is sick and report the sickness to the service providers thus earning a score of 6. The private veterinarians were ranked as more important than the paravets/paraprofessionals because they have technical expertise and link closely with the government veterinarians who are more central actors in coordinating epidemic diseases control at district and national level. The private veterinarians were given a score of 5 and paravets a score of 4. Herdsmen and drug shops were given a score of 2 each for their role in reporting disease out breaks see Figure 4 below

Network of Actors involved in clinical treatment, prevention and surveillance of epidemic livestock diseases



Problems in epidemic disease control in district B

1) Poor relations between government veterinarians and Paravets/paraprofessionals

The main problem in the control of epidemic diseases in district B is the "poor relations" between the government veterinarians and Paravets see Figure 4 above. Paravets rarely report disease out breaks to the government veterinarians as mandated by the Animal Diseases Act 1964 revised edition 2005[2]. This Act provides for the prevention, control and eradication of animal diseases and requires that all outbreaks of epidemic animal diseases must be reported to the nearest veterinary authority who should in turn report to the Commissioner Livestock Health and Entomology within 24 -48 hours using the fastest means. Their relationship is poor because government veterinarians perceive them as subordinates, and are not cooperative with paravets when they are consulted majorly because they are perceived as less qualified. Additionally, government veterinarians have no incentive to build good professional relationships with paravets since they have assured government salary. Worse still the veterinary surgeons act is outdated and ineffective in strengthening veterinary and paravet relations. The DVOs always depends on reports from private veterinarians. The relationship between the paravets and private veterinarians is good because the paravets often consults them and considered as colleagues irrespective of the level of training. This mainly because private veterinarians need to survive and it is through such networks with the paravets that they get new clients.

2) Inadequate and unpredictable government financing

Another problem is the inadequate and unpredictable government financing which limits the ability of DVOs, verification team, and other governments departments to implement vaccination tasks. When the ministry procures vaccines, it is expected to provide logistical support to the local government staff for implementation of the vaccination campaigns. However, the ministry does not provide such logistical support and therefore the government veterinarians are compelled to charge farmers for each animal vaccinated to recover such costs. The advantage in Mukono district is that the farmers are able to pay for these services and even though the government veterinarians give the vaccines to the private veterinarians, the latter are able to recover their costs.

Problems of veterinary service delivery at the National level

1. Policy inconsistency

The creation of autonomous institutions like National Agricultural Advisory Services (NAADS) which has its own governance structure has resulted in the duplication of responsibilities and multi or dual accountability. Under NAADs, local governments have to hire NAADs staff and MAAIF staff in both crop and livestock. These staffs perform the same task but NAADS staff are facilitated and paid well. This has undermined the traditional public services system because NAADs is running a parallel system yet is also under government/MAAIF. Also, under decentralized governance system, technical and financial lines of management are separated as district veterinary offices (DVOs) have to report to both MAAIF for technical matters, and the Ministry of Local Government and district local government for administrative matters. This has also destroyed the chain of command from the center to district which is key to animal disease control (OIE 2011; FAO 2011). Respondents stated that "Decentralization and NAADs has broken the chain of command. Disease reporting and quarantine implementation has become problematic. The DVO reports to Chief Administrative Officer (CAO) who is head of all civil servants in district, the District council and political heads who are locally elected leaders, and thus he has no incentive to

[2] Animal Diseases Act 1964 http://www.ulii.org/ug/legislation/statutory-instrument/2005/38

report to central ministry. DVOs cannot report outbreak of certain disease because the local government of officials would fire them or suspend them from office. The director of animal resources in Uganda noted a case of Bukedea district were the veterinarian was sent on forced leave to pave way for lifting the quarantine. If quarantines are issued, politicians can suspend the veterinarians to lift the quarantine since they are appointed by the district service commission and not public service. Therefore, veterinarians serve the interests of at local government leaders other than the technical leaders at MAAIF". A number of cases were quarantines have been lifted by local politicians or leaders have appeared in press see (Edyegu 2011; Monitor 2012; Otim 2011a; Wetaka 2011; Otim 2011b).

