



Sustainable distribution of Newcastle Disease (ND) vaccine as a way to control ND, and improve poor livestock keepers' livelihoods in Burkina Faso

FINAL EVALUATION

25th April 2013

Executive summary

Backyard poultry keeping constitutes the third pillar of the national economy in Burkina Faso, behind cotton and gold. In the Central Eastern region, poultry keeping provides essential animal products for local consumption and exports, and provides an important income source for backyard poultry farmers. Poultry keeping contributes greatly to poverty alleviation in rural areas especially for the fragile fringes of the population (women and youth) and provides a high quality protein source.

The full potential of backyard poultry is yet to be realized by farmers due to a number of limiting factors that cause poor production and big poultry losses. It was noted that the major causes of losses were infectious diseases, poor husbandry, theft, predation and nutrition issues. Newcastle Disease (ND) was the leading infectious disease identified.

A ND control pilot project was designed to address the challenges due to this infectious disease that causes mortality and production losses in the backyard poultry in rural areas. The project was implemented in partnership between GALVmed and VETO IMPACT in three project provinces of the Central Eastern region: Boulgou, Kouritenga, Koulpelogo.

VETO IMPACT is a registered private veterinary company that provides animal health services and veterinary products and has its operational office in the Central Eastern region of Burkina Faso. The veterinary company has over fifteen years of experience working and providing services in the Central Eastern region.

The project period lasted for 15 months and included 4 ND vaccination campaigns: The baseline study was conducted on August 2011 just before the first vaccination and the final evaluation was conducted on December 2012 after the last vaccination. The intervention managed to provide service to 8,861 households in the project area whereby 404,000 chickens were vaccinated against Newcastle Disease.

The project was successful based on the results of a random survey using questionnaires to 306 households showed:

- The number of poultry per household increased from 34.05 at the beginning to 51.95 at the end of the project period. The increase was mainly due to the number of chicks, as the number of adult poultry only increased slightly.

- Monthly poultry production per household increased by 1.14 fold (from 1.18 to 1.35 poultry produced per month per household)

The annual net poultry income has been increased on average by 21,714 CFA (USD 43) per household after the project intervention.

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1. Summary Report

a) Background

In Burkina Faso, backyard poultry keeping constitutes the third pillar of the national economy, behind cotton and gold. In the Central Eastern region, poultry keeping provides essential animal products for local consumption and exports, and provides an important income source for backyard poultry farmers. Poultry keeping contributes greatly to poverty alleviation in rural areas especially for the fragile fringes of the population (women and youth) and provides a high quality protein source.

A baseline study conducted in the project area in partnership between Veto-Impact and GALVmed in August 2011 highlighted the constraints to backyard poultry keeping. The main findings included: Newcastle Disease was responsible for up to 60 to 90% of poultry mortality in the backyard poultry in the surveyed area, livestock keepers didn't have enough knowledge on backyard husbandry (hence poor production) due to the lack of access to information on poultry husbandry and also to lack of access to health care services. Lastly it was also noted that livestock keepers had poor access to essential inputs such as drugs and vaccines.

b) Newcastle Disease (ND) Pilot Project Description

A Newcastle Disease control pilot project was designed to try to find solutions to the challenges found during the baseline survey in the project area in the Central Eastern region of Burkina Faso.

