Participatory control of Newcastle disease in village poultry using thermostable ND vaccines in Uganda

[RUFORUM (Call ID RU/CGS/GRG/15/11/09)]

Abstract: This study proposes to undertake participatory/action research to understand the challenges and limitations that constrain effective Newcastle disease (ND) control among village rural poultry in Uganda. Village poultry is one of those abundant assets for the rural poor in Uganda that could be utilized to eradicate poverty in the country addressing the needs of the underprivileged in society especially women and children. ND has been identified as the principal disease limiting rural poultry production in low-income food-deficit countries (LIFDCs). The disease kills up to 70-100% of household poultry and therefore is of major economic importance constraining village free-range poultry production. It causes heavy losses estimated between US$ 62 million and US$ 78 million per annum in Uganda. The available vaccines in the country are not suitable for the free-range village production system because of big doses and require cold chain. Novel genotypes of Newcastle disease virus (NDV) strains have also been reported in Uganda recently which may result in vaccination failures. Although studies have demonstrated immense benefits that accrue from vaccination, there has not been a successful vaccination programme for decades in Uganda because of lack of suitable vaccines and lack of understanding of the challenges and therefore the opportunities for a successful vaccination strategy for the free-range poultry production system. The proposed study would like to look at the limitations and challenges that are currently constraining village free-range poultry and work closely with farmers to identify opportunities through participatory approaches that will enable possible solutions to effectively control the disease. The proposed work will engage communities to strengthen innovative capacity and knowledge generation for ND control which is one key RUFORUM's thematic areas. The proposed work will also compliment a bigger project that is developing potential thermostable ND vaccines from local strains by the same team.

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1.0 Introduction

1.1 Background and the Problem

Most nations including Uganda are struggling to improve the livelihoods of their population under strategic development targets. According to the World Bank, countries that have been most successful in tackling poverty have encouraged a pattern of growth that provides opportunities that make efficient use for the most abundant assets of the poor and enabled them to increase their capacity to take advantage of the available possibilities (World Bank, 1990). Village poultry is one of those abundant assets for the rural poor in Uganda that could be utilized to eradicate poverty in the country. However, the village poultry production in Uganda is still faced by a multitude of problems. One of the major constraints is the existence of various diseases and the inability of the poultry owners to control them (Ojok, 1993). Newcastle disease (ND) has been identified as the principal disease limiting rural poultry production in low-income food-deficit countries (LIFDCs) (Spradbrow, 1992). The disease may kill up to 70-100% of household poultry and therefore is of major economic importance (Mukiibi, 1992) Epidemiological factors such as uncontrolled contacts in the villages between birds from different households as well as frequent introduction of birds from markets, gifts or other purchases in the free-range poultry management systems favor existence and spread of Newcastle disease virus (NDV) (Yongolo *et al.,* 2002).

Although vaccination offers the best control strategy for ND, conventional vaccines are unsuitable for sustained use in village poultry production because of their cost, large dose preparations, thermolability and cold chain requirements (Spradbrow,1992). Thermostable vaccines, such as V-4 and I-2, are not yet available in Uganda and only limited immunological tests on the I-2 have been done and the challenges for successful and sustainable vaccination strategies were never investigated. Vaccination failures have also been reported in some countries due to differences in the vaccines used and the circulating virulent NDV (Seal *et al*.,2005). A novel genotype of NDV that does not cluster with any strains in the world, not even in the East Africa region and may also result in vaccine failures has also been reported in Uganda (Otim *et al.,* 2004) although cross-protection of ND vaccines is well known.

Little success has been attained in Uganda to contain this disease and the population continues incur losses ranging between US$ 62 million and US$ 78 million per annum. Besides these technical problems mentioned above, there are also socio-economic issues that have not been well investigated that limit successful and sustainable vaccination programmes. The knowledge, attitudes and practices of the communities with regard to ND vaccination has not been extensively studied and this seriously limits successful and sustainable vaccination programmes of free-range poultry which form 80% of the national flock.

1.2 Objectives

The purpose of this study is to identify opportunities for successful and sustainable ND vaccination strategies among communities for the free-range poultry production system in Uganda.

