

Newcastle Disease Vaccine and Poultry Productivity Changes: Gairo, Tanzania

A GALVmed Monitoring and Evaluation Study



Executive summary

This study assesses data from one of the earlier GALVmed market development field projects where commercial Newcastle Disease (ND) vaccine supply chains were being introduced to serve smallholder customers. In addition to the ND vaccine, dewormers and improved poultry husbandry practices (relating to feeding and housing) were also introduced to smallholders. The primary project focus, however, lay in ND vaccines since this was considered the primary constraint in smallholder poultry production and the primary market opportunity for the animal health industry.

The project commenced in 2014 in Gairo District, Morogoro Region, Tanzania. At this time GALVmed's market development team were initiating field projects where the main focus was ND vaccines, but where the strategic context was wider as GALVmed sought to build a better market understanding of the basic smallholder market issues (e.g. to what extent will smallholders realise productivity gains through better animal health inputs?, to what extent will they pay the market price for these inputs?, to what extent will supply chain actors, such as vaccinators, realise sustainable economic returns from these products?).

The project, while pragmatically focused on market understanding, generated reasonable levels of data on poultry productivity before and after the initiation of the ND vaccine supply. Limited data was also collected on adoption (smallholders). This study focuses on the analysis and interpretation of smallholder data collected via surveys that were rolled out prior to vaccine delivery (baseline) and after 24 months (endline). The main findings indicate:

- That poultry productivity increased significantly after the project intervention. Average household flock sizes increased from 21.6 to 42.2 and average household poultry income increased from Tsh. 353,152.17 (USD 162.45) to an average of Tsh. 940,304.35 (USD 432.54).
- That while the above productivity increases are remarkably high, it is not clear which aspects of the project intervention (awareness campaigns, ND vaccine, dewormers and improved husbandry practices) are driving the increases and to what extent. The perceived wisdom is that the control of a major disease, such as ND, results in substantial productivity gains, which are then substantially amplified as smallholders have the confidence to invest further in improved feeding, housing, and other health products. While this seems a logical interpretation, Randomised Controlled Trials (RCTs) would be required to definitively demonstrate this.

- That adoption rates of the ND vaccine were estimated to increase from 68.1%, prior to commencement of the project, to 93.8% at the study endline. This is consistent with ND adoption rates observed elsewhere in similar projects and indicates their perceived value by smallholders as indispensable farming inputs. Very few agricultural inputs attain this level of adoption in the smallholder sector.

Vaccinators earned a monthly gross income of between Tsh. 112,500 (USD 51.75) and Tsh. 187,500 (USD 86.25) for poultry vaccination up to the end of February 2016. While 877,400 doses of vaccine were sold over the life of the project, an additional 388,800 doses of ND vaccine were sold in the nine months after external support to the project ended. This indicates a good economic incentive and a sustainable basis for this last link in the commercial supply chain of the ND vaccine.

The data generated through this study was foremostly aimed at building market understanding for GALVmed and the numerous partners engaging the smallholder animal health market. This data shows, for example, that it is reasonable to assume (given the substantial productivity returns) that the vast majority of poultry owning smallholders will pay the market price for a product such as ND vaccine. This can then inform market size and market penetration considerations. Such evidence and understanding is crucial to GALVmed in working towards its mission of developing effective market based animal health distribution networks that can provide smallholders with a portfolio of products to meet their livestock health needs.

It is also understood that the data emanating from this (and similar) studies may be of interest to researchers looking to undertake more rigorous impact assessments (e.g. RCTs). In this regard, GALVmed's remit is not to undertake these rigorous and costly research studies but rather to use pragmatic approaches, which still yield good data and which can point to areas of potential interest for the research community.

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Background

This project expanded the commercial supply chain for smallholder animal health inputs in Gairo District, Morogoro Region in Tanzania. The intention of the Monitoring & Evaluation study was to gain a wider understanding of the smallholder animal health sector, focusing on poultry and Newcastle Disease (ND) in particular.

Introduction

Smallholder poultry production plays an important, and often undervalued, role in supporting rural livelihoods in developing countries. With minimal time and financial investment required, poultry represent a valuable source of protein and cash income in times of need (GALVmed, 2015; Bessell et al., 2017).

An infectious, rapid-onset, and economically devastating viral disease, ND is one of the biggest causes of poultry loss worldwide. Outbreaks of velogenic ND can cause morbidity and mortality rates of up to 90%. In developing countries, the impact of ND on smallholder poultry is particularly significant (Ahuja & Sen, 2007; Yune & Abdela, 2017). Effective and inexpensive ND vaccines exist that are appropriate for use in rural settings, but, in many areas, a lack of resources and infrastructure for vaccine distribution and for vaccination services hampers the uptake of these products (Wong et al., 2017).

Where ND is not controlled, rural households typically do not consume poultry products, favouring keeping eggs to produce more chickens for sale. Households use this income to purchase staple foods and other, often less nutritious, food products (Wong et al., 2017). Some of the benefits of ND control include increased income, particularly for female-headed households, and increased consumption of poultry products in the household. Studies have also associated ND control with increased trust between community and government, doubling of household incomes, and improved nutrient intake (Aklilu et al., 2007; Alders et al., 2010; cited in Wong et al., 2017).

Project background

GALVmed's market development activities in Africa and Asia comprise three types:

1. Small-scale pilot projects to test smallholder willingness and ability to pay market-related prices for animal health inputs and products.
2. Field projects, based on these pilots, to expand the commercial supply chain for smallholder animal health inputs and to demonstrate economic viability for smallholders, retailers, and vaccinators.
3. Larger market initiatives to generate positive cash flows and achieve subsequent growth and expansion through these profits, drawing commercial partners into the smallholder sector.

Map of project area Gairo District, Morogoro



This field project represents the second type of initiative at a time when GALVmed was testing the commercial principle of whether smallholders would be willing to pay market-related prices for animal health inputs and whether, at scale, these inputs and products would realize sufficient productivity gains to ensure their sustained use. The field project focused on ND vaccines since this was considered the primary constraint in smallholder poultry production and the primary market opportunity for the animal health industry.

Reaching approximately 34,000 smallholder households, from February 2014 to February 2016, the scaled field project had four key objectives: to establish a profit-based vaccine supply chain; to identify and train a cadre of community vaccinators; to improve smallholder awareness of the importance of poultry vaccination and deworming; and to improve smallholder poultry management practices (i.e. low cost nutritious feed supplements, construction of poultry houses, protection from predation, traditional natural hatching and brooding techniques).

Addressing the first objective, the project expanded its operations to distribute ND vaccines in suitable doses, along with other animal health products, to smallholders in the project area. Prior to the project, a systematic supply chain for the provision of vaccines to smallholders in rural areas did not exist. Retail stores did not regularly stock ND vaccines, nor were the vaccines available in appropriate dose sizes.

The project worked with agents along the supply chain to improve the availability of high-quality vaccines and other products packaged in suitable doses. By the end of the project, there was a steady supply of ND vaccine and other products in the project area. The project also trained 96 community vaccinators in smallholder poultry vaccination, deworming, improved poultry management practices, cold chain management, and

provided community vaccinators with cooler boxes. In turn, community vaccinators engaged smallholders in deworming their poultry, adopting ND vaccines, practicing better poultry management, and purchasing and using high-quality animal health products. Village- and sub-village-level awareness, vaccination, and deworming campaigns complemented community vaccinator efforts.

To enhance sustainability, the Tanzanian Ministry of Livestock Development and Fisheries was involved as a key stakeholder in project meetings and played a role in awareness creation activities and general project planning. By February 2016, 96 community vaccinators were in operation at a ratio of 1:354 smallholder families, each earning an average gross income of between approximately Tsh. 112,500 (USD 51.75) and Tsh. 187,500 (USD 86.25) per month for vaccination services to smallholders¹ up to the end of February 2016. Approximately 877,400 doses of ND vaccine were sold over the life of the project. By November 2016 - nine months past the withdrawal of external support to the project - an additional 388,800 doses of ND vaccine were sold, demonstrating the commercial viability of the vaccine in the field project area.

GALVmed Monitoring and Evaluation carried out a study to assess the poultry productivity changes associated with the Market Development field project in Gairo. The study was implemented through questionnaire-based surveys that were rolled out prior to vaccine delivery (baseline) in February 2014 and after 24 months (endline) in February 2016. This study provides a snapshot of the project's initial uptake and effects on poultry productivity.

A one week old chick being vaccinated against Newcastle Disease via eye-drop



¹Community vaccinators agreed to sell no less than 3000 doses per campaign x3 campaigns per year. However, some vaccinators sold in excess of 15,000 doses and some sold less than 3000. The vaccinator determined the cost of the vaccine. Community vaccinators charged between Tsh. 150 (USD 0.07) and Tsh. 250 (USD 0.11) per dose. Therefore, this figure is an approximate range for the "average" vaccinator.

Study design

Questionnaire

The survey questionnaire (Appendix 1) comprised a mix of structured open and closed questions, which were tested and revised in a pilot study. Survey questions addressed flock size, consumption of poultry meat, productivity, husbandry practices, and use of vaccines and knowledge of poultry rearing. The questionnaire was written in English and translated into the local language. Each questionnaire took between 45 and 60 minutes to administer. A sample of survey forms were appraised by a supervisor during data collection. Following the completion of each survey, data was entered into a customised database.

Sampling

Sample size was calculated with a 95% confidence interval and significance level of 5%. The baseline and endline comprised 495 smallholder households. Using random stratified sampling, villages were selected from each lower administrative unit weighted by the number of households in the administrative unit. The same survey was used with the same households at baseline and endline. In households that agreed to participate in the study, the person responsible for looking after poultry was interviewed. In households that had no poultry, or were unwilling to participate in the survey, the next household was selected.

Data processing and statistical analysis

Data was collected on paper forms, before being manually entered into electronic format. Outliers were removed on a single-metric basis (rather than declaring entire records void). Subsequent analysis was completed using a combination of Microsoft Excel & R statistical software.

Most comparative indicators were calculated using only the data provided in the surveys. Limited calculations required the use of external information for improving the context, understanding, and comparison possibilities (e.g. approximate value of poultry). Only where applicable, categorical responses were aggregated into broader topic areas – with care taken to avoid double counting.

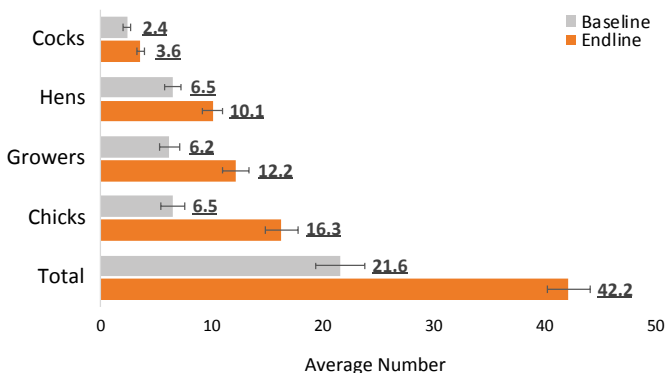
Findings

This section first reviews the findings from the major focus of the study - the effects of the project on smallholder productivity - and then turns to the minor focus of the study, which is on smallholder adoption.

Productivity

From baseline to endline, smallholder poultry flock sizes increased significantly. The increases were statistically significantly different for all categories of smallholder poultry – cocks, hens, growers, and chicks (Figure 1). The largest increases were seen in chicks (151% increase) and growers (97% increase). During the baseline, the average number of birds was 21.6 – comprising mature birds (41% – i.e. hens 30% and cocks 11%), growers (29%), and chicks (30%). After the project intervention, this number almost doubled to 42.2 on average – comprising mature birds (32% – i.e. hens 24% and cocks 8%), growers (29%), and chicks (39%). The larger increases in growers and chicks suggest that more chicks survived because of the vaccination programme as well as improved rearing practices.

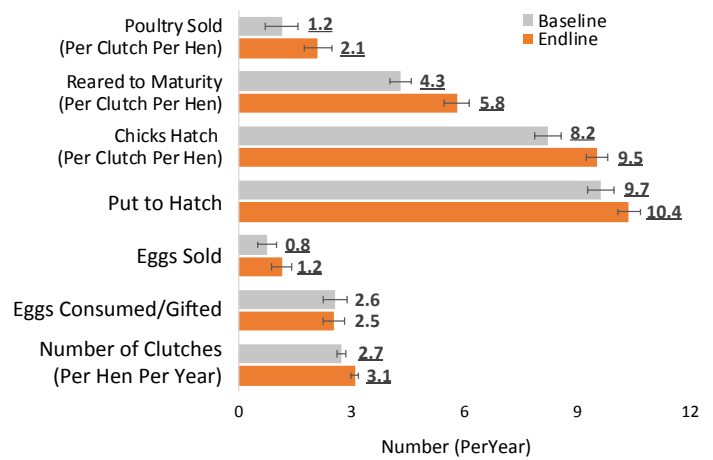
Figure 1. Average flock size at baseline and endline



One of the key expected outcomes of the project was that household income would increase as a result of smallholder poultry sales. This outcome was predicated on the assumption that reduced poultry morbidity and mortality would make more poultry available for sale. Mirroring the average flock size increases in Figure 1, Figure 2 shows that the number of poultry clutches, eggs, chicks, and birds reared to maturity, also increased from baseline to endline. The 'laying productivity' of hens increased, demonstrated by the number of clutches per hen that improved from 2.7 to 3.1 per annum. Statistically significant increases were also seen in the number of eggs sold per clutch (up from 0.8 to 1.2 on average), the number of chicks hatched per clutch per hen (up from an average of 8.2 to 9.5), and the number of poultry raised to maturity (showing the biggest average increase from 4.3 to 5.8 poultry birds).

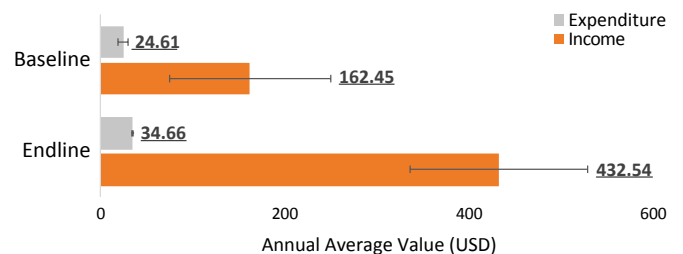
Correspondingly, there was a large and statistically significant increase in the sale of poultry from baseline to endline with smallholders selling 2.1 poultry per clutch, per hen, compared to 1.2 poultry per clutch, per hen, at baseline. In both the baseline and endline surveys, poultry sales rather than egg sales were the main contributing source of income. The low volume of egg sales may be due to the fact that smallholders preferred to hatch the eggs to increase the size of their productive flocks (Wong et al., 2017) or a consequence of the improved income from poultry meat production. Another reason may be that there is not a well-developed market for 'second-hand' eggs – people may distrust the quality. In this analysis, egg sale volume did not contribute to the calculation of income from poultry.

Figure 2. Poultry productivity



Household income from poultry increased substantially relative to expenditure from baseline to endline (Figure 3). Overall, household expenditure on poultry increased 41% from Tsh. 53,500.00 (USD 24.61) to an average of Tsh. 75,347.83 (USD 34.66) per annum. Smallholder income from poultry increased 166% from an average of Tsh. 353,152.17 (USD 162.45) to an average of Tsh. 940,304.35 (USD 432.54) per annum.

Figure 3. Poultry expenditure: poultry income



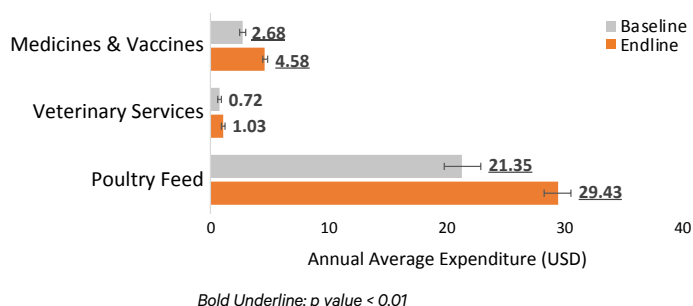
Bold Underline: p value < 0.01

A key hypothesis was that smallholders with access to vaccinations and other animal health products, who were made aware of and were motivated to use these products, would increase their expenditure on poultry-related medicines and vaccines, veterinary services, and feed. Figure 4 shows that spend on most poultry-related health items increased over the life of the project. The increases in expenditure from baseline to endline were statistically significantly different for poultry feed, and medicines and vaccines, but not for veterinary/professional services.

Expenditure on poultry-related medicines and vaccines saw the biggest increase of 70.1% from baseline to endline, from Tsh. 5,826.09 (USD 2.68) to Tsh. 9,956.52 (USD 4.58). The largest contributor to the production cost was the poultry feed cost of Tsh. 46,804.35 (USD 21.35) during the baseline assessment. This increased during the implementation of the project to Tsh. 63,978.26 (USD 29.43). The veterinary cost per smallholder was minimal in the baseline and endline, as most smallholders did not pay for veterinary services.

As in the baseline, at endline smallholders spent the most per annum on poultry feed, followed by medicines and vaccines, and then veterinary/professional services.

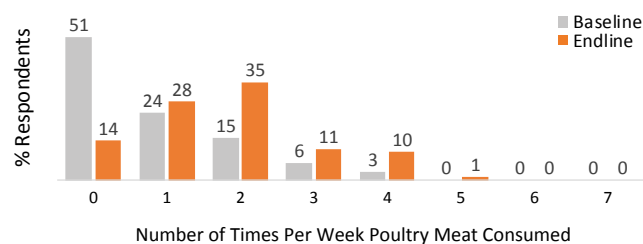
Figure 4. Expenditure on medicine and vaccines, veterinary services, and feed



One of the assumptions was that vaccine adoption would lead to a decrease in poultry morbidity and mortality, which would make more poultry available for offtake through gifting, selling, and consumption. Poultry, as a source of protein, is important for improving rural household diets (Bruyn, 2015), which typically consist of starchy staples (Tarvinga, Muchenje, & Mushunje, 2013).

Figure 5 demonstrates a consistent increase in poultry meat consumption over the life of the project, with a reduction in respondents eating no poultry meat (14% at endline versus 51% at baseline), and an increase in respondents eating poultry more than once per week.

Figure 5. Critical protein intake through poultry consumption

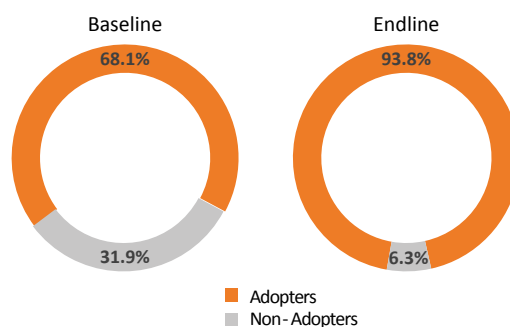


Adoption

The study looked into the reasons smallholders did not vaccinate their poultry. A number of reasons were cited, chief among them the fact that vaccines and vaccinators were not available, with no delivery of doorstep veterinary services. By creating awareness around the benefits of vaccine adoption, strengthening the supply chain, and building a cadre of community vaccinators, the project responded directly to the barriers to vaccine adoption as identified through surveying smallholders in the project area.

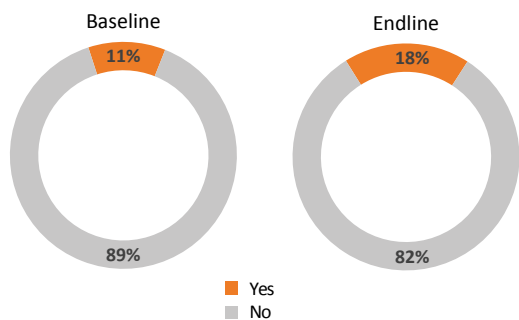
There was a 38% increase in adoption of the ND vaccine in the project area (Figure 6) coupled with a consistent increase in flock size (Figure 1) over the life of the project. Per Figure 6, adoption of vaccines improved from 68.1% adoption (337 smallholder households) in the baseline to 93.8% adoption (464 smallholder households) at endline. The high baseline was mainly due to government distribution of ND vaccines in the project area prior to implementation of the field project.

Figure 6. Percentage of respondents adopting / not adopting ND vaccine



The project trained community vaccinators on low-cost poultry housing and feed management. In turn, community vaccinators cascaded this information to smallholders. Figure 7 suggests that the community vaccinators were successful in motivating a small number of smallholders to construct poultry housing over the life of the project. Poultry house ownership increased from 11% of respondents at baseline to 18% at endline.

Figure 7. Poultry house ownership



Another key assumption was that ND vaccination would reduce the rates of poultry mortality in the project area. Figure 8 shows that almost all (93.8%) respondents vaccinated their poultry against ND over the course of the project. Figure 9 demonstrates that, correspondingly, there was a drop in attribution of ND as a cause of poultry death. ND was cited by 94.4% of smallholder respondents as a major disease responsible for poultry death in the baseline compared to 54% at endline – a 42.8% decrease. This is a substantial reduction and likely linked to the increase in the number of smallholders adopting the ND vaccine. Altogether, the findings suggest that awareness campaigns were successful in improving smallholder knowledge and awareness of ND.

Figure 8. Diseases vaccinated against

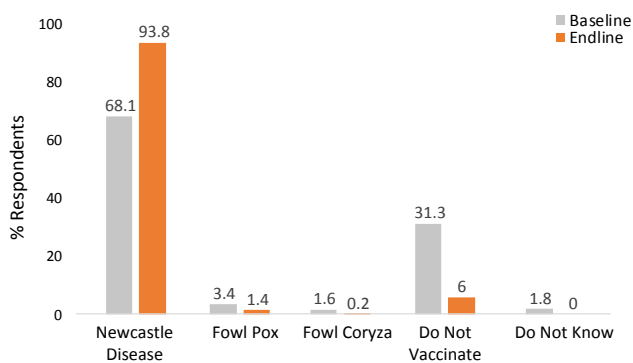
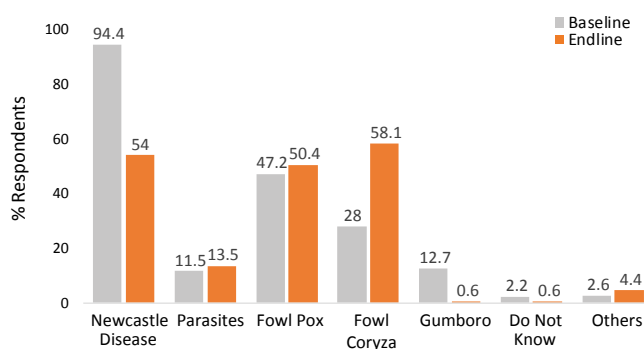


Figure 9. Major diseases killing poultry



Conclusions

The results together indicate that the field project was successful in motivating smallholders to adopt and pay for ND vaccines that, in turn, reduced the effect of ND and increased poultry flock size. Other factors may have contributed to increased productivity but it is reasonable to assume that the uptake of the ND vaccination had the biggest impact on the poultry productivity of smallholders. Enhanced levels and quality of animal feed, feed additives and improved production practices also played an augmenting role in the production process.

With an adoption rate of 93.8%, income gains of over 166%, and increases in household poultry consumption, the findings suggest that smallholder customers perceive the ND vaccine as an indispensable farming input. Through awareness raising campaigns and community vaccinator efforts, the project appears to have changed smallholder attitudes towards purchasing and adopting vaccines and other high quality animal health products. The increase in poultry meat consumption also suggests that smallholders are using part of their produce gains to feed their families as opposed to generating income alone.

Smallholders in the project area experienced significant productivity improvements from the use of the ND vaccine and other animal health products. Statistically significant increases were seen in the number of clutches per hen, per year, the number of eggs and poultry sold per clutch, the number of chicks put to hatch and hatched per clutch, per hen, and the number of poultry raised to maturity. The gains are large enough to suggest that adoption of the ND vaccine would likely persist after the cessation of the project and other awareness activities.

The fact that smallholders made significant income gains, paid for vaccines, and paid the community vaccinator service fee for vaccinations - with community vaccinators earning a monthly gross income of between Tsh. 112,500 (USD 51.75) and Tsh. 187,500 (USD 86.25) - suggests that the project established a strong basis for sustainability and profitability over the long term. It is reasonable to assume that income will increase even further as flock size exponentially increases.

Whether key players in the vaccine supply chain (e.g. agrovets) realised sufficient commercial returns to sustain their long-term business commitment remains to be seen. The fact that agrovets stocking improved in the project area is a step in the right direction. Likewise, that 388,800 doses of ND vaccine were sold in the nine months after external support to the project ended goes some way towards demonstrating the commercial viability for both retailers and vaccinators.

Overall, the project managed to influence the supply chain so that better quality products are available to smallholders in the correct vial sizes and with adequate cold chain management to safeguard vaccine efficacy. It also influenced the Government veterinary department by including it in the project, ensuring that community vaccinators remain viable and successful in continuing vaccination programs for smallholder poultry in the project area.

Combined with findings from other field projects in Asia and Africa, the understanding gained through this field project has contributed significantly to GALVmed's progression towards larger scale market initiatives with commercial partners, such as vaccine manufacturers. It is these larger scale commercial initiatives, built upon the understanding gained through the smaller field projects, which will ultimately deliver GALVmed's vision of scale and economic sustainability in serving the animal health needs of smallholders.

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Questionnaire

Target Group	Household
Enumerator	
Date	

Respondent's Data	
Surname	Name
District	
Village	
Sub_village	
Address	
Mobile phone	
Email	

Social: Education

1.-Education of the respondent

- | | |
|---|---|
| <input type="radio"/> Illiterate | <input type="radio"/> High school |
| <input type="radio"/> Literate without formal schooling | <input type="radio"/> Diploma or Certificate Course |
| <input type="radio"/> Literate below Primary school | <input type="radio"/> Graduate |
| <input type="radio"/> Primary school | <input type="radio"/> Postgraduate or above |
| <input type="radio"/> Middle or Secondary school | |

2.-What is the most common source for poultry related information?

- | | |
|---|--|
| <input type="checkbox"/> Govt Veterinary/paraveterinary | <input type="checkbox"/> Dealers |
| <input type="checkbox"/> Private veterinary | <input type="checkbox"/> Community animal health workers |
| <input type="checkbox"/> State Agriculture University | <input type="checkbox"/> Vaccinators |
| <input type="checkbox"/> NGOs | <input type="checkbox"/> Other farmers, friends and/or relatives |
| <input type="checkbox"/> Cooperatives | <input type="checkbox"/> No information provider |

Social: Health

3.-How many times per week do you eat poultry in your meals?

_____ Times per week eat poultry

- Multiple choice Unique choice Number

Economic: Economic structure

4.-Who takes care of the poultry?

- | | |
|---|---|
| <input type="checkbox"/> Adult male (s) | <input type="checkbox"/> Young girls in the house |
| <input type="checkbox"/> Adult female (s) | <input type="checkbox"/> Young boys in the house |

5.-Who buys the poultry feed?

- | | |
|---|--|
| <input type="checkbox"/> Adult male (s) | <input type="checkbox"/> Young boys in the house |
| <input type="checkbox"/> Adult female (s) | <input type="checkbox"/> Do not buy feed |
| <input type="checkbox"/> Young girls in the house | |

6.-Who is responsible for buying the medicines for the poultry?

- | | |
|---|--|
| <input type="checkbox"/> Adult male (s) | <input type="checkbox"/> Young boys in the house |
| <input type="checkbox"/> Adult female (s) | <input type="checkbox"/> Do not buy medicines |
| <input type="checkbox"/> Young girls in the house | |

7.-Who primarily makes the decision about selling the poultry?

- | | |
|--|---|
| <input type="radio"/> Adult male (s) | <input type="radio"/> Young boys in the house |
| <input type="radio"/> Adult female (s) | <input type="radio"/> Joint decision |
| <input type="radio"/> Young girls in the house | <input type="radio"/> Do not sell poultry |

8.-Who primarily decides the use of poultry income?

- Adult male (s)
- Adult female (s)
- No poultry income

Economic: Poultry production

9.-Do you have poultry house?

- Yes
- No

10.-What do you do if your poultry falls ill?

- | | |
|--|--|
| <input type="checkbox"/> Treat with traditional / home remedies | <input type="checkbox"/> Poultry traders |
| <input type="checkbox"/> Seek help from neighbors | <input type="checkbox"/> Community animal health workers |
| <input type="checkbox"/> Call local paravet or Livestock Inspector | <input type="checkbox"/> Consume |
| <input type="checkbox"/> Call the government veterinary | <input type="checkbox"/> Do nothing |
| <input type="checkbox"/> Get medicines from the medicine stores | <input type="checkbox"/> Sell immediately |
| <input type="checkbox"/> Private veterinary | |

11.-What are the main causes of poultry losses?

- | | |
|--|---------------------------------|
| <input type="checkbox"/> Infectious diseases | <input type="checkbox"/> Theft |
| <input type="checkbox"/> Parasites | <input type="checkbox"/> Others |
| <input type="checkbox"/> Predators | |

12.-What are the major diseases that are killing your poultry?

- | | |
|--------------------------------------|--------------------------------------|
| <input type="checkbox"/> Newcastle | <input type="checkbox"/> Gumboro |
| <input type="checkbox"/> Parasites | <input type="checkbox"/> Do not know |
| <input type="checkbox"/> Fowl pox | <input type="checkbox"/> Others |
| <input type="checkbox"/> Fowl coryza | |

13.-What are the major symptoms when the poultry is sick?

- | | |
|---|--|
| <input type="checkbox"/> Gasping | <input type="checkbox"/> White diarrhea |
| <input type="checkbox"/> Coughing | <input type="checkbox"/> Brownish/Bloody diarrhea |
| <input type="checkbox"/> Sneezing | <input type="checkbox"/> Yellow diarrhea |
| <input type="checkbox"/> Twisted necks | <input type="checkbox"/> Brownish black spots |
| <input type="checkbox"/> Circling | <input type="checkbox"/> Sudden death |
| <input type="checkbox"/> Complete paralysis | <input type="checkbox"/> Swelling of eyes and head |
| <input type="checkbox"/> High mortality | <input type="checkbox"/> Others |
| <input type="checkbox"/> Green diarrhea | |

14.-What do you do with the dead poultry?

- | | |
|---|---|
| <input type="checkbox"/> Eat them at home | <input type="checkbox"/> Bury in the ground |
| <input type="checkbox"/> Throw away in some open area | <input type="checkbox"/> Sell |
| <input type="checkbox"/> Throw away in some pond or river | <input type="checkbox"/> Other |

15.-For which diseases do you vaccinate your poultry?

- | | |
|--|---|
| <input type="checkbox"/> Newcastle Disease | <input type="checkbox"/> Gumboro |
| <input type="checkbox"/> Fowlpox | <input type="checkbox"/> Do not know |
| <input type="checkbox"/> Fowl coryza | <input type="checkbox"/> Do not vaccinate |

16.-Who administers the Newcastle disease vaccines?

- | | |
|---|--|
| <input type="checkbox"/> Govt. paravet or Livestock Inspector | <input type="checkbox"/> NGO service providers |
| <input type="checkbox"/> Govt. Veterinary doctor | <input type="checkbox"/> Farmer themselves |
| <input type="checkbox"/> Private veterinary doctor | <input type="checkbox"/> Do not vaccinated |
| <input type="checkbox"/> Community animal health worker | |

17.-If not vaccinating poultry please provide reasons

- | | |
|--|---|
| <input type="checkbox"/> Vaccines not available | <input type="checkbox"/> Poor quality of vaccines |
| <input type="checkbox"/> Not aware of advantages of vaccines | <input type="checkbox"/> Cost of the vaccine is high |
| <input type="checkbox"/> Not aware of time and use of vaccines | <input type="checkbox"/> No delivery of veterinary services at the doorstep |
| <input type="checkbox"/> Does not affect productivity | <input type="checkbox"/> Pack size |
| <input type="checkbox"/> Vaccinators not available | <input type="checkbox"/> Other |

18.-Did you have a Newcastle disease outbreak in the last 12 month?

- | | |
|----------------------------------|--|
| <input type="radio"/> Yes, once | <input type="radio"/> Yes, three times or more |
| <input type="radio"/> Yes, twice | <input type="radio"/> No |

Economic: Lili Lite General

19.-Number of goat that you have in the house

|_____| Goat

20.-Number of sheep that you have in the house

|_____| Sheep

21.-Number of pigs that you have in the house

|_____| Pigs

22.-How much money do you spend in poultry feed per month?

|_____| Local currency per month

23.-Value of the medicines or vaccines bought for poultry during the last 12 months

|_____| Local currency

24.-Veterinary or other professional fees paid for poultry during the last 12 months

|_____| Local currency

25.-If you have a specific poultry house, which is the estimated value of the poultry house

|_____| Local currency

26.-Cost of repair and maintenance in the poultry house during the last 12 months

|_____| Local currency

Economic: Lili Lite Chickens

27.-Number of male Cocks that you have in the household

|_____| Cocks

28.-Number of hens that you keep in the household

|_____| Hens

29.-Number of poultry growers that you keep in the household

|_____| Growers

30.-Number of chicks that you keep in the household

|_____| Chicks

31.-Number of clutches per hen per year

|_____| Number of hen clutches per year

32.-Number of chicken eggs consumed or gifted per clutch

|_____| Chicken eggs per clutch

33.-Number of chicken eggs sold per clutch

|_____| Chicken eggs per clutch

34.-Number of chicken eggs put to hatch per clutch

|_____| Chicken eggs per clutch

35.-Number of chicken chicks hatch per clutch

|_____| Chicks per clutch

36.-Number of chicken chicks reared to maturity per clutch

|_____| Chicks per clutch

37.-Number of poultry sold per clutch

|_____| Chickens sold per clutch

38.-Number of poultry bought for replacement during the last 12 months

|_____| Poultry

Economic: Lili Lite Guinea Fowl

39.-Number of male Guinea fowl that you have in the household

|_____| Guinea Fowl

40.-Number of female Guinea fowl that you keep in the household

|_____| Guinea Fowl

41.-Number of Guinea fowl growers that you keep in the household

|_____| Guinea Fowl Growers

42.-Number of Guinea fowl chicks that you keep in the household

|_____| Chicks

43.-Number of clutches per Guinea fowl per year

|_____| Guinea Fowl clutches per year

44.-Number of Guinea fowl eggs consumed or gifted per clutch

|_____| Guinea Fowl eggs per clutch

45.-Number of Guinea fowl eggs sold per clutch

|_____| Guinea Fowl eggs per clutch

46.-Number of Guinea fowl eggs put to hatch per clutch

|_____| Guinea Fowl eggs per clutch

47.-Number of chicks Guinea fowl hatch per clutch

|_____| Guinea Fowl per clutch

48.-Number of Guinea fowl chicks reared to maturity per clutch

_____ Guinea Fowl per clutch

49.-Number of Guinea fowl sold per clutch

_____ Guinea Fowl sold per clutch

50.-Number of Guinea fowl bought for replacement during the last 12 months

_____ Guinea Fowl

Economic: Lili Lite Ducks

51.-Number of male ducks that you have in the household

_____ Ducks

52.-Number of female ducks that you keep in the household

_____ Ducks

53.-Number of ducks growers that you keep in the household

_____ Ducks Growers

54.-Number of ducks chicks that you keep in the household

_____ Chicks

55.-Number of ducks produced monthly

_____ Ducks per month

56.-Number of ducks consumed or gifted per month

_____ Ducks per month

57.-Number of ducks bought for replacement during the last 12 months

_____ Ducks

Economic: Lili Lite Turkeys

58.-Number of male turkeys that you have in the household

_____ Turkeys

59.-Number of female turkeys that you keep in the household

_____ Turkeys

60.-Number of turkeys growers that you keep in the household

_____ Turkeys Growers

61.-Number of turkeys chicks that you keep in the household

_____ Chicks

62.-Number of turkeys produced monthly

_____ Turkeys per month

63.-Number of turkeys consumed or gifted per month

_____ Turkeys per month

64.-Number of turkeys bought for replacement during the last 12 months

_____ Turkeys