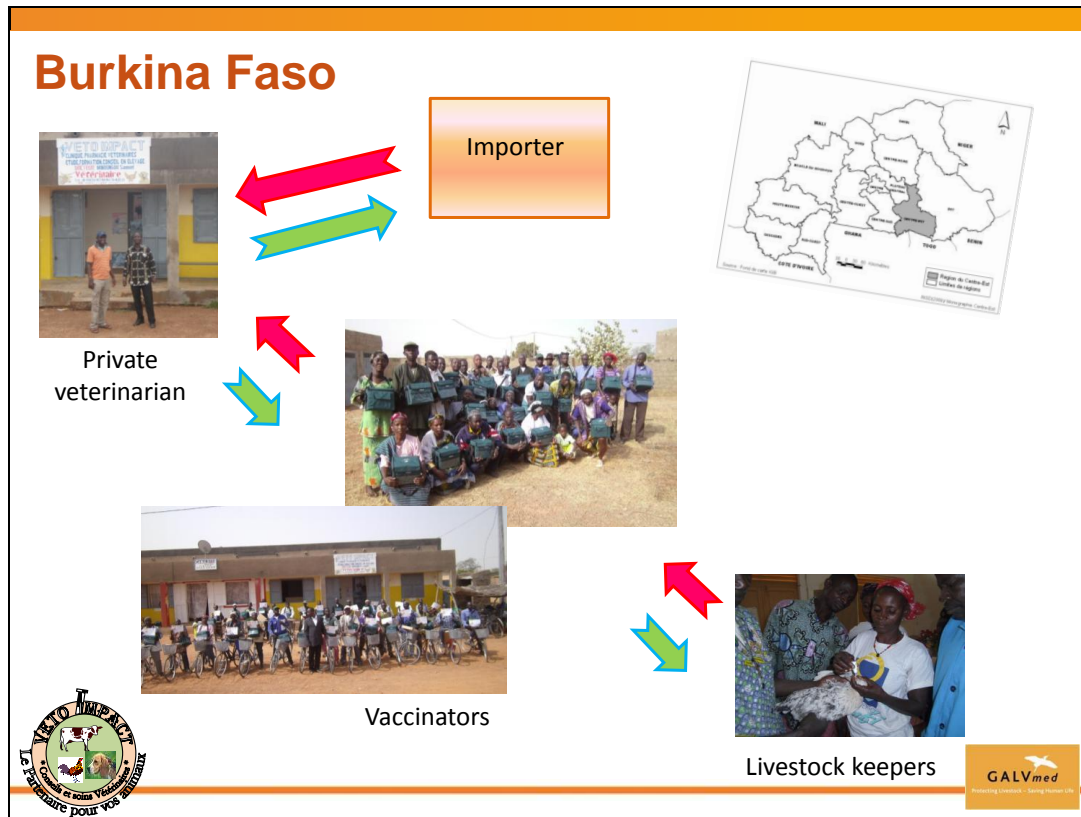
The overall purpose and objective of the pilot project was to develop and design sustainable poultry and other animal health products supply chain by utilizing information gained from the baseline study. To achieve this, the project developed a network between all the actors involved in livestock vaccination. The actors were given different level of capacity building and awareness creation on issues regarding the use, maintenance and business of poultry vaccines. The purpose of the awareness creation at farmers' level was to promote the demand of animal health products including ND vaccine. Distributors were given some training on how to stock vaccines and cold chain maintenance to keep them viable hence stimulating supply to the distribution chain. In order for the supply chain to be viable, each actor needs to make profit and since all of them make a supplementary income through this intervention, scope for sustainability is high.

The project involved backyard poultry livestock keepers, poultry vaccinators, private veterinarian, and veterinary products wholesalers to address the challenges facing the backyard poultry production in the project area.

The main activities of the project were:

1. Capacity building of the various actors involved in the distribution chain: distributors, community poultry vaccinators and backyard poultry livestock keepers.
2. Poultry extension materials revision, adaptation, publication and awareness creation for backyard poultry livestock keepers, vaccinators and field extension officers.
3. Purchasing cold chain material and equipment to improve vaccine distribution chain in the project area.
4. Conducting vaccination campaigns.
5. Evaluating the project implementation.

The animal health products supply chain model designed and used in Burkina Faso can be seen below:



The number of vaccinators, vaccination campaigns, households and ND vaccine doses is presented in Table 1.