Specific objectives

- Investigate the current knowledge, attitudes and practices of the stakeholders and communities that may limit or enhance successful and sustainable implementation of ND vaccination programme for smallholder village free-range poultry.
- Establish the current challenges and limitations that constrain effective control of the disease.
- Establish the level of protection and impact that can be attained with live thermostable vaccines
- Identify lessons and best practices and opportunities that can be used for instituting a successful and sustainable ND vaccination programme for smallholder village free-range poultry production in village communities

1.4 Justification of the study and Associated Projects

The Agricultural Sector Development Strategy and Implementation Plan (DSIP) of the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) which is part of the Uganda National Development Plan (NDP) has included poultry as a good opportunity to get the rural poor out of poverty (MAAIF, 2009). Indeed the Government of Uganda (GoU) also realized the limitation of Newcastle disease to poultry production and provided funds in its 2009/2010 national budget for procurement of NCD vaccines (MFPED, 2009). Vaccination is the best tool for controlling this disease in poultry. Uganda Industrial Research Institute (UIRI) is also in the process of starting commercial thermostable vaccine production in the country which will address the problems of lack of availability in-country of thermostable vaccines. Our group has also recently received funding under the Millenium Science Initiative (MSI) to develop thermostable ND vaccines and avail seed vaccine stocks to industrial producers and testing for cross protection against the novel genotypes of the NDV recently reported in the country but none of the above is looking at successful uptake pathways and utilization of the vaccines. There are no studies aimed at understanding the farmers' knowledge, attitudes, and practices which largely determine the ultimate use and control of the disease by the primary end-user, the poultry farmer, deep in the village. Neither have their been studies to understand the major challenges and limitations for implementing a successful and sustainable community ND vaccination programme or identify potential opportunities available in the communities. This study therefore proposes to undertake a participatory/action research to understand the knowledge, attitudes and practices of the communities and together identify challenges and limitations that limit effective control of the disease. This is very critical for identifying the opportunities for sustainable control of ND in the communities. The student research projects will therefore help identify the best uptake pathways for the various vaccines that are being developed and produced by the other associated projects. This will ensure that the developed or produced vaccines will be effectively used to control the disease by the communities. The proposal addresses three of RUFORUM's thematic areas: (a) engaging communities to strengthen innovation capacity and knowledge generation; (b) increasing productivity and enhancing sustainable natural resource (poultry) use and management and (c) technology uptake pathways, farmer commodity value chains and markets.

1.5 Research questions.

- What is the current knowledge, attitudes and practices of the stakeholders and communities that may limit or enhance successful and sustainable implementation of a ND vaccination programme for smallholder village free-range poultry?
- What are the current challenges and limitations that constrain effective control of the disease in smallholder village free-range poultry production in local communities?
- What are the opportunities available for successful and sustainable implementation of a ND vaccination programme for smallholder village free-range poultry?
- What level of protection and impact can be attained with thermostable vaccination programme?
- What lessons and best practices can be learned from a community participatory ND vaccination approach for smallholder village free-range poultry production in village communities?

2.0 Literature Review

Newcastle disease is a highly contagious disease affecting chickens and other poultry species and wild birds. It often devastates unvaccinated flocks in periodic outbreaks. It usually results in 70-100% mortalities, which is a huge loss to the households. It is caused by RNA viruses of the Avian Paramyxovirus serotype 1 (APMV-1), (synonym: Newcastle disease viruses). The virulent forms of the viruses, which exhibit an intracerebral pathogenicity index (ICPI) of $\geq$0.7, are the cause of ND. These viruses have been grouped by virulence phenotype, with lentogenic, mesogenic, and velogenic strains reflecting increasing levels of virulence. Velogens, the most virulent viruses, are those that may cause extensive hemorrhagic lesions, particularly in the gastrointestinal tract (viscerotropic), and/or a predominance of nervous signs (neurotropic). The lentogenic strains are common among domestic poultry and wild bird populations (Alexander, 2003).

NDV have historically been grouped into either genotypes or genetic lineages. Recent analysis of the genome sizes and sequences of the F and L genes has revealed two distinct clades within APMV-1: classes I and II (Seal *et al*., 2005). The class II viruses comprise the vast majority of sequenced NDV and include isolates recovered from poultry (gallinaceous birds) and from pet and wild birds. The class II NDV are further categorized into genotypes I to IX, with the genomic sequences of commonly used vaccine strains resembling velogenic NDV isolated during the 1940s (class II, genotype II). Different pathotypes are characterized by differences in the amino acid sequences surrounding the F_0 cleavage site, which hosts the molecular marker for virulence (Millar *et al.*, 1988).

Phylogenetic studies of both the F protein and the HN protein genes of NDV have been used for molecular epidemiologic analysis and characterization of NDV and to group NDV into specific lineages (Ke *et al*., 2001). Restriction enzyme site mapping of the F protein gene and sequence analysis have also been used to classify NDV isolates into seven genotypes and was the basis for identification of a novel genotype of NDV isolates from Uganda (Otim *et al*., 2004).

The natural ecology of NDV is not fully understood, and research has focused mainly on tracing either the origin of specific viruses or the spread of virulent viruses during ND outbreaks in poultry (Perdersen *et al.*, 2004). Suggestions that waterfowl provide a natural reservoir for NDV hav been made and epidemiological links between

outbreak isolates recovered from poultry and those isolates found in wild bird populations have been hypothesized (Jorgensen *et al.,* 2004). The pathogenesis and epidemiology of ND has been reviewed (Alexander, 2003). ND in village chickens is attributed to birds that are shedding virus during and after incubation or post vaccination (Spradrow, 2001). It has been suggested that outbreaks that occur in the dry season are not because the virus survives better under these conditions but because villagers have more time and move around quite a lot with chickens in markets and to friends carrying the virus with them. The major source of infection of ND is the introduction of new birds to a flock. Markets also serve as a common source of Newcastle disease infection, sometimes through the random sale of infected birds during outbreaks to salvage those not yet showing clinical signs (Otim *et al*., 2007).

The control of ND is mainly through vaccination and biosecurity. Conventional methods for controlling ND are based on live vaccine delivered by the intranasal, intra-ocular or intra-muscular routes. Live vaccines have traditionally been heat-sensitive and require storage at or below 4°C. Complete and effective cold chains are expensive and difficult to maintain and extensively raised birds are difficult to catch, hence making vaccination labour intensive (Spradbrow, 1992).

Two heat resistant vaccine strains have been developed, known as V-4 and I-2, and their potential advantages for use in village production systems have been underscored. Thermostable ND vaccines exhibit a relative resistance to inactivation on exposure to elevated temperatures. They are prepared from a strain of NDV that retains its ability to infect cells after storage outside a cold chain for a short period of time and involves isolation of naturally occurring thermostable variants of the virus and increasing the thermostability of this variant by artificial selection in the laboratory (Spradbrow, 1992).

The heat resistant V4 (NDV4-HR) vaccine against ND has yielded encouraging results in many countries in Africa and Southeast Asia (Alders and Spradbrow, 1992). NDV4-HR vaccine is a living vaccine which is thermostable, retaining its activity for 12 weeks at a temperature of 28°C in freeze-dried form (Spradbrow, 1992). Its ease of administration makes it suitable for use by village farmers and the vaccine strain can be transmitted by contact from vaccinated to non-vaccinated birds. Although this vaccine has been commercialized, it is only available in large doses that the smallholder farmer cannot afford. The I-2 strain, which has been tested in a number of countries has also proved to be protective against local virulent strains of the ND virus (Tu *et al*., 1998).

It is generally recognized that vaccination against ND would greatly reduce the losses that accrue from ND outbreaks and the benefits of vaccination outweigh the costs. Recent assessment of the effect of vaccination in village poultry in Uganda, showed a flock size increase significantly higher than unvaccinated flocks (Nahamya *et al*., 2006). Understanding the knowledge, attitudes, and practices as well as involving farmers in solving their problems is critical in successful implementation of programmes in the communities, an aspect that has many times been ignored in purely biomedical research.

This study proposes to use participatory research methodologies to establish the background for successfully implementation of a sustainable ND vaccination programme. Participatory research, also known as action research, collaborative inquiry, emancipatory research, action learning, and contextural action research, is “learning by doing” - a group

of people identify a problem, do something to resolve it, see how successful their efforts are, and if not satisfied, try again. (Brien, 2001).

What separates this type of research from general professional practices, consulting, or daily problem-solving is the emphasis on scientific study, where the researcher studies the problem systematically and ensures the intervention is informed by theoretical considerations. Much of the researcher's time is spent on refining the methodological tools to suit the exigencies of the situation, and on collecting, analyzing, and presenting data on an ongoing, cyclical basis. The factors that affect adoption of new technologies are categorized as farm-level or village level. The farm house-hold factors associated with adoption include age, education, personal charctaristics of the hosue-hold head, size, location and tenure status of the farm and also availability of cash or credit and access to markets. At the village level, there are higher-order factors affecting successful adoption of technologies. Social actors like the village leaders, farmers, researchers, aid official, extension workers, loac politicians and traders , each persue their own short and long- term objectives and strategies which will influence the success of technology uptake. Coalition of the actors, such as formation of poultry farmers' associations, enables them to address the problem and focus resources and ideas and energy. Some critical external factors, such as market fluctuations, other disease events, which may influence adoption of technologies need to be identified and addressed. The role of the diverse social actors, the coalitions they form and conditioning their success will influence the social dimension of technical change. (Cramb, 2000).

3.0 Research Approach and Conceptual Framework:

This study is premised on the concept that there are many stakeholders that play various roles in a successful and sustainable ND vaccination programme including the primary beneficiaries (the poultry farmers), the service providers (including vaccine manufacturers, extension agents, vaccinators, vaccine suppliers) and local community based organizations, non-governmental organizations as well as national and local authorities and policy makers. The approach therefore is to understand each of these stakeholder's knowledge, attitudes/perceptions, and practices about vaccinating free-range poultry and try to understand the challenges and limitations each of them meets in fulfilling their roles and ultimately identify opportunities to harness the potential role of each stakeholder to contribute to a successful vaccination campaign. The conceptual framework of accomplishing this study is based on participatory/action research approach (illustrated in Fig. 1) which involves diagnosing the problem, action planning, taking action, making an evaluation of the actions and impacts, and reflecting on the lessons and best practices learnt for further feedback into more improvements.

This study has two components each of which will be undertaken by one student namely:

- (a) socioeconomics study to understand the current knowledge, attitudes and practices of the communities that may limit or enhance successful and sustainable implementation of a ND vaccination programme for smallholder village free-range poultry, identifying the challenges and limitations that constrain effective control of the disease and documenting the lessons and best practices learnt in the process of implementing a participatory vaccination

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- (b) vaccination study working with communities to vaccinate and then evaluating both the immunological protective responses and the impact on the poultry production dynamics.

Throughout the process, the study shall create a process that maximizes the opportunities for involvement of all participants and maintain an open communication among the stakeholders and communities involved by making sure that the relevant persons, communities and authorities are consulted at all stages of the research, and that the principles guiding the work are accepted in advance by all. In addition all participants will be allowed to influence the work, and the wishes of those who do not wish to participate will be respected. The development of the work will remain visible and open to suggestions from others, and the direction of the research and the probable outcomes will be collective.

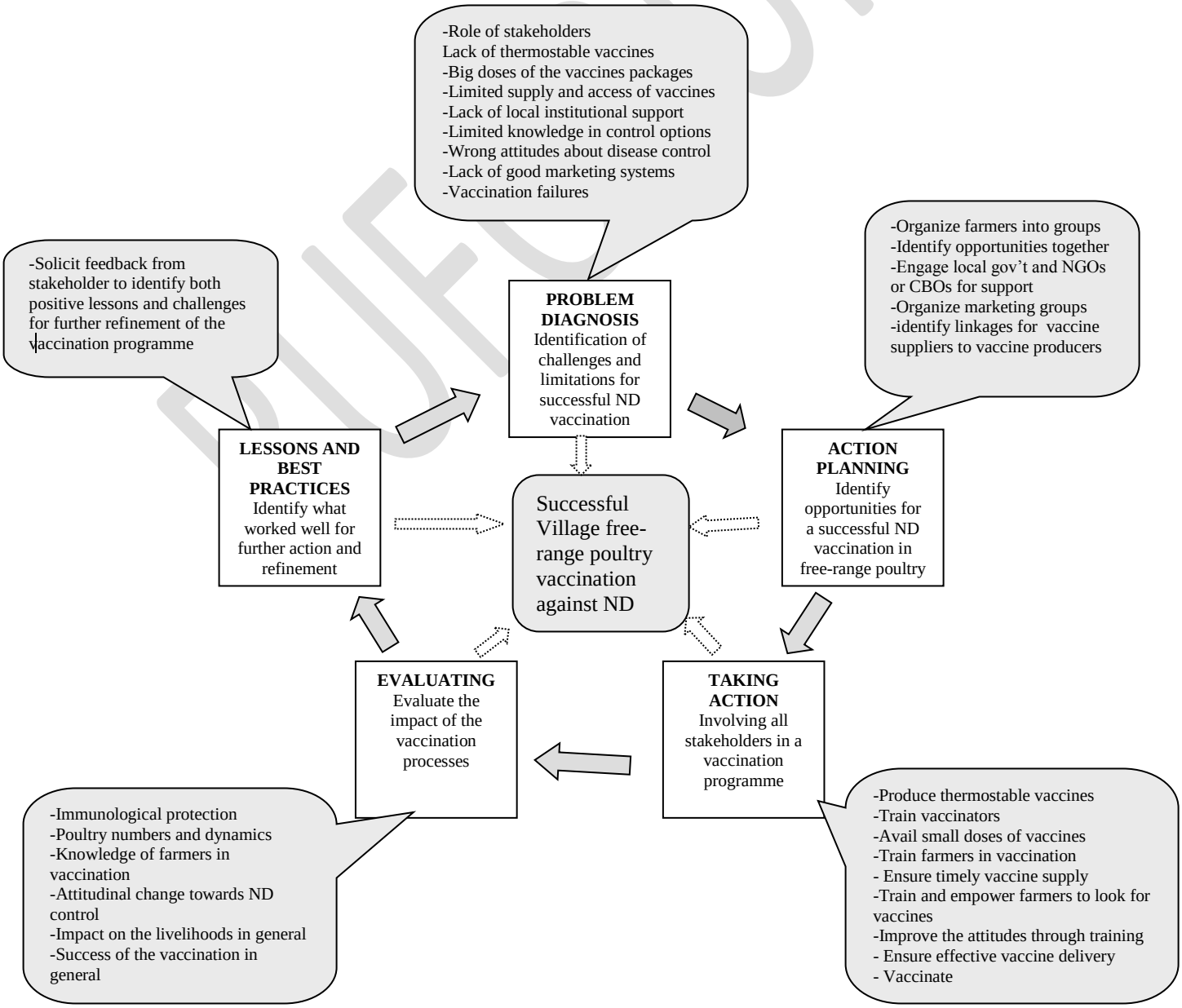

Fig 1: Conceptual Framework for the study

4.0 Methodology

4.1 Study design: An action research methodology will be employed in this study embracing the principles of participation and reflection as well as empowerment and emancipation of people and groups with regard to arriving at strategies for a successful and sustainable vaccination programme for ND of free-range village poultry in the communities. The study will involve all stakeholder and actors in Newcastle disease control. The study will involve qualitative, quantitative and experimental data collection methodologies to address the research problem. Qualitative methods will be used to understand the challenges and limitations that constrain effective Newcastle disease (ND) control among village rural poultry in Uganda. A KAP study component will be used to establish the basic information of current knowledge, attitudes and practices that will also identify the current challenges and limitations that constrain successful vaccination programmes. The process will lead to participatory identification of opportunities for successful and sustainable control strategies of the disease. Quantitative methods will be used to collect poultry production data both before and after vaccination to evaluate the impact of vaccination. Experimental methods will be used to produce the thermostable vaccines as well as evaluation of the immunological protection of the vaccinated poultry. The study will start with a stakeholder analysis to identify all the stakeholders and their roles in a successful vaccination programme for ND in village communities.

4.2 Selection of study sites: The study will be carried out within the communities in the Eastern part of Uganda (Iganga district) where there is the highest density of smallholder free-range poultry in the country. In this area they have also had serious challenges of ND just like other areas and the novel genotype of the NDV was also isolated in this region. They are also known not to practice ND vaccination in the free-range poultry. The entry point to the communities will be through the local district leadership with whom the project will be discussed and their assistance and support will be sought in the entire implementation process.

4.3 Baseline survey: An exploratory cross-sectional survey using descriptive and analytical approaches by qualitative and qualitative methods of data collection and analysis will be done to collect baseline information. In this survey, the current knowledge, attitudes and practices of the communities that may limit or enhance successful and sustainable implementation of a ND vaccination programme for smallholder village free-range poultry will be explored. In addition, the current challenges and limitations that constrain effective control of the disease in smallholder village free-range poultry production in local communities will also be studied. At the same time data will be collected about the current availability and access to vaccines, and the options available for ND control in the communities and the potential opportunities for successful and sustainable ND vaccination in free-range poultry. Determination of pre-vaccination HI titres among the poultry population will also be undertaken

Survey sample Size

The cross-sectional survey will target 400 respondents from the selected district in Eastern Uganda (Iganga district). The sample size is derived from the formula

$n=Z^2pq/e^2$

where

z - is the test statistic at a 95% confidence interval,
p - is the proportion of variable of interest in the study population,
q - is 1-p
e - is the acceptable error (of 5%) we are willing to commit

Since there is varied knowledge about problems associated with ND disease, we use the 50% level to maximize the above expression at 95% confidence interval, thus;

$p = 0.5, q = 0.5 , z = 1.96, e = 0.05$

By substitution in the formula; $n= (1.96^2 \times 0.5 \times 0.5)/0.05^2 =384$

We shall therefore take an approximate sample of 400 persons. To select the households to participate in the survey, a multi-stage cluster sampling approach will be used. The total sample size will be representative of the district. The main sampling is the district and sub counties. There will be two (2) sub counties, 2 parishes, and 2 villages selected randomly in the district. In each village, about 50 interviews will be completed, yielding 400 interviews. The households in each village will be randomly selected using systematic sampling. In every selected village, a list of eligible households will be generated. The list will be generated following a screening of households for poultry farming. The total number of households divided by 70 (target number of interviews required per village) will give the sampling interval. A village map will be drawn demarcating the boundaries. After determining the sampling interval, the right hand corner of the village will be considered as the starting point. Therefore the first household in the right had side corner will be taken as household number 1.

The qualitative part will be conducted using participatory rapid appraisal methods such as focus group discussions (FGDs), and key informant interviews (KIs). Focus group discussions of about 8-12 homogeneously composed participants will be convened and guided along key issues surrounding the challenges and opportunities for having a successful ND vaccination for free-range poultry. The FGDs will target the community (men alone, women alone and children alone) to determine the key opportunities that can lead to a successful vaccination. The gender dynamics are very crucial for a successful vaccination given that village chickens are taken care of mainly by women and children, therefore the opinions of men, women and children will be gathered. The FGDs will be facilitated by a moderator and a note taker. All discussions will be tape-recorded and will last about 2 hours.

In depth interviews with service providers, national veterinary services, community based organisation working in the communities, local leaders, agricultural extension staff, and local government leaders will be conducted. Knowledgeable informants of selected farmers who have experience with village free-range poultry vaccination will also be interviewed. The interview will seek information about the best ways to undertake a successful DN vaccination and what are the key limitations.

Questions exploring people's perceptions about free-range vaccination against ND will also be explored.

A questionnaire will be administered to selected individuals in the community to find out further information in the challenges and limitations of ND vaccination as well as potential opportunities for successful vaccination. It will also be used to gather baseline information about poultry production parameters and dynamics prior to vaccination. At the same time, baseline antibody titres in the poultry population will be assessed collecting serum to establish the pre-vaccination sero-status using the Haemagglutination Inhibition (HI) tests as described by Allan and Gough (1974). The production data and sero-status of the poultry will be undertaken once a year to determine if the vaccination induced protection and impact of vaccination.

4.4 Vaccination: In order to establish the level of protection and impact that can be attained with thermostable vaccination programme, the 1-2 thermostable vaccine will be produced in the Faculty of Veterinary Medicine Virology Laboratories in embryonated eggs and packaged in small 50 – 100 doses ready for delivery to farmers according to standard procedures (Alders and Spradbrow, 2001). The seed vaccine will be obtained from the International Rural Poultry Centre of the Kyeema Foundation (www.kyeemafoundation.org) through Dr. Robyn Alders and Professor P.B Spradbrow of Kyeema Foundation. Alternatively, possibilities for importing the thermostable vaccines for use in this study will be explored and the easier alternative.

Working with local authorities in Iganga district, three independent villages not involved in any previous vaccination against ND and who will have participated in the baseline survey will be selected for the ND study. We shall work with the three village communities independently to identify the best vaccination strategies and implement them together in two of he villages. One village will be provided with the thermostable vaccine, while the other will be provided with the commercial Lasota vaccine. In the third village, no vaccination will be done and will act as the control group. The two villages that will undertake vaccination will each decide on the best strategies to vaccinate their birds. Technical training will be provided where appropriate to empower the communities in doing the vaccination. Vaccinators will be trained to vaccinate birds with standard doses by eye drop with 0.1 ml of each strain containing at least 1×10^6 50% egg infectious doses [EID_{50}]. Baseline poultry numbers and pre-vaccination HI antibodies against NDV will be taken as explained above from each village. Blood samples will be collected every three months by the student to determine the antibody levels. Communities will be empowered to collect poultry data for a period of 24 months for poultry population dynamics data. Every three months, follow up meetings will be conducted and more information in changes in knowledge, attitudes and practices collected through qualitative methods and this will also be meant to provide feedback and further consultations to inform the process. Communities will also be linked to service providers for supply of other requirements and other technical advice.

4.5 Data handling and analysis

Qualitative data will be summarized ethnographically and categorized according to the main themes identified. Key phrases will be quoted verbatim to reflect participant's

views, beliefs and perceptions about factors that vaccination of village poultry. Ket challenges and opportunities will also be discussed.

Quantitative data will be entered and analyzed using EPI – INFO. Frequencies and tables will be used to analyse different factors affecting vaccination challenges and opportunities. Appropriate statistical analyses will be done depending on the tpe of variables to draw inferences about the data.

The antibody titre data will be recorded as reciprocals of the highest dilution that cause haemagglutination inhibition, which will then be logarithmically transformed, by $\log_2$ and all the analyses done on the transformed data. The HI titre ($\log_2$) for each group will be calculated as geometric mean titres (GMT). A general linear model (GLM) procedure will be used for analysis of variance between the various households and antibody titres generated. Protection cut-offs will be taken as HI titre $\log_2$ of 4. Differences in the production parameters following vaccination will be analyzed by one-way analysis of variance (ANOVA). Graphical presentation of the data will be made using Microsoft Excel for Windows 2007. An alpha level of 0.05 will be used in all the statistical analyses for testing significant differences.

Graduate student Research

Student 1: A student will be recruited on the programme to undertake the socioeconomics component of the study. This student will develop a proposal and study instruments to address the following objectives of the study:

1. Investigate the current knowledge, attitudes and practices of the stakeholders and communities as well as socioeconomic issues that may limit or enhance successful and sustainable implementation of a ND vaccination programme for smallholder village free-range poultry.
2. Establish the current challenges and limitations that constrain effective control of the disease in smallholder village free-range poultry production in local communities
3. Identify lessons and best practices that can be used for instituting a successful and sustainable ND vaccination programme for smallholder village free-range poultry production in village communities

Student 2: The second student will undertake experimental studies to evaluate the immunological protection of the vaccine in the community that will answer the following objectives:

1. Establish the protection levels induced by the vaccination
2. Estimate the impact of vaccination on the production dynamics following vaccination with the thermostable vaccine.

5.0 Dissemination and Communication

The results, lessons learnt and best practices from the study will be disseminated and communicated and packaged appropriately for different stakeholder including the following:

- Presentations at workshops
- Publication in journals for the scientific community. Each student is expected to generate two publications in peer reviewed journals (total of 4 from the study)
- Policy briefs to policy makers as well as national and local authorities
- Pamphlets and training materials for the farmers and NGOs/CBOs.

6.0 Project management

A logical framework (appendix 1) for the project has been developed for ease of monitoring and evaluation of the project against the set targets and milestones. The PI will be in charge of the overall project management assisted by the other research team members and periodic meeting at least on monthly basis will be held to review progress and the minutes of these meetings will be made available for monitoring progress. On quarterly basis these meetings will include the students. The research team will be responsible for student recruitment and their mentoring throughout their study. There will be monitoring and evaluation at several levels. The student progress will be monitored through quarterly reports that they will be required to submit to their supervisors and the PI. In addition several indicators have been set in the logframe and will be used to monitor the progress of the project. At the filed level there will be the monitoring and evaluation for seroconversion through HI antibodies and protection against natural challenge in the field in addition of monitoring of the numbers in poultry as a result of vaccination by comparing villages where no vaccination has been done, villages vaccinated with commercial vaccines and villages where vaccination has been done with the selected strains. Half yearly report will be submitted to RUFORUM reporting the progress of the study with challenges met and the steps to overcome them. Participatory monitoring and evaluation with the communities will be done quarterly against agreed targets with the communities by all stakeholders.

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8.0 Expected Outputs

1. Opportunities for ND control in free-range poultry through vaccination established
2. Two persons trained manpower at Master Level
3. Community vaccinators trained in ND vaccination
4. At least 4 articles published in peer-reviewed journals from the study

9.0 Expected Outcomes

1. Control of Newcastle disease especially for the remote areas that cannot afford cold chains established
2. Improvement of incomes and livelihoods of the poor people

11.0 Brief CVs of the PIs.

12.0 Budget Estimates

ITEM/ ACTIVITY	Year 1	Year 2	Total
A) Graduate Students			
1) Tuition and registration fees	3,200	3,200	6,400
2) Stipend ($200 per student per month)	4,800	4,800	9,600
3) Supervision ($1200 per year per student)	2,400	2,400	4,800
4) Thesis writing and publication	-	700	700
5) Book allowance	200	-	200
6) Medical allowance	150	150	300
SUB-TOTAL	**10,750**	**11,250**	**22,000**
B) Research costs (include travel and other related research costs)			
1) Lab consumable supplies	7,000	3,000	10,000
6) Vaccines	1,500	1,500	3,000
7) Vehicle hire and fuel for field work	2,500	2,700	5,200
8) Subsistence allowances	1,500	2,400	3,900
SUB-TOTAL	**12,500**	**9,600**	**22,100**
C) Travel and Conferences			
1) Travel (Local and International costs for RUFORUM conferences)	-	4,000	4,000
SUB-TOTAL	**0**	**4,000**	**4,000**
D) Coordination			
1) Collaborators (Total $200 per month)	1,200	1,200	2,400
2) Coordination costs (coordination fee at $ 150 per month)	1,800	1,800	
3) Incentive for graduating students within 30 months ($1000 per student)	-	-	3,600 -
4) Contribution to national forums	500	-	500
SUB-TOTAL	**3,500**	**3,000**	**6,500**
E) Other costs (Dissemination and communication)	1,000	1,500	2,500
SUB-TOTAL	**1,000**	**1,500**	**2,500**
TOTAL	**27,750**	**29,350**	**57,100**
ADMINSTRATIVE COSTS (Maximum 5%)	1,388	1,468	2,855
GRAND TOTAL	**29,138**	**30,818**	**59,955**

Budget Notes: To train graduate students under this project, funds have been requested for stipend and tuition to support the training of two Master students for 2 years each at the recommended university tuition fees and stipend. Minor equipment to supplement what is available and handle increased volume of work has been requested. Funds for lab consumables such as like pipette tips, serological pipettes, disposal/waste bags, cryovials, microtitre plates, centrifuge tubes, microcentrifuge tubes, reagent bottles, beakers, conical flasks,, disinfectants, buffers and general reagents, embryonated eggs, gloves, waste bins, cryoboxes, cryoracks, test tube racks, viral medium, antibiotics and anti-fungals. Travel funds are requested for vaccine delivery and filed data collection as well as sample collection. Funds have also been requested for coordination and dissemination and feedback of findings t stakeholders.

13.0 Work plan

	Year1				Year 2			
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Study design and consultations								
Procurement of materials								
Student recruitment and regsistration								
Students undertake coursework								
Baseline survey								
Vaccination and follow up								
Data entry and analysis								
Feedback workshops and consultations								
Attend workshops and conferences								
Theses writing								
Report writing								
Publications								

Appendix 1: LOGICAL FRAMEWORK

Narrative Summary	Verifiable indicators	Means of Verification	Critical Assumptions
Goal To successfully and sustainably control ND in free-range poultry production system in Uganda.	Increased free-range poultry production	❖ National and district reports	• Government and stakeholders remain committed to providing ND vaccines • Peace and stability exists
Purpose To identify opportunities for successful and sustainable ND vaccination strategies among communities for the free-range poultry production system in Uganda.	Decrease prevalence of ND to less than 10% in vaccinated villages	❖ Study report	❖ Willingness of stakeholders to play their roles and take advantage of the opportunities
Outputs 1. Current knowledge, attitudes and practices of the various stakeholders and communities as well socioeconomic issues that may limit or enhance successful and sustainable implementation of a ND vaccination programme for smallholder village free-range poultry established 2. Current challenges and limitations that constrain effective vaccination in free-range poultry established 3. Protection levels and impact attained with thermostable vaccination programme known 4. Lessons learnt, best practices and opportunities established	1. KAP study data 2. Data on challenges and limitations 3. Protection and poultry dynamics data 4. Data on lesson learnt, best practices and opportunities	❖ Study report ❖ Publications ❖ Training materials ❖ Workshop proceedings and presentations ❖ Student theses ❖ Final study report	
Activities 1 Design study instruments and consultations 2 Feedback workshops and routine consultation 3 Student recruitment 4 Students undertake coursework 5 Baseline survey 6 Vaccination and follow up 7 Data entry and analysis 8 Attend workshops and conferences 9 Theses writing 10 Final report writing	**Milestones** 1. Study instruments and consultations completed by end of month 3 2. Quarterly feedback workshops 3. Students registered by month 3 4. Students complete coursework by month 12 5. Baseline data collection completed by end of month 9 6. Vaccination complete in month 12 7. Attend workshops every 12 month 8. Theses submitted by month 24 9. Final report submitted 2 month after end of project	❖ Study instruments ❖ Feedback workshop notes ❖ Registration and IDs ❖ Progress reports ❖ Data base and preliminary findings ❖ Vaccination records and database ❖ Workshop proceedings ❖ Copies of the theses ❖ Final Project Report	