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Full Length Research Paper

Involvement of key stakeholders in controlling animal diseases in rural settings: Experiences with African swine fever in Uganda

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Key stakeholders' involvement in the design and enforcement of effective African swine fever (ASF) biosecurity measures is very vital. Unfortunately, many times key stakeholders are less involved in the policy designing process. This study analyzed information from stakeholders in Mukono District, to assess the acceptability of enforcing ASF biosecurity measures among key stakeholders. Mukono District has a high density of pigs and a history of frequent ASF outbreaks. Key informants (n = 23) were identified and interviewed in four sub-counties to generate an ASF control stakeholders' list. Eleven stakeholder groups were identified by the Key Informants. Sixty participants representing different stakeholder groups identified through the Key Informant interviews participated in a workshop to assess stakeholders' characteristics regarding strict enforcement of ASF control measures. Stakeholder grid analysis revealed 60% as drivers, and 40% as supporters. There were no blockers, abstainers, and bystanders. Despite this, majority of the groups (90%) did not have adequate capacity to implement the intervention due to financial constraints and inadequate technical support. These results show that there is great support for enforcement of biosecurity measures if stakeholders are facilitated with financial and technical support thereby limiting outbreaks of ASF in rural areas of Uganda.

Key words: African swine fever, biosecurity, influence, power, roles, interests, stakeholder.

INTRODUCTION

The agricultural sector is very important in the economy of Uganda. It contributes up to 23.8% of the Gross Domestic

Product (GDP), generating about 48% of export earnings (Sebudde et al., 2018). The livestock sector alone contributes 15% of agricultural GDP (Tatwangire, 2014). This sector registered a 3% increase in the number of livestock and poultry between 2009-2010 with 4.5 million households (70.8%) rearing at least one species of livestock (Uganda Beaural of Stastics, 2016). The pig is one of the important livestock species in Uganda in addition to sheep, goats, cattle and chicken (UIA, 2009). Uganda has the biggest pig population in East Africa (FAOSTAT, 2018). The pig population in Uganda has been steadily increasing over the years; from 0.19 million in 1980; to 1.7 million in 2002, to 3.2 million in 2008 and to 4 million in 2016 (UBOS, 2016). Pig production in Uganda is widespread with about 1.1 million (17.8%) households owning at least one pig (Tatwangire, 2014).

Unfortunately, this rapid growth in the pig sector is affected by many challenges. Some of these include; inadequate quality extension services, high input costs, fluctuating feed sources and prices and pig diseases (Muhanguzi et al., 2012). There are several pig diseases in Uganda but African Swine Fever (ASF) has so far proven to be the single biggest problem hindering the pig industry (Muhanguzi et al., 2012). African swine fever is a highly contagious disease that affects both domestic and wild pigs (Penrith et al., 2004). This pig disease causes enormous economic losses to domestic pig farmers (Mulumba-Mfumu et al., 2019) due to the high mortality rates that accompany outbreaks (Arias and Sanchez-Vizcaino, 2002; Costard et al., 2009). ASF has neither cure nor vaccine (Costard et al., 2013, Penrith et al., 2004). The only way to control the disease at the moment is through quick diagnosis and strict implementation of biosecurity measures (Dione et al., 2017).

In order to control animal diseases, there is need for both international and local animal disease control laws. Uganda has good policies and laws that when well implemented can limit the spread of highly contagious diseases such as ASF. For instance, the Animal Diseases Act (Government of Uganda Animal Diseases Act, 2014), provides for enforcement of quarantines in areas with animal disease outbreaks. The policy prevents the movement of animals and animal products from and into such areas and, animal owners (pigs inclusive) are required to keep them in proper buildings or paddocks constructed in accordance with the specifications. When well implemented, these requirements can potentially limit the spread of ASF. However, despite the presence of these laws, ASF outbreaks are still common (Kalenzi Atuhaire et al., 2013) because the enforcement of these regulations requires the cooperation of several stakeholders.

Stakeholder analysis has been effectively used in multiple disciplines to deduce solutions to various challenges. In the human health sector, stakeholder analysis led to the successful improvement of maternal and newborn health in Uganda (Namazzi et al., 2013). Similarly, in the veterinary sector, effective control of highly contagious animal diseases such as ASF can only be achieved if all key stakeholders are identified, involved in policy designing and implementation of the designed measures.

In Uganda, enhancing the capacity of all pig stakeholders through community sensitizations using drama and radio talk shows has been identified as being important in the control of ASF (Ouma et al., 2017). Stakeholder capacity building ought to be preceded by a stakeholder analysis to develop a proper engagement framework. A proper stakeholder engagement framework determines who should participate, when and how (Luyet et al., 2012). Many times stakeholders are less involved in the policy designing process thus affecting policy implementation. In this study, we assessed the acceptability of enforcing ASF biosecurity measures among key stakeholders in the control of African swine fever in Mukono District, a rural area in central Uganda.