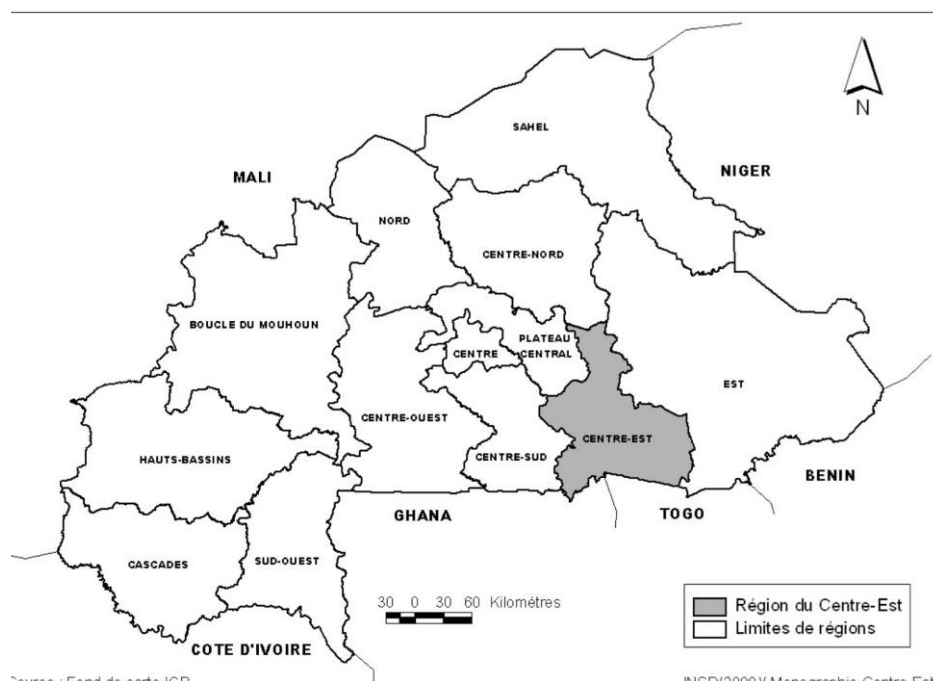
Table 1. Target and actual numbers for the project

		Target	Actual
1	#Vaccinators trained	36	50
2	#Vaccination campaigns	3	4
3	#Households	18,000	8,861
4	#ND doses used	1,000,000	404,500

c) Location of the ND Pilot Project

Map 1 below shows the Central Eastern Region where the project was located.

Map 1. Burkina Faso map showing the Central Eastern Region



Source : Fond de carte IGB

INSD(2009)V Monographie Centre-Est

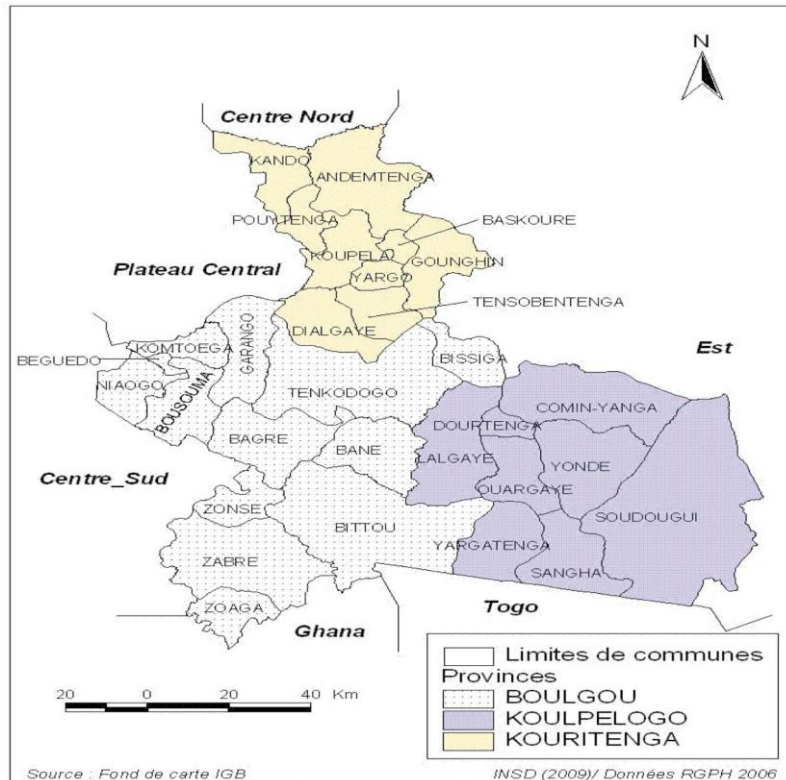
The main data from the Central Eastern region/project area is shown in Table 2.