2. Exclusion of technical expertise in program planning

Another problem cited by respondents relates to planning and implementation of animal health programs or activities. Respondents noted that "the technical leaders of the department of Livestock Health and Entomology under MAAIF take only the third position in the decision making. Major decisions and policies are made in planning committees composed of economists and accountants without the technical expertise of the staff who then have to implement the animal health programs. Most respondents cited example of the so-called "Non Agricultural Technology and Agribusiness Advisory Services[3] (Non ATAAS), where planning and provision of agricultural services are planned based on commodities. Non ATAAS is part of MAAIF Agricultural Development and Investment Plan (DSIP) 2010/2011-2014/2015 with the objective of pursuing private sector led and market oriented agricultural development through a commodity approach (MAAIF 2012). According to the respondents, this planning design does not reflect the implementation structure of the ministry and thus cannot be effectively implemented. The problem of exclusion of technical staff from MAAIF in agricultural policy reform is discussed in detail by Kjær & Joughin (2012) and has led to lack of ownership of reforms and the development of inadequate implementation strategies (Kjær & Joughin 2012; Bahiigwa et al. 2005).

3. Insufficient budgetary allocation and financial indiscipline

The other major problem is the insufficient budgetary allocation and lack of financial discipline by government. Respondents noted that budgetary allocation to animal health and entomology are often low. This finding is supported by a study of the Economic Policy and Research center, which reveals that allocations to animal health and entomology from the recurrent expenditure varied from 0.507bn to 0.586 bn Uganda shillings ($250,0000 to $300,000) between 2005 to 2008 (Economic Policy and Research centre 2009).

4. Synthesis and Policy recommendations

The study has identified a number of actors that are involved in the delivery of veterinary services in Uganda. The number and type of actor depends on the type of the service and production system for example, CAHWs and NGOs are involved both in curative and preventive services in pastoral systems, but not in intensive productive systems. The NGOs' main influence in pastoral communities is in the provision of preventive services. The influence each actor has depends on following factors irrespective of the type of service and production system:

1) Control of financial resources
2) Closeness to the animal

[3] Non ATAAS report http://www.agriculture.go.ug/userfiles/Final%20Synthesis%20Report%20-%20NON-ATAAS%20DSIP%2014%20November%20%202012-2.pdf

3) Education level and availability of the service provider
4) Ability of the veterinarians to communicate with paravets and farmers
5) Relationship between the paraprofessionals and the veterinarians

Table 2 below shows the relationship between service type, production system and veterinary service delivery problems. The sign ☹ indicates that, for that particular service in the given production system, the problem is recurrent and ☹☹ means that the problem is very recurrent.

- **Clinical services:** As shown in table 2, drug abuse, delays in reporting, and staffing problem and government staff absenteeism are very recurrent problems in pastoral communities. Low staffing levels and absenteeism by the government veterinarians is mainly attributed to poor infrastructure in the pastoral areas. Also, language barriers between the veterinarians and community animal health workers and veterinarian and farmers were found to be a very recurrent problem in delivery of curative services in pastoral communities. In the productive system in Mukono, the recurrent problems in delivery of clinical veterinary services were drug misuse, and personnel management issues and poor paravets and veterinarians relations.
- **Preventive services:** In the case of preventive services, delayed reporting of epidemic animal diseases, capture of resources by the veterinarians especially during vaccination exercises, political interference, insufficient and unpredictable budgetary allocations were found to be very recurrent both productive areas and recurrent in pastoral areas. Absence of cooperation between paravets and veterinarians was considered recurrent problem in Mukono. Exclusion of veterinarians in decision making at the ministry level was found to be major challenges in delivery of preventive services.

Insert Table 2: Service type, production system and service delivery problems
Table 2: Service type, production system and service delivery problems

Service and production system	Drug Abuse	Delayed reporting	Absensteism and staffing problem	Capture by veterinarians	Language problems	Finance and political interfearence	Paravets and Veterinarians relations
Clinical services (pastoral areas)	☹☹	☹☹	☹☹		☹☹		
Clinical services (productive areas)	☹	☹					☹☹
Preventive services (Pastoral areas)		☹	☹	☹	☹	☹	
Preventive services (productive areas)		☹☹		☹☹		☹☹	☺☺

Source: Authors

Policy options and Conclusion

The emerging picture is that challenges of veterinary service delivery in Uganda are linked to institutional pluralism, decentralization and budgetary constraints that limit effectiveness of the existing institutions. Consequently, given the existing fiscal challenges, the key to improving animal service delivery in Uganda rests on getting priorities, policies and institutions right. Creating an independent ministry responsible for livestock may be

advantageous in advocating for veterinary policy, legislation and education. Countries like Kenya and Tanzania which have independent ministries of livestock have put in place veterinary legislation that guides the provision of veterinary services. For example, Tanzania passed a Veterinary Act in 2003[4] and Kenya in 2010,[5] but Uganda still depends on the Veterinary Surgeons Act of 1958[6] . Uganda, too, used to have an independent ministry of livestock industry and fisheries before 1992 but was merged with ministry of agriculture with the objectives of enhancing efficiency and effectiveness of public expenditures and rationalizing the use of resource (Kuteesa et al. 2006).