METHODOLOGY

Study area

This study was carried out in Mukono District (0.2835° N, 32.7633° E), located in the central region of Uganda. Mukono District has a total area of 2,986.47 Sq. Km and is bordered by Buikwe District in the East, Kayunga District in the North, Luwero District in the North West, Kampala city and Wakiso District in the South West and a shoreline on Lake Victoria to the South. Mukono District has a high density of pigs and a history of frequent ASF outbreaks. The district is composed of 13 sub-counties (SCs), 72 parishes and 795 villages with a human population of 596,561 (289,804 males and 307,757 females) distributed in 144,160 households (HH) (Uganda Bureau of Statistics (UBOS), 2017). Of these households, 63,079 (43.8%) are involved in livestock rearing. Mukono District is the only district in Uganda, which is piloting a community initiated and monitored ASF control program where ASF stakeholders implement biosecurity measures aimed at ASF control.

Stakeholder analysis

Stakeholder analysis for this study was carried out in 3 phases: the first phase was carried out to generate a list of stakeholder groups who can influence the implementation of ASF control measures in Mukono District. This was followed by categorizing stakeholder groups based on their power and influence towards the successful implementation of ASF control, and their (stakeholder groups) characteristics in terms of their roles and interests towards ASF control.

Generation of ASF pig stakeholder group list for Mukono District

This was carried out in four sub-counties (SCs) of Mukono District, central Uganda. The sub counties were Kasawo, Namuganga, Ntenjeru and Mpunge (Figure 1). In Kasawo SC, key informant interviews were held with one veterinary officer in each of the 6 parishes (Kitovu, Kabimbiri, Kakukuru, Namaliri, Kasana and Kigogola). Additionally, discussions were held with two veterinary officers in Kasawo SC head offices making a total of eight key informant interviews in this SC.

In Namuganga SC, interviews were held with one veterinary

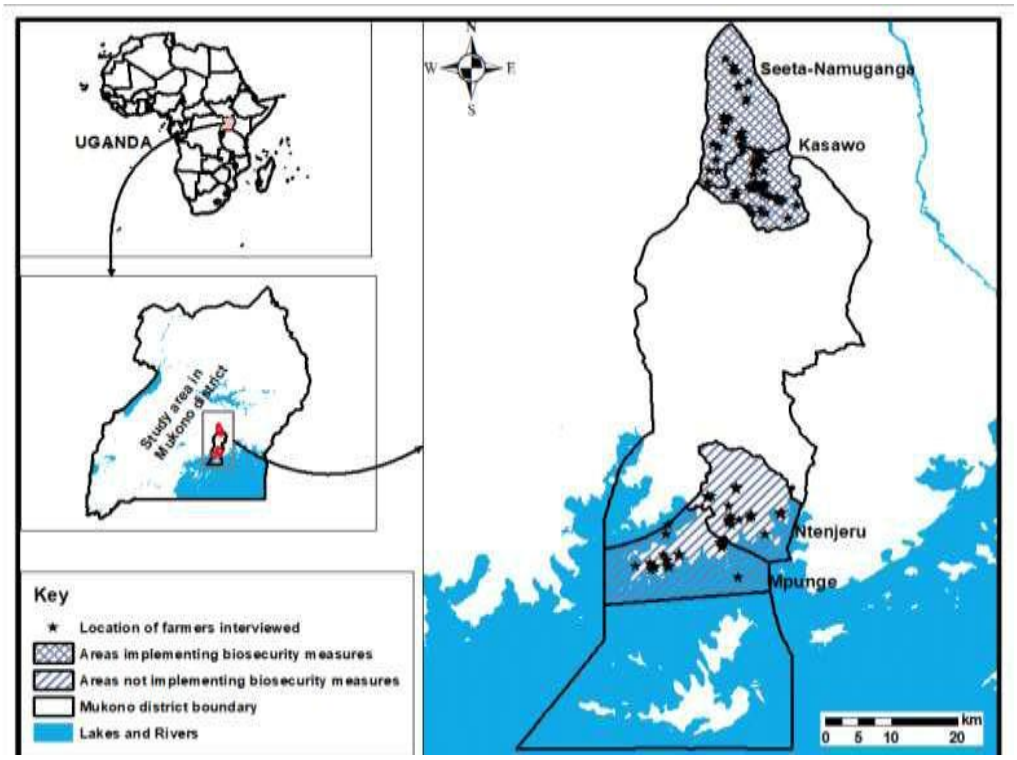

Figure 1. A map of Mukono District showing the study area.

officer in each of the five parishes of Kituula, Kitale, Namuganga, Namanoga and Kayini. In Mpunge SC, one key informant interview was held with one lead pig farmer in each of the four parishes of Ngombere, Mpunge, Lulagwe and Mbazi parishes. In Ntenjeru SC, five key informant interviews were held as follows: two veterinary officers and three parish ASF control mobilizers. We also held one key informant interview with the Mukono District Veterinary Officer (DVO). At this step, respondents were only asked about names of stakeholder groups within and outside Mukono District and their descriptions in relation to ASF control. Consent of each respondent was sought before commencement of the interview to which they responded in approval and their responses were both hand written and audio recorded. The recorded audios were later transcribed and typed in Microsoft® Word. Based on these interviews, a stakeholder group list was developed indicating the name of the stakeholder group and a brief description of their relationship with ASF control in Mukono District.

Categorization of ASF control stakeholder groups

A stakeholder workshop was held at Mukono Zonal Agricultural Research and Development Institute (MUZARDI) on 20/3/2019. The workshop comprised of a total of 60 individual ASF control stakeholders drawn from 13 different stakeholder groups. During the meeting, stakeholders from the same stakeholder group sat closest to each other to allow them to share ideas and report the consensus in case it was required. All necessary visual materials (elements that constitute the ASF biosecurity program, analysis grids, and definitions of key words) were displayed in manila papers on the walls of the workshop room for easy reference by the participants. The stakeholder group list that was earlier developed during the initial steps of the study was displayed as well in manila papers for all participants to view and verify. The workshop facilitator introduced the purpose of the workshop and requested participants who consented to the publication of the workshop results to sign a consent form. Fortunately, all participants consented and signed the consent forms. Using a stakeholder analysis grid, participants classified stakeholders into five categories (of drivers, blockers, supporters, bystanders and abstainers) depending on their power and influence, and level of agreement with the enforcement biosecurity measures in ASF control. The stakeholder categories were defined as follows:

i) Drivers: A stakeholder or group that has high power, influence and high agreement with the enforcement biosecurity measures in the control of ASF and can champion it;
ii) Blockers: A stakeholder or group that has high levels of power and influence in the control of ASF, but highly opposes the enforcement of control measures;
iii) Supporters: Those that support the practices, but whose influence and power may be limited (on their own);
iv) Bystanders: Those that disagree to the control practices but with low influence and support;
v) Abstainers: Those who are neutral to the control practices, but may or may not have influence.

All stakeholder groups were categorized into the five categories by selecting one and asking participants in this group to rate their degree of power and influence in ASF control (using a scale of 1-3) by writing on pieces of paper. Power of a stakeholder was defined as the extent to which a stakeholder was able to persuade other stakeholders to embrace and implement ASF control measures. The influence of a stakeholder on the other hand was defined as the power a stakeholder can exert over the execution of ASF control measures. Each stakeholder group was later asked to assess their own level of agreement with the implementation of ASF control measures using the same scale of 1-3. The level of agreement of a stakeholder was defined as the extent to which a stakeholder approves/ accepts the proposed ASF control measures. The

research team analyzed these responses in Microsoft® excel (Microsoft Corp., Washington, DC, USA) and developed the stakeholder categories.

Analysis of stakeholder group categories

After categorization of all stakeholder groups, those categorized as abstainers, bystanders and blockers were separated from the other categories. These participants were asked to brainstorm in focus groups the reasons why they had abstained from or blocked the strict enforcement of ASF biosecurity measures. The stakeholders who were categorized as supporters and drivers were further asked to reveal their roles and interests towards the control of ASF.

Strategies to deal with each stakeholder group

Researchers brainstormed on the strategies to deal with each stakeholder group based on each stakeholder's roles and category. The strategies were in terms of empowerment, continuous engagement, further involvement and further consultation.

Importance and relationships among stakeholder groups

To determine the relationship among the different stakeholder groups, participants were requested to attach circles cut out of manila paper in three sizes as described by Richards and Panfil (2011) were the level of importance is directly proportional to the size of the cut manila paper. The three sizes were large, medium and small representing level of importance of the stakeholder group. Importance of a stakeholder was defined as the roles of such a stakeholder in achieving anticipated results for the implementation of ASF control measures. Since all stakeholder groups were from Mukono district all the circles were purple. For each stakeholder group, the participants described the importance of the stakeholder's involvement in the control of ASF and selected the corresponding size of the circle as summarized below.

Little importance = small circle (1 cm in diameter)
Some or moderate importance = medium sized circle (2 cm in diameter)
Very important = large circle (3 cm in diameter)

The stakeholder group names were then inscribed on these circular cards. The circles were then arranged according to working relations among stakeholder groups. Those with very close working relationships were put closest to each other and vice versa for those with little or no working relationship. Since stakeholder groups located out of Mukono District, failed to attend this workshop, the exercise was done for only stakeholder groups located within the district. The next stage was to attach triangular manila cards of three different sizes, large (3 cm × 3 cm × 3 cm), medium (2 cm × 2 cm × 2 cm) and small (1 cm × 1 cm × 1 cm) representing level of influence of stakeholder to the edge of the stakeholder circle. The outputs were reviewed by all participants, who later discussed the relative importance and influence of each stakeholder. The arrangement was then captured with a digital camera. The overlap of the circles represented the extent of the working relationship between stakeholder groups.

RESULTS

Stakeholder groups in the control of ASF in Mukono

The stakeholder groups that were identified by Key Informants were from both within and outside Mukono District (Table 1). The key stakeholder groups included those involved in animal healthcare such as veterinarians, pig production value chain actors (for example traders), law enforcement, regulatory and administrative agencies at both local and national levels. Table 1 gives a brief description of each of these stakeholder groups.

Grid analysis of stakeholder group categories

The stakeholder grid analysis revealed that 60% of the stakeholders were drivers and 40% were supporters. There were no blockers, abstainers, and bystanders (Table 2). The categorization was in respect to the stakeholder's level of agreement with the use of biosecurity measures in ASF control, power, and influence in implementing ASF control measures in Mukono (Table 2).

The capacity of stakeholder groups to control the spread of ASF

All stakeholders discussed within their stakeholder groups, and each stakeholder group came up with a score between the scales of 1 to 3 to signify their own capacity in the control of ASF, giving reasons for their score as indicated in Table 3. It was observed that 90% of the stakeholders were incapacitated in the implementation of the ASF intervention measures due to financial constraints and inadequate technical support.