Table 2. Structure of Central Eastern region population

Population	1 132 016
Men	529 333
Women	602 683
Urban population	198 496
Rural population	933 520
Density	77,0 hbts/km ²
Men per 100 women	87,8
Urbanisation rate in %	17,5
Average annual growth rate in %	2,9
Average number of kids per women	6,6
births for 1000 inhabitants	47,5
Number of households	186 732
Size of households	6,1
Children girls schooling rate in %	51,2
Children boys schooling rate in %	58,2

The administrative organisation of the project area can be seen in Map 2.

Map 2. Administrative organisation of centre east region



The project area is located in the Central East region of Burkina Faso. Central Eastern region is situated at the extreme east of Burkina between 1° 0 'S and 0° 45' west longitude , between 12°35 'S and 10°55 'S north latitude. It covers a surface of 14,709.6 km². Its population is essentially composed by Bissa, Mossi, Fulani, and some Koussassé. The region has three provinces namely Boulgou, Koulpelogo and Kourittenga. Again the region has 30 townships with 748 administrative villages.

- The region county capital is Tenkodogo, 185 km far from Ouagadougou.
- It occupies a geographical position favourable to commercial exchanges.
- Thanks to its position is a rotating plate of agricultural and pastoral product trade for the country, and the neighbouring countries.

Objectives of the Baseline Study

The objective of the baseline study was to gather data to generate baseline information:

- 1- To justify the selection of the study area.
- 2- To identify the constraints surrounding Newcastle Disease vaccine and other animal health products critical for the design and implementation of the pilot project.
- 3- To collect information to monitor the progress, outputs and outcomes of the study. This information would assist in evaluating the intervention strategies.

d) Description and methodology of the Baseline Study and Final Evaluation

The sample size was calculated based on the human population, the number of villages and the poultry population in the area. For percentage response data, the maximum standard error was estimated to be no more than $\pm 5.00\%$. Once the area of intervention was chosen, a list of villages was sent to the statistician to select by randomisation the villages where the questionnaires would be administered. The number of interviews was calculated in relation to the budget for the project.

Randomisation: The villages were randomly selected by third party data capture consultants¹ from the total list of villages given to them. 51 villages were selected and in each village questionnaires were done to 6 households. A total of 306 households were involved. Six enumerators were used for the survey, including 2 women.

The Final Evaluation was carried out on the same 306 households using the Baseline questionnaires.

e) Timelines

Table 3. Timelines of the ND project

	Aug 11	Sep 11	Oct 11	Nov 11	De 11c	Jan 12	Feb 12	Mar 12	Apr 12	May 12	Jun 12	Jul 12	Aug 12	Sep 12	Oct 12	Nov 12	Dec 12
Baseline	X																
1 st vac								X									
2 nd vac											X						
3 rd vac													X				
4 th vac															X		
Final evaluation																	X

f) Baseline Information and Data Analysis

In partnership with “Bases & Datos”, GALVmed developed a data capture and analysis software named “Lili-Lite” that was used for the collection and analysis of the data during the Baseline and the Final Evaluation.

The software was designed in such a manner that the questionnaires were adapted to the local circumstances, and could be printed in English or the local language. Data entry screens mimic the questionnaires, and could also be completed in English or the local language.

Data collection was done by local enumerators, and data entry was done by a trained member who is the partner to principal investigator.

The data were submitted to Bases & Datos for analysis and report generation. Reports were sent back to the partners as pdf documents.

2. Results of the Burkina Faso Pilot Project to increase the adoption of Newcastle vaccine

a) Methodology of the analyses

After receiving the data, quality control was carried out to ensure the data were adequate for analysis. Data points which deviated by more than or less than 3 standard errors from the mean were considered for exclusion from the analysis. If these were considered to be genuine outliers, they were omitted.