However, this turned out to be counterproductive and has negatively affected delivery of agricultural services including veterinary services (Semana 2002). A number of other autonomous institutions such as National Agricultural, Research Organization (NARO) in 2005, NAADS (2001), and Dairy Development Authority (DDA) in 1998 were created to improve delivery of agricultural service including livestock (Lukwago 2010). However, the creation these autonomous institutions have instead increased public expenditure while service delivery has stagnated or continued to decline. Programs under some of these institutions like NAADs could be implemented by the public extension system instead of running parallel systems that performing the same functions (Rwamigisa 2013). This could reduce the financial or budget problems and rivalry that exists between MAAIF and some of these institutions.

Another challenge to provision of veterinary services identified in this study is limited number of active veterinary professionals and difficulty in attracting and retaining veterinary staff especially by local governments in marginal areas. This paper proposes three strategies to ensure availability of enough qualified veterinary staff in Uganda and they include the following: first, centralizing the administration of veterinary staff. This paper argues that administrative decentralization which was aimed at empowering farmers and local leaders to supervise and monitor extension staff is not appropriate for veterinary services because veterinary services requires an efficient chain of command to ensure the quality. Decentralized administration of veterinary staff fragments the chain of command and reduces the responsiveness of the veterinary system (Petitclerc 2012). In addition, the local leaders or politicians have captured decentralization power and have used it to interfere with provision of preventive veterinary services.

The second option is recruitment of holders of diploma in veterinary science at sub county level other than restricting to only degree holders. Veterinarians are difficult retain, motivate and will require higher wages compared with paraprofessionals holders of diploma in veterinary medicine (Leonard et al. 1999). The third strategy is supporting veterinary training and education. It is impossible to have enough qualified veterinary staff both diploma and degree holders to offer veterinary services in Uganda without appropriate funding. Funding of veterinary education needs to target students from pastoral or marginal areas. A

[4] **The Veterinary Act, 2003** http://www.mifugo.go.tz/documents_storage/Veterinary%20Act%2016%202003.pdf

[5] **The Veterinary Surgeons and Para-Professionals Bill, 2010** http://www.kenyalaw.org/klr/fileadmin/pdfdownloads/bills/2010/Vet._Surgeons_and_Paraproffs_Bill__2010.pdf

[6] **The Veterinary Surgeons Act of 1958** http://www.ulii.org/ug/legislation/consolidated-act/277

government scholarship similar to the one of the Ministry of Health scholarships fund for hard to reach and priority areas[7] aimed at training medical personnel would be needed in animal health. As argued by Bellemain & Coppalle (2009) and Fanning et al. (2009) veterinary education is a key to improving governance of veterinary services and reduce animal disease economic and health risks.

Conflict of interest

The co-Authors Patience Rwamigisa and Neolina Nantima are staff of MAAIF. However, they would not expect to personally benefit from the implementation of any of the recommendations made in this paper. Hence, no conflict of interest was identified.

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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(1), pp.33–45; discussion 391–401.

Ahuja, V. & Redmond, E., 2001. Economic and Policy Issues in Livestock Service Delivery to the Poor. *Poor Livestock Policy Initiative: Fostering the Policy Dialogue in Support of Equitable, Safe and Clean Livestock Farming FAO Rome*, 68(May).

Bahiigwa, G., Rigby, D. & Woodhouse, P., 2005. Right Target, Wrong Mechanism? Agricultural Modernization and Poverty Reduction in Uganda. *World Development*, 33(3), pp.481–496.

Bellemain, V. & Coppalle, J., 2009. Essential veterinary education in the governance of public Veterinary Services. *Revue Scientifique et Technique-Office …*, 28(2), pp.649–656.

Birner, Regina, Cohen, M. & Ilukor, J., 2010. Rebuilding Agricultural Livelihoods in Post-Conflict Situations: What are the Governance Challenges? The Case of Northern Uganda. *International Foof Policy and Research Institute (IFPRI) Washington, DC*.

Blanchet, K. & James, P., 2012. The role of social networks in the governance of health systems: the case of eye care systems in Ghana. *Health policy and planning*, pp.1–14.

Borgatti, S.P. et al., 2009. Network analysis in the social sciences. *Science (New York, N.Y.)*, 323(5916), pp.892–5.

[7] The Ministry of Health scholarships fund for hard to reach and priority areas http://health.go.ug/docs/scholarships.pdf

Brass, D., Butterfield, K. & Skaggs, B., 1998. Relationships and unethical behavior: A social network perspective. *Academy of Management Review*, 23(1), pp.14–31.

Butts, C.T., 2009. Revisiting the foundations of network analysis. *Science (New York, N.Y.)*, 325(5939), pp.414–6.

Byarugaba, D., 2004. A view on antimicrobial resistance in developing countries and responsible risk factors. *International journal of antimicrobial agents*, 24, pp.105–110.

Byarugaba, D., Kisame, R. & Olet, S., 2011. Multi-drug resistance in commensal bacteria of food of animal origin in Uganda. *Afr. J. Microbiol. Res*, 5(12), pp.1539–1548.

Carrington, P.J., Scott, J. & Wasserman, S., 2005. *Models and methods in social network analysis*, : Cambridge University Press.

Dahlstrom, R. & Ingram, R., 2003. Social networks and the adverse selection problem in agency relationships. *Journal of Business Research*, 56(9), pp.767–775.

Economic Policy and Research centre, 2009. *Agriculture Sector Public Expenditure Review Phase three: Efficiency And Effectiveness Of Agricultural Expenditures*, Available at: http://www.eprc.or.ug/pdf_files/agric_pets.pdf.

Edyegu, D., 2011. Meat prices up as quarantine bites. *The New Vision, Ugandas daily leading news paper*. Available at: http://www.newvision.co.ug/D/8/17/752032.

Eisenhardt, K., 1989. Agency theory: An assessment and review. *Academy of management review*, 14(1), pp.57–74.

Fanning, S., Whyte, P. & O'Mahony, M., 2009. Essential veterinary education on the development of antimicrobial and anti-parasitic resistance: Consequences for animal health and food safety and the need for. *Revue scientifique et technique*, 28(2), pp.575–582.

FAO, 2011. *Good emergency management practice: the essentials* W. G. Nick Honhold, Ian Douglas & J. L. Arnon Shimshoni, eds., FAO Animal Production and Health Manual.

FAO, 2009. *Poultry policies , legislation and strategies in Uganda*, Rome Italy.

FAO, 2008. *Uganda Poultry sector country review*,

Granovetter, M., 1985. Economic action and social structure: the problem of embeddedness. *American journal of sociology*.

Haan, C. De & Umali, D., 1992. Public and private sector roles in the supply of veterinary services. *World Bank.*

Hall, D.C., Ehui, S. & Delgado, C., 2004. The livestock revolution, food safety, and small-scale farmers: why they matter to us all. *Journal of Agricultural and Environmental Ethics*, 17(4-5), pp.425–444.

J. Bosco, K., 2012. Antimicrobial Drug Resistance and Plasmid Profiles of *Salmonella* Isolates from Humans and Foods of Animal Origin in Uganda. *Advances in Infectious Diseases*, 02(04), pp.151–155.

Joloba, M.L. et al., 2001. High prevalence of carriage of antibiotic-resistant Streptococcus pneumoniae in children in Kampala Uganda. *International journal of antimicrobial agents*, 17(5), pp.395–400.

Kjær, A.M. & Joughin, J., 2012a. The reversal of agricultural reform in Uganda: Ownership and values. *Policy and Society*, 31(4), pp.319–330.

Kjær, A.M. & Joughin, J., 2012b. The reversal of agricultural reform in Uganda: Ownership and values. *Policy and Society*, 31(4), pp.319–330.

Kuteesa, F. et al., 2006. Uganda : A Decade of Budget Reform by. *oECD Journal on Budgetinging*, 6(2), pp.1–25.

Leonard, D K et al., 1999. The new institutional economics of privatizing veterinary services in Africa. *Revue scientifique et technique (International Office of Epizootics)*, 18(2), pp.544–561.

Leonard, David K., 2000. *Africa ' s Changing Markets for Health and Veterinary Services : The New Institutional Issues*, Palgrave Macmillan.

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(1), pp.61–80.

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

Lister, S, 2006. Evaluation of General Budget Support: Synthesis Report. *The Organisation for Economic Co-operation and Development (OECD)*, (May).

Lister, Stephen et al., 2006. Evaluation of General Budget Support – Uganda Country Study Coordinator. *The Organisation for Economic Co-operation and Development (OECD)*.

Luke, D. a & Harris, J.K., 2007. Network analysis in public health: history, methods, and applications. *Annual review of public health*, 28, pp.69–93.

Lukwago, D., 2010. *Increasing Agricultural Sector Financing Why it Matters for Uganda's Socio-Economic Transformation*, Advocates Coalition for Development and Environment (ACODE).

Ly, Cheikh, 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*. London: Macmilan Press Ltd, London and St maartins Press New York.

MAAIF, 2012. *Proposed plan to operationalise the non-ataas component of the agriculture sector development strategy and investment plan*,

Marsden, P. V, 1990. Network and data management. *Anuuual Review of Sociology*, 16, pp.435–463.

Mbowa, S., Shinyekwa, I. & Mayanja, M.L., 2012. The challenges of the Private Sector Driven Veterinary Extension Services Delivery in the Dairy Sector in Uganda. , (22), pp.1–4.

Monitor, 2012. Local leaders authorise sale of pork despite quarantine. *The Monitor Publications, Uganda's daily news paper*. Available at: http://www.monitor.co.ug/News/National/Local-leaders-authorise-sale-of-pork-despite-quarantine/-/688334/1638710/-/t77n4nz/-/index.html.

Msellati, L., Commault, J. & Dehove, A., 2012. Good veterinary governance : definition , measurement and challenges. *Rev. sci. tech. Off. int. Epiz.,*, 31(2), pp.413–430.

OIE, 2011. Generic Guidelines for Disease Control. , (March), pp.24–28. Available at: http://www.oie.int/doc/ged/D11244.PDF.

Otim, R., 2011a. Livestock quarantine seals off pockets of Teso residents. *The Monitor Publications, Uganda's daily news paper*. Available at: http://www.monitor.co.ug/News/National/-/688334/1199862/-/byjvyxz/-/index.html.

Otim, R., 2011b. Quarantine stalls back-to- school drive. *The Monitor Publications, Uganda's daily news paper*, p.2011. Available at: http://www.monitor.co.ug/News/National/-/688334/1098616/-/cindq3z/-/.

Petitclerc, M., 2012. Governance , veterinary legislation and quality. *Rev. sci. tech. Off. int. Epiz.,*, 31(2), pp.465–477.

Pica-Ciamarra, U. & Otte, J., 2008. Animal Health Policies in Developing Countries–A Review of Options. *Pro-Poor Livestock Policy Initiative*, (08), pp.1–27.

Provan, K.G. et al., 2003. Building community capacity around chronic disease services through a collaborative interorganizational network. *Health education & behavior : the official publication of the Society for Public Health Education*, 30(6), pp.646–62.

Raabe, K. et al., 2010. *How to Overcome the Governance Challenges of Implementing NREGA: Insights from Bihar Using Process-influence Mapping*, International Food Policy Research Insitute.

Rwakakamba, M., 2008. Challenges Facing the Agricultural Sector in Uganda. In *Presentation at the Uganda National Farmers Dialogue*. Uganda Nataional Farmers Federation.

Rwamigisa, P.B., 2013. The Role of Policy Beliefs and Discourses A Case Study of NAADS in Uganda. In *Political Economy of Agricultural Policy in Africa*. Future Agricultures Consortium.

Sasanya, J.J. et al., 2005. Use of sulfonamides in layers in Kampala district, Uganda and sulfonamide residues in commercial eggs. *African health sciences*, 5(1), pp.33–9.

Schiffer, E. & Waale, D., 2008. *Tracing power and influence in networks: Net-Map as a tool for research and strategic network planning*, International Food Policy Research Institute (IFPRI).

Schneider, H., 2011. Good governance of national veterinary services. *Revue scientifique et technique (International Office of Epizootics)*, 30(1), pp.325–38.

Semana, A., 2002. Agricultural Extension Services at Crossroads: present dilemma and possible solutions for future in Uganda. *Proceedings of CODESRIA-IFS Sustainable Agriculture Initiative Workshop, Kampala Uganda*.

Vaarten, J., 2012. Clinical impact of antimicrobial resistance in animals. *Revue scientifique et technique (International Office of …*, 31(May 2011), pp.221–230.

Wetaka, A., 2011. Traders Defy Cattle Quarantine. *Uganda Radio Network*. Available at: http://ugandaradionetwork.com/a/story.php?s=36240.

Wolfe, A.W., 1997. Social network analysis: Methods and applications. *American Ethnologist*, 24(1), pp.219–220.

Woodford, J., 2004. Synergies between veterinarians and para-professionals in the public and private sectors: organisational and institutional relationships that facilitate the process of privatising animal health services in developing countries. *Revue scientifique et technique-Office international des …*, 23(1), pp.115–135.

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