The roles of stakeholder groups in ASF control

In general, all stakeholders identified in the study were involved in ASF control in one way or another as shown in Table 4. Farmers were identified to play significant roles in ASF control since they are in direct contact with animals. These roles included reporting suspected ASF cases to veterinarians, restricting animal movements, disinfecting pig sties and restricting visitors from their farms. Interestingly, participants pointed out that Security and judiciary support ASF control strategies through enforcement of measures such as quarantines by restricting unlawful animal movements in the community in addition to apprehending and prosecuting quarantine defaulters.

Interest of stakeholder groups in ASF control

Stakeholders had varying interests in ASF control (Table 5), but all were geared towards increasing pig production to improve both household nutrition and income. The interests of the stakeholders in the implementation of ASF control measures reflected their roles in the community and occupation.

Table 1. ASF control stakeholder group list for Mukono District, Uganda.

S/N	Name of stakeholder	Description
1	Veterinarians	All private and public (local government) veterinary doctors/ officers and animal husbandry officers within Mukono. They treat pigs and provide technical advice to farmers.
2	Agricultural officers	They oversee crop and animal production in the SC.
3	Veterinary/human Drug shops	Sell animal drugs and give extension advice to farmers. Human pharmacies also sell disinfectants (like Jik) to pig farmers for ASF control.
4	Local council (LC) leaders	Include LC 1, 2 and 3 in the lower local government administrative units within Mukono. They help in enforcing ASF quarantines during outbreaks and information dissemination.
5	Pig traders	Butchers, buyers, 'pork joint' operators and transporters, locally termed as '*Babizzi*'. They have a pig traders' association with elected leadership. The traders come from within and outside Mukono.
6	Pig farmers and pig farm workers	Both commercial and small-scale farmers involved in pig rearing with leaders in every village locally called *'Ssabalijja'* who coordinate ASF control activities.
7	Pig consumers	Kasawo and Namuganga SCs pork consumers are organized into a pork consumers' association, that monitors the quality of pork being sold and the hygiene of the butcher.
8	ASF researchers	These include researchers from; COVAB and CONAS at Makerere University, and ILRI. These institutions are involved in ASF research in Mukono and Uganda in general.
9	Security and judicial agencies	Police, crime preventers, the courts of law and prisons within and outside Mukono, all help in enforcing ASF control.
10	Media Houses	Include radios (Sauti Radio), television stations (Bukedde), community radios with raised speakers (that cover 3-4 villages). These media stations, sensitize the community about ASF disease control strategies.
11	District officials	Include the CAO, DVO, OWC /NAADS) officers. UWEP and YLP officials involved in poverty alleviation by distributing animals including pigs to farmers.
12	Pig feed suppliers	Supply animal feeds, give advisory services to farmers regarding control of ASF. They may also help in the spread of ASF in case they sell contaminated pig feeds to farmers.
13	MAAIF	Government Ministry in charge of agriculture, animal industry and fisheries resources in the country. Provides technical guidance for formulation, review and implementation of animal production Acts, policies and legislation.
14	Policy and law makers	District Council makes and approves community by-laws and ordinances while the parliament of Uganda which enacts policy, regulations and acts e.g. the animal disease Act.
15	Dog owners	Stray dogs are believed to aid in ASF spread by moving ASFv contaminated swill from one location to the other.
16	Sub County and Parish chiefs	Government Administrators at the SC and Parish levels. They are involved programme/ activity such as ASF control to be successful in their communities.
17	Church leaders	Church leaders play a pivotal role in the community, for example, the Church of Uganda (COU) in Mukono is involved in pig projects. The Church gives free piglets to Christians.
18	Parish health coordinators	These work with veterinarians for information sharing regarding butcher health and hygiene.
19	Local NGOs	Include Feed the Hungry (involved in buying and distribution of piglets to farmers in Mukono), child fund (works in Jinja and Kampala) but buys piglets from Mukono for distribution in Jinja and Kampala.
20	Pig processors	Include Fresh Cuts that is located in Kampala, buy pigs from Mukono farmers and process pig products. There is also Wambizi, a pig abattoir, located in Nalukolongo, Kampala that receive pigs from all over Uganda.
21	Pig breeders	These produce and sell high quality piglets and pig semen to farmers. Kampala Capital City Authority (KCCA) has a pig-breeding center in Kyanja that has been in this business for five years.
22	Beach management units	These are in areas bordering the lake such as; Katosi and Mpunge landing sites. They handle Silver fish, locally called 'Mukene' used in making pig feeds which when contaminated with ASF can spread the disease.
23	Community Development officers	They sit at the Sub County and heavily engage with all developmental activities, of which pig farming is one of them.

CAO: Chief Administrative Officer, CONAS: College of Natural Sciences, COVAB: College of Veterinary Medicine, Animal resources and Biosecurity, ILRI: International Livestock Research Institute, MAAIF: Ministry of Agriculture, Animal Industry and Fisheries, NAADs: National Agricultural Advisory Services, OWC: Operation Wealth Creation, UWEP: Uganda Women Entrepreneurship Programme, YLP: Youth Livelihood Programme

Relationship, importance and influence of stakeholder groups

According to the proximity of circle attached to the stakeholders, farmers, consumers and traders are all closely related as evidenced by the close grouping of their respective circles. In this cluster, farmers and consumers were seen as more important than traders since their circles were bigger than those of traders. Interestingly, traders and farmers were seen as more influential than consumers because their triangles were bigger than that of consumers.

District officials, security and judicial agencies were all closely related due to their circles being aggregated together but the district officials were seen as more important (bigger circle) than both the security and judicial agencies (smaller circles).

Table 2. Analyzed categories of stakeholder groups in the control of ASF.

Stakeholder	Interest in the issue	Level of agreement	Level of power and influence	Type of power	Category
Pork consumers	Ensure that only clean and pork from healthy pigs is sold	High	Low	Beneficiary	High level supporter
District Officials *(CAO, LC5, OWC, DCDO)*	Supervise the veterinary officers	High	High	Decision maker	High level Driver
Pig Trader	Generate income from pigs and pig products	High	High	Beneficiary	High level Driver
Religious Leaders	Community spiritual overseers	Medium	High	Opinion leader	High level supporter
Community Development Officers (CDO)	Ensure implementation of community development programs	High	High	Development implementer	High level Driver
Agricultural Officer	Provide Agricultural extension service.	Medium	Low	Beneficiary and influence policy	High level supporter
Security and Judicial officials	Enforcement of community law and order	Medium	High	Law and order enforcer	High level supporter
Local Council leaders	Grassroot administrative structure of the community	High	High	Opinion leader	High level Driver
Veterinary officers	In charge and supervisor of animal welfare in the district	Medium	High	Beneficiary and influence policy	High level supporter
Pig farmer	Earn a living from rearing pigs	High	High	Beneficiary	High level Driver
Researchers	Design simple community-based ASF control measures	High	High	Beneficiary and influence policy	High level Driver

DCDO: District Community Development Officer, LC5: Local Council Five.

On the other hand, district officials, security and judicial agencies were regarded as equally influential because their triangles were of equal sizes.

Veterinary officers, CDOs, religious and local council leaders were all closely related as evidenced by their circles being grouped together. Veterinary officers were the most important stakeholders in this group. Comparatively, local council and religious leaders were both deemed moderately important while CDOs were the least important. Collectively, all stakeholders in this group were deemed highly influential owing to the equal sizes of their respective triangles. Researchers were not related to any other stakeholder group as observed by the standalone circle. They were also not aggregated with any other stakeholder group but researchers were seen as moderately important since their circle had moderate size and are highly influential due to the large size of their triangle. Agricultural officers were not directly mandated in animal production community outreach services although it was noted that in circumstances where no veterinarians existed, they provided minimal animal production services to farmers. In this respect, it was unanimously agreed by the participants that Agricultural officers be excluded from this stage. However, through animal production trainings, Agricultural officers would to some level provide animal production services to pig farmers in the absence of veterinarians (Figure 2).

Strategies for dealing with the stakeholder groups

Following the categorization of stakeholder groups

Table 3. Stakeholder group's capacity to control the spread of ASF.

Stakeholder	Score	Reasons for their capacity	Potential solution
Veterinarians	2(moderate)	Inadequate facilitation and staffing for enforcement.	Increase funding and recruitment for field staff for community outreach.
Agricultural officer	1(Low)	Inadequate technical knowledge among the staff on ASF the lack of a close working relationship with other stakeholders minimizes their capacity in ASF control.	Recruit more staff for community outreach and provide staff training on animal production.
CDOs	3(high)	They have a close working relationship with the farmers stakeholders in the community (farmers, traders and butchers) in implementing ASF control measures.	Provide funding for adequate community outreach.
Farmers	2(moderate)	Inadequate funding and technical knowledge to implement recommended biosecurity measures.	Sensitize farmers on ASF control measures and subsidize prices of effective disinfectants.
Religious leaders	2(moderate)	There is need for facilitation to enable religious leaders reach out to the community.	Provide funding for community outreach.
Security and Judicial agencies	1(Low)	Inadequate funding to enforce quarantine.	Provide funding for quarantine enforcement.
District officials	2(moderate)	Limited human resources and funds humper the effective involvement of the district officials in ASF control.	Recruit more staff and increase supervision funds
Local leaders	2(moderate)	Limited facilitation to local leaders reduces their effectiveness in sensitizing the community on ASF control measures.	Provide funds for community outreach.
Pork Consumers	2(moderate)	In ability to accurately identify ASF sick pigs aids the spread of the disease.	Train consumers on simple animal disease diagnostics.
Researchers	3(high)	They have the funding for research and sensitization of all stakeholder groups in ASF control.	Train all stakeholder groups in disease control measures.

(Table 2), strategies were devised to deal with each of them based on their power, influence and importance. These strategies include empowerment, further consultation, continuous engagement and further involvement (Table 6).

DISCUSSION

This study identified and evaluated stakeholders' interest, capacity, roles and influence/power in relation to the implementation of biosecurity measures in the control of ASF in rural settings. The results of this study revealed that all stakeholders were either drivers or supporters of the intervention. These are vital factors in determining the success of an intervention and could smoothen the implementation and acceptance of the measures among stakeholders. The high level of supporters and drivers may reflect the direct and indirect benefits of the interventions for stakeholders. The direct beneficiaries (farmers, traders, consumers and veterinarians) either earned an income or consumed quality pork while the indirect beneficiaries (district officials, religious and local leaders, judiciary and security) were happy to see an increased level of economic stability in the society. In that respect, community members get employment and reduction in the level of crime in the long run is achieved since most youth would be engaged in pig production. Youth empowerment in agricultural sector would increase food production and household income, create stability in terms of security which leads to socio-economic development of a country. The high level of drivers with high influence in particular at the district and community levels ensures the sustainability of the intervention programs. There is a need to involve stakeholders identified as drivers with high influence at the national level since they are very instrumental in policy formulation and influence (Kanmiki and Bempah, 2017).

All the supporters, such as pork consumers, religious leaders, security and judiciary, and veterinarians are stakeholders who need to be empowered, involved further and continuously engaged (Luyet et al., 2012) so as to become drivers of the intervention (Table 2). The consumers for example should be sensitized on

Table 4. The roles of stakeholder groups in ASF control.

Stakeholder	Roles of stakeholders in ASF control
Consumers	Ensure that the pork butchers and the butcher environment have and maintain good hygiene. Promote the consumption of only disease free pork.
Pig Farmers	Ensure proper farm hygiene by; disinfecting the farm and surroundings and restricting visitors entering the farm in addition to constructing improved pig sties.
Religious Leaders	Sensitize people about ASF, and instant reporting of outbreaks to veterinarians.
Agricultural Officers	Sensitization farmers on ASF and report outbreaks to the relevant authorities.
Pig Traders	Instant reporting of outbreaks, slaughtering only on slaughter slabs, not buying of sick pigs and observing proper hygiene in farms and slaughter slabs by disinfecting.
CDO	Sensitize people about ASF, mobilize the community and NGO, link farmers to ASF technical people, coordinate all stakeholders involved in ASF control and assist in enforcing quarantine.
Security /Judiciary	Sensitization of the community and farmers on ASF control measures and enforce quarantine.
Local Leaders	Monitor, mobilize and sensitize farmers on ASF control measures.
Veterinarians	Sensitize, monitor, supervise, and create awareness among all stakeholders on ASF control measures. Regulate and enforce veterinary laws, coordinate and provide veterinary services and, initiate the institution of quarantines during ASF outbreaks in their areas of operation.
District Officials	Recommend for declaration of quarantine to MAAIF and enforcement of quarantine in the affected areas of the district. They also enact by-laws intended for ASF control, sensitize farmers on ASF control measures and oversee extension service provision to farmers.
Researchers	Sensitization of all stakeholders in ASF control in the pig production value chain. Conduct ASF surveillance and testing. Solicit for funding to carry out research on ASF.

the dangers of zoonotic disease such as tuberculosis, anthrax, ebola and helminthiasis that one can contract from consuming uninspected pork although ASF is non-zoonotic. Consumers should also be empowered to form consumer protection associations with a strong voice to ensure the sale of clean and healthy pork. The religious leaders on the other hand are influential people in the community who can change the mindset of the masses and therefore need to be empowered and involved further to continuously remind the masses on the importance of implementing biosecurity. The security and judiciary play crucial roles in the implementation of quarantines during disease outbreaks. Empowering them through formulation of policies with clear guidelines and providing financial support for activities during quarantines could greatly improve on the control of animal diseases in the community (Larry, 2004). The veterinarians believe that recruitment and posting of staff at each parish would tremendously improve on surveillance and service delivery which eventually would lead to success in disease control.

Much as all stakeholders were either drivers or supporters, most of them needed technical support in the implementation of biosecurity measures in the control of ASF. The capacity of almost all stakeholders was either low or moderate and hence needed improvement. As mentioned earlier, there is need for increased human resources to all technical stakeholders and funding for better service delivery (Table 3). Since most stakeholder groups felt that sensitization of farmers, traders and consumers (Table 4) was their responsibility, there should be efforts to standardize and coordinate dissemination messages. The local government department of production is best suited to coordinate this activity since the mandate of improving production is it responsibility. By doing this mixed and confusing messages will be eliminated. This will promote early detection of ASF and rapid implementation of biosecurity measures which to date are still the only effective means of ASF control (Gallardo et al., 2015; Dione et al., 2017). It was generally agreed therefore that involving all stakeholders in developing the guidelines for biosecurity implementation would

Table 5. Interests of stakeholder groups in ASF control in Mukono District.

Stakeholder	Interests of stakeholders in the control of ASF
Security and Judiciary Consumers	Are interested in a disease free pigs community, this creates employment, leading to decrease in crime rates in the community
	They are interested in good hygiene of the butcher and its immediate surrounding environment.
	They are also interested in the consumption of good and disease free pork.
District officials	These want to fulfill their mandate to control ASF epidemic and keep the reputation of their district.
	A good reputation will enable them lobby funds from donors for piggery projects in Mukono district.
	They want to ensure that there is diversity of livestock enterprises for Operation Wealth Creation (OWC) program for people to have improved nutrition and increased household income.
	They want the pig sector to thrive by having increased number of improved pig breeds for people to get employment opportunities
Local leaders	The local leaders are interested in increased household (HH) income among their electorates.
	They want to see their pigs multiply their animals and increase in number to; 1) provide market for pig feeds e.g. maize, 2) get organic manures and access enough pork in their area at affordable/reduced prices.
Agricultural officers	They are interested in community members getting jobs in the piggery sector.
	They want farmers to have supplementary income from pig production.
	They want increased pig manure for crops from pig farmers.
	They want increased protein supply from pig farmers to consumers.
Veterinarians	They are interested in community members getting jobs in the pig sector.
	They want HH to have increased HH income.
Pig farmers	They want communities and HH to comfortably rear pigs for them be food secure.
	Farmers aspire to increase their HH income by getting jobs from increased rearing of ASF free pigs.
	They believe that higher incomes will reduce domestic violence in their homes.
	They to be more food secure and reduce malnutrition among their household members.
CDOs	They prefer having an ASF-free community to motivate pig farmers and increase production and in turn supported government involved in livestock.
Pig traders	They benefit from having an ASF-free community since ASF outbreaks are usually accompanied by several restrictions like quarantines which affect their business negatively.
Religious Leaders	Increased HH and church income from increased piggery production
	Reduced domestic violence among the faithful in their congregation
	Reduced crime rates among the faithful in their congregation
Researchers	They want control the spread of ASF
	They want to increase the level of awareness about ASF among all stakeholder groups involved in pig production.
	They want farmers to produce and sell ASF disease free pigs.

foster ownership of such a policy and subsequent sustainability.

Since financial constraint was mentioned as a challenge, costs of effective disinfectants and other farm inputs needed for disease control need to be subsidized by government to a rate that can be easily afforded by the farmers. The high costs of animal drugs and disinfectants hamper the implementation of biosecurity as a control measure in many developing countries (Kouam and Moussala, 2018). Subsidizing farm inputs relevant to disease control as well as adherence to

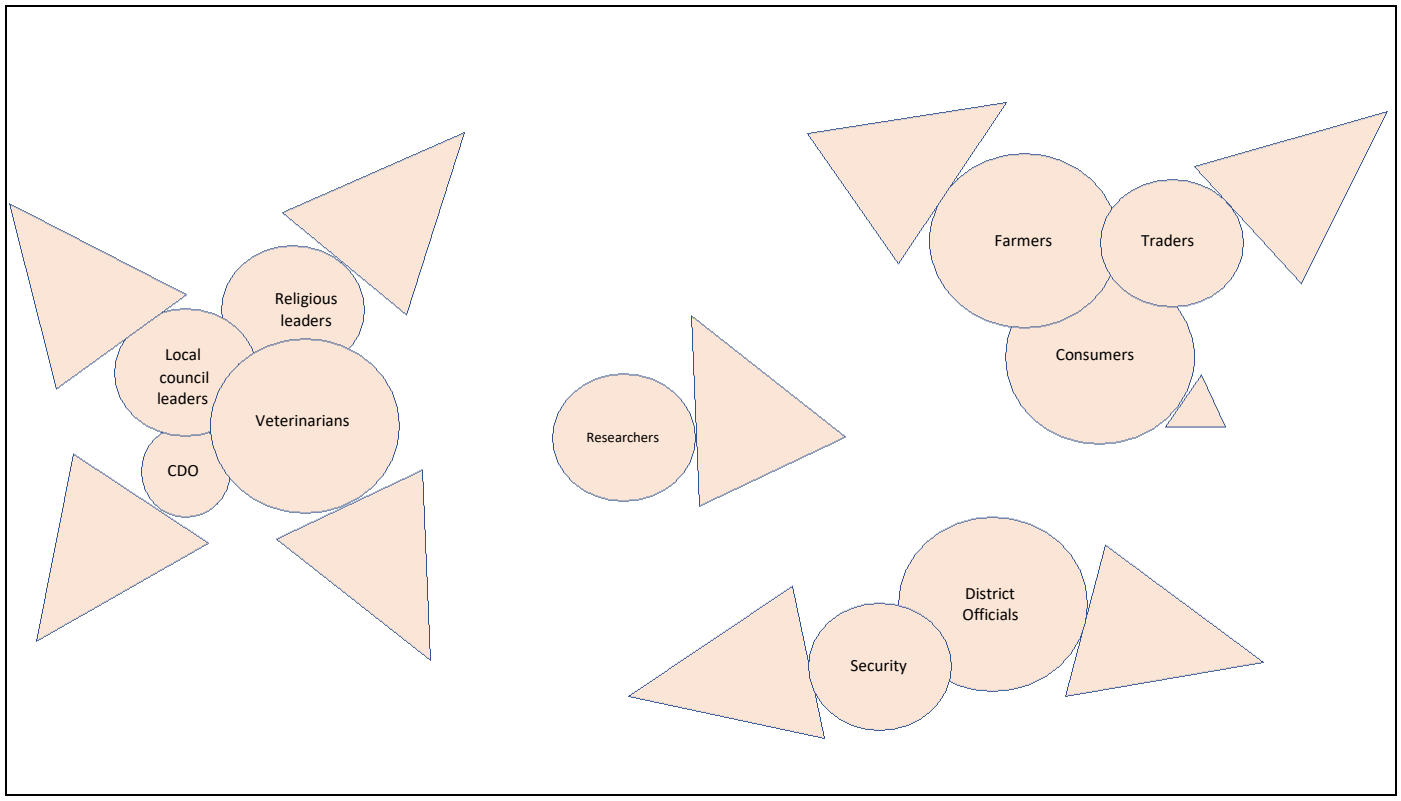

Figure *2.* Relationship, power, influence and importance of stakeholders. Circle = importance of stakeholder; Triangle = power and influence. Stakeholders whose circles are touching or closer indicate similarity in roles in the control of ASF in Mukono Dis trict

Table 6. Strategies to deal with each stakeholder groups.

Stakeholder	Justification/criteria		Strategy to deal with stakeholder
	Power and influence	Importance	
Agricultural officer	Low	Moderate	Provide animal production training and continuously engage
Traders	High	Moderate	Consult further and continuously engage
Consumers	Low	High	Empower
Veterinarians	High	High	Involve further and continuously engage
CDOs	High	Low	Consult further and involve further
Security and Judiciary	High	Moderate	Consult further and continuously engage
Local Council leaders	High	Moderate	Consult further and continuously engage
Researchers	High	Moderate	Consult further and continuously engage
District leaders	High	High	Involve further and continuously engage
Farmers	High	High	Involve further and continuously engage
Religious leaders	High	Moderate	Consult further and continuously engage

practices reporting ASF outbreaks, sale of only disease free pork and many other practices that do not require any drugs would play a great role in controlling the spread of ASF.

From this study, it was also revealed that funding of the other stakeholder groups was required to enable them play their roles effectively. Provision of funding to religious leaders, district, and local council, and security and judiciary, veterinarians, agricultural officers and CDO would greatly improve on community outreach services leading to improvement on the implementation of control measures. In the same way, increasing the human resource for the veterinarians, CDOs and agricultural officers would improve on the technical support provision to farmers while to the district, security and judiciary it would improve on supervision and monitoring of service providers to the farmers.

The farmers in the stakeholder analysis meeting felt that

it would be proper to involve all stakeholder groups in designing the guidelines of implementing biosecurity measures. This concern arose since farmers in particular thought that their experience in ASF outbreak management at the farm need to be amalgamated with that of the technocrats so as to develop a binding working document for ASF control at farm and butcher levels. Indeed, during the discussions, farmers pointed out some control measures such as each farmer having their own drugs, syringes and needles that the veterinarian can use while treating pigs on a particular farm to avoid transmission of infections from other farms. Secondly, farmers also suggested that the manure from pig sties should be disinfected before use in the crop fields since that could be a potential source of disease spread.

Success in implementing biosecurity measures as a means of ASF control in the rural setting, requires a number of changes in management and animal husbandry practices to be done at the farms, slaughter slabs and butchers. These include: The farmers should be encouraged to desist from free ranging system of management and embrace the use of raised housing or double fencing to reduce contact between their pigs and roaming pigs. Secondly, traders and butchers should be told to stop buying and slaughtering ASF sick pigs. Thirdly, all the slaughter slabs should be fenced to prevent stray dogs, cats, free ranging pigs and birds from accessing swill which can be carried to pig farms and transmit disease. Interestingly, during the meeting participants did come up with some vital and creative ASF control measures. Such measures included:

1) Encouraging individual farmers to have their own injection syringes and needles for treating pigs in their own farms since those of the veterinarians may transmit diseases if not properly disinfected because they (veterinarians) treat pigs in many farms.
2) Farmers were also encouraged to obtain both feeds and water from safe sources (ASF free sources) because many times ASF is spread to unsuspecting farms through African swine fever virus (ASFv) contaminated feeds.
3) Each pig farmer was encouraged to have their own breeding boar where possible or used artificial insemination instead of borrowing a boar from another farmer or using a community boar (where people take their sows to a boar that stationed in one of the farms for servicing). The use of a community boar and boar borrowing aid the spread of ASF among farms.
4) The movement of pig farm wastes especially from pig sties was discouraged since it could spread ASF among farms once one of the farms in infected with ASFv.

The results of this stakeholder analysis show that there is need to sensitize and mobilize the community before the implementation of biosecurity measures for any animal disease control or intervention to succeed. There is also need to consult the stakeholders in the pig value chain during the development of the biosecurity implementation guidelines to promote support and agreement to the intervention. Lastly, it is crucial to promote a good working relationship and understanding among all the stakeholders for the success of the intervention (Auvinen, 2003).

Methodological considerations

We were not able to interview some categories of stakeholder groups who could have had an influence in the intervention, these include: pig feed manufactures, pork processers, law makers and MAAIF officials despite our endeavor to do so. The study was done in only one district and yet the situation in other districts may be varying.

Conclusion

This stakeholder analysis has revealed that all key stakeholders in the pig value chain in a rural area in Uganda were either drivers or supporters of the implementation of biosecurity measures in the ASF control; although, there was need for financial and technical support to key stakeholders for the intervention to be implemented and enforced. These results show that there is great support for enforcement of biosecurity measures if stakeholders are facilitated with financial and technical support thereby limiting outbreaks of ASF in rural areas of Uganda.

Recommendation

There is need for adequate funding for community outreach to facilitate sensitization activities especially to the veterinarians, CDOs and district officials.

ETHICS

Permission to carry out the study was granted by the Ugandan National Council for Science and Technology under the reference number A497. Consent from the District veterinary officer was obtained prior to the start of interviews in Mukono District. All participants were informed that the study was voluntary, confidential, and that they had the choice of ending their participation at any time of the interview. An informed consent was given by all participants prior to the implementation of the study.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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