For collected responses, comparisons were made of the difference between the “before” and “after” answers at the household level, and the p-value was calculated. When the variable studied was numerical, a paired t-test was used to calculate the statistical significance of the difference between

¹ Bases y Datos; www.basesydatos.com

the values and its corresponding p-value. In addition 95% confidence intervals were obtained for the differences.

In the following sections questions are referenced by the letter q and their number, e.g. q1258 refers to question 1258 from the original questionnaire.

Reported findings were given as means/proportions \pm standard error, or the difference of the means/proportions \pm standard error, depending on which was being considered. For the difference in proportions or t-test means, the p-values are included in the bracketed information. For example (q1289, 11.88% \pm 3.22 and 42.57% \pm 4.92, $p < 0.001$) means that question 1289 had percentage 11.88% with 3.22 % as standard error in the Baseline Survey and percentage 42.57% with 4.92% as standard error in the Final Evaluation, and that the difference between these percentages is statistically significant with a p-value less than 0.001. The differences between before and after were considered statistically significant if the p-value was 0.05 or less. The p-value was only indicated when statistical significance was found. Reported p-values have not been adjusted for multiple comparisons.

The Cost-Benefit Analysis (CBA) for the farmer (the value of the intervention at individual household level), was calculated using the current values of CFA currency when the questionnaires were administrated. There was no adjustment for inflation between the first and the second questionnaire; therefore the values of CFA are nominal. Inflation rate in 2011 in Burkina Faso was 8.9% according to CIA World Factbook estimations for 2011 (<https://www.cia.gov/library/publications/the-world-factbook/geos/uv.html>).

b) Respondents key data

A summary of key findings are shown in Table 4. In both cases (Baseline and Final Evaluation) the respondents were primarily men (q1372). More than 72% of the respondents were illiterate, around 23% had primary school education, and almost 5% had secondary school education or higher (q1385). The majority of those men were the poultry's owner (q1407) and also the main responsible for caring the poultry (q1406) in their household.

Table 4. Respondent's data.

No Q	Response	% Before	% After	Difference	Lower CI 95%	Upper CI 95%
q1372	Gender of the respondent					
	Male	85.29%	85.29%	0.00%	-6.08%	6.08%
	Female	14.71%	14.71%	0.00%	-14.63%	14.63%
q1373	Age of the respondent					
	12 to 18 years old	0.98%	0.98%	0.00%	-15.77%	15.77%
	19 to 45 years old	38.89%	38.89%	0.00%	-12.39%	12.39%
	46 to 65 years old	37.91%	37.91%	0.00%	-12.49%	12.49%
	Older than 65 years old	22.22%	22.22%	0.00%	-13.97%	13.97%
q1374	Marital status of the respondent					
	Single	1.96%	1.96%	0.00%	-15.69%	15.69%
	Married	94.44%	94.44%	0.00%	-3.73%	3.73%
	Widow or widower	3.59%	3.59%	0.00%	-15.56%	15.56%
	Divorced	0.00%	0.00%	0.00%	N/A	N/A
q1375	Relationship of respondent with head of household (main decision maker)					
	The head of household	84.64%	84.97%	0.33%	-5.85%	6.50%
	Spouse of the head of household	11.76%	11.44%	-0.33%	-15.22%	14.57%
	Children	2.61%	2.61%	0.00%	-15.64%	15.64%
	Other	0.98%	0.98%	0.00%	-15.77%	15.77%
q1385	Education of the respondent					
	Illiterate	72.55%	72.55%	0.00%	-8.30%	8.30%
	Literate without formal schooling	10.78%	10.78%	0.00%	-14.97%	14.97%
	Literate below Primary school	12.42%	12.42%	0.00%	-14.83%	14.83%
	Primary school	0.00%	0.00%	0.00%	N/A	N/A
	Middle or Secondary school	2.94%	2.94%	0.00%	-15.61%	15.61%
	High school	1.31%	1.31%	0.00%	-15.74%	15.74%
	Diploma or Certificate Course	0.00%	0.00%	0.00%	N/A	N/A
	Graduate	0.00%	0.00%	0.00%	N/A	N/A
Postgraduate or above	0.00%	0.00%	0.00%	N/A	N/A	
q1406	Who takes care of the poultry?					
	Adult male(s)	67.99%	52.63%	-15.36%	-23.85%	-6.86%
	Adult female(s)	20.60%	37.07%	16.48%	5.03%	27.92%
	Young boys in the house	8.93%	8.24%	-0.70%	-13.64%	12.25%
	Young girls in the house	2.48%	2.06%	-0.42%	-13.80%	12.96%
q1407	Who is the poultry's owner?					
	Man	93.09%	68.95%	-24.14%	-31.04%	-17.23%
	Woman	6.91%	31.05%	24.14%	9.85%	38.43%

c) The living quarters of the Household

A summary of key findings related to the living quarters of the household are shown in Table 5.

Table 5. Housing features.

No Q	Response	% Before	% After	Difference	Lower CI 95%	Upper CI 95%
1395	The house of the respondent is					
	Owned	100.00%	100.00%	0.00%	0.00%	0.00%
	Rented	0.00%	0.00%	0.00%	N/A	N/A
1396	Type of roofing material					
	Grass	54.58%	49.02%	-5.56%	-16.56%	5.45%
	Iron sheet	45.42%	50.98%	5.56%	-5.85%	16.96%
	Roofing tiles	0.00%	0.00%	0.00%	N/A	N/A
	Mixed	0.00%	0.00%	0.00%	N/A	N/A
1397	Type house floor					
	Mud	41.83%	38.56%	-3.27%	-15.52%	8.99%
	Concrete	58.17%	61.44%	3.27%	-6.78%	13.31%
	Mixed	0.00%	0.00%	0.00%	N/A	N/A
	Other	0.00%	0.00%	0.00%	N/A	N/A
1398	Do you have a latrine or toilet?					
	Yes	88.24%	84.97%	-3.27%	-9.07%	2.53%
	No	11.76%	15.03%	3.27%	-11.48%	18.01%
1399	Do you have access to tap water in your household?					
	Yes	90.20%	90.85%	0.65%	-4.22%	5.53%
	No	9.80%	9.15%	-0.65%	-15.73%	14.42%
1400	Do you have separate room for your kitchen in your house?					
	Yes	97.06%	97.71%	0.65%	-1.91%	3.22%
	No	2.94%	2.29%	-0.65%	-16.29%	14.98%
1401	What energy sources are used for cooking?					
	Electricity	0.00%	0.00%	0.00%	N/A	N/A
	Gas	0.00%	0.22%	0.22%	N/A	N/A
	Kerosene/Charcoal	0.00%	0.00%	0.00%	N/A	N/A
	Cow dung	1.82%	3.36%	1.53%	-11.47%	14.53%
	Firewood	69.70%	68.46%	-1.25%	-8.57%	6.08%
	Other	28.47%	27.96%	-0.51%	-11.67%	10.65%
1402	Do you sleep on a bed with mattress?					
	Yes	0.33%	0.65%	0.33%	-15.48%	16.13%
	No	99.67%	99.35%	-0.33%	-1.44%	0.78%

Results from economic structure are shown in Table 6.

Table 6. Economic structure.

No Q	Response	% Before	% After	Difference	Lower CI 95%	Upper CI 95%
q1404	Primary occupation (head of the household)					
	Agriculture	99.34%	99.35%	0.00%	-1.28%	1.29%
	Livestock keeping	0.33%	0.33%	0.00%	-15.83%	15.83%
	Fishing	0.00%	0.00%	0.00%	N/A	N/A
	Trade and Transport	0.33%	0.33%	0.00%	-15.83%	15.83%
	Technical or Professional	0.00%	0.00%	0.00%	N/A	N/A
	Government service	0.00%	0.00%	0.00%	N/A	N/A
	Worker of private sector	0.00%	0.00%	0.00%	N/A	N/A
Others	0.00%	0.00%	0.00%	N/A	N/A	
q1405	Secondary occupation (head of the household)					
	Agriculture	0.33%	0.33%	0.00%	-15.83%	15.83%
	Animal husbandry	42.62%	47.39%	4.76%	-7.00%	16.52%
	Fishing	0.33%	0.33%	0.00%	-15.83%	15.83%
	Trade and Transport	19.34%	17.65%	-1.70%	-16.01%	12.62%
	Technical or Professional	0.00%	0.00%	0.00%	N/A	N/A
	Government service	0.00%	0.00%	0.00%	N/A	N/A
	Worker of private sector	0.00%	0.00%	0.00%	N/A	N/A
Others	37.38%	34.31%	-3.06%	-15.77%	9.64%	

The breakdown of data related to household inhabitants, their education and their health and nutrition are shown in Table 7.

Table 7. Inhabitants, education, health and nutrition of the household.

No Q	Question	Units	Before	After	Difference	Lower CI 95%	Upper CI 95%
q1376	Number of persons who live in the household	Persons	13.80	13.84	0.04	0.00	0.08
q1377	Number of females younger than 18 years in the household	Females	2.39	2.39	0.00	-0.02	0.02
q1378	Number of females between 18 and 65 years in the household	Females	3.00	3.00	-0.01	-0.02	0.01
q1379	Number of females older than 65 years in the household	Females	0.51	0.51	0.00	0.00	0.00
q1380	Number of males younger than 18 years in the household	Males	2.62	2.62	0.00	-0.02	0.03
q1381	Number of males between 18 and 65 years in the household	Males	1.87	1.87	0.00	0.00	0.00
q1382	Number of males older than 65 years in the household	Males	0.41	0.41	0.00	0.00	0.00
q1383	Number of children younger than 5 years	Child/Children	3.04	3.10	0.06	0.03	0.10
q1384	Among the girls of the household, how many of them are attending Secondary school?	Females	1.33	1.34	0.01	0.00	0.02
q1390	Please type the time to nearest medical centre	Minutes	36.00	36.09	0.10	-0.09	0.29
q1392	How many times children under 5 years old are drinking milk per day?	Times per day	0.01	0.01	0.00	0.00	0.00
q1393	How many times per week do you eat meat/fish in your meals?	Times per week	3.47	3.96	0.48	0.40	0.57

Concerning health status, the nearest medical center (q1390) was located 36 minutes from the the study area, and almost all children in the household were vaccinated against major diseases (not show in Tables; q1391: 97.70% and 97.71% of the children, before and after the intervention, respectively).

Households did not receive nutritional support from any NGO or Government agencies (q1394). Children did not drink milk daily (q1392). However, they ate fish and/or meat more than 3 times per week in both instances (baseline and final evaluation) (q1393).

Poultry were not allowed to roam free inside the house (not shown in Tables; q1403: 99.02% and 99.67% of household, before and after the intervention, respectively) and the majority of the households had poultry houses (not shown in Tables; q1417: 80.72% and 84.97% of household, before and after the intervention, respectively)

d) Livestock, poultry and shoats

In both instances (Baseline and Final Evaluation) very few households had access to education and training services in their area for livestock (q1386, $99.67 \pm 0.33\%$ and $97.71 \pm 0.85\%$, $p < 0.05$). The low proportion of households that had education regarding vaccines/ veterinary medicines available before the intervention, was obtained via the community animal health workers (q1387, 100%). After the intervention, mainly veterinary clinics and secondly, community animal health workers were the most common source of information regarding vaccines/ veterinary medicines (q1387, $87.50 \pm 11.69\%$ and $12.50 \pm 11.69\%$, respectively).

Among the sources for providing information regarding vaccines and veterinary medicine, poultry vaccinators and extension agencies were the most preferred by the households (q1388, $75.40 \pm 2.23\%$ and $11.76 \pm 1.67\%$, respectively). After the intervention, para veterinarians were still the most preferred source by households followed by veterinary clinics and extension agencies (q1388, $66.67 \pm 2.37\%$; $14.39 \pm 1.76\%$ and $9.85 \pm 1.50\%$, respectively).

Concerning poultry information, almost 35% of the households did not have access to this kind of information, and the rest of the households, received the information mainly from community animal health workers (q1389, $54.69 \pm 2.78\%$). After the intervention, most of the household had access to poultry information provided by community animal health workers and private veterinarians (q1389, $66.50 \pm 2.39\%$ and $18.93 \pm 1.98\%$, respectively).

In both instances (Baseline and Final Evaluation) the person who mainly took care of the poultry was the adult male (q1406). In general, around 60% of the households did use to buy poultry feed but when households bought it, the main responsible person of buying the poultry feed was also the adult male (q1408: $24.16 \pm 2.37\%$). It is a cultural habit that all in the household belongs to the chief of the family. In practise poultry belong to women and it is mainly women and children who take care of the poultry.

Before the intervention, around 18% of the households did not buy medicines for the poultry but when medicines were bought, the adult male was the main person who took the decision for buying them (q1409, $63.74 \pm 2.56\%$). After the intervention, almost 94% of the households bought medicines, and the main decision for buying them was mainly taken still by the adult male of the house although the role of the woman was more notable than before (q1409, $52.51 \pm 2.57\%$ and $38.52 \pm 2.50\%$, respectively).

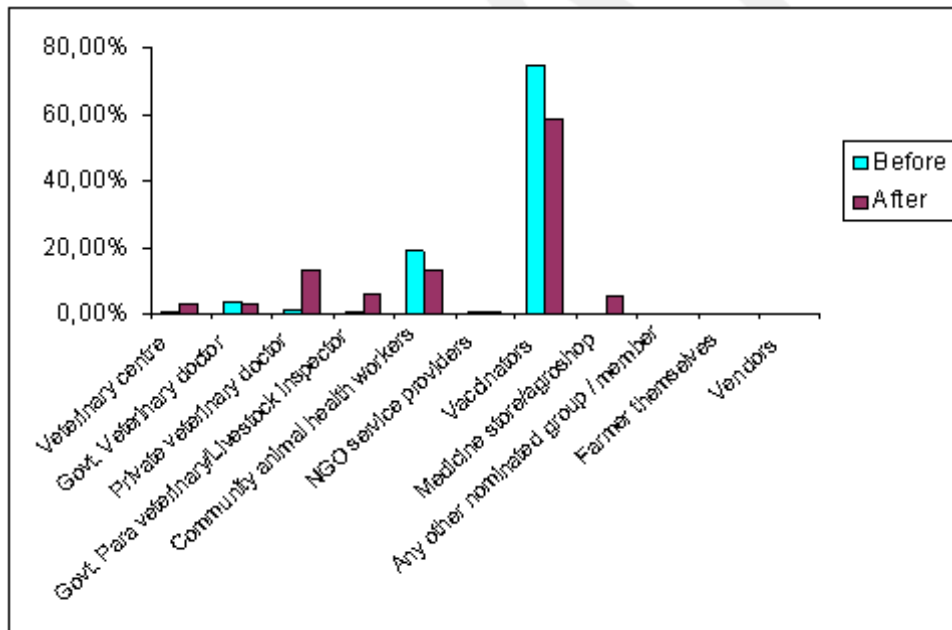
In both instances (Baseline and Final Evaluation) the decision about poultry sales was mainly taken by the adult male (q1410, $92.76 \pm 1.49\%$ and $68.30 \pm 2.66\%$, before and after intervention, respectively). Around 35% of the poultry used to be sold to the market or was collected by agents, about 35% to village grocery shops and around 20% directly to consumers in other villages/ cities (q1411). The adult male was the person who mainly took the decision about how to use poultry income (q1413, $80.59 \pm 2.15\%$, and $64.06 \pm 2.58\%$, before and after intervention, respectively), followed by the adult female (q1413, $15.59 \pm 1.97\%$; and $35.94 \pm 2.58\%$, before and after intervention, respectively).

No money was borrowed to rear poultry either in the 12 months prior to the first questionnaire administration (q1414) or during the time between the Baseline and Final evaluation (q1414).

In both instances (Baseline and Final Evaluation), most of the households treated ill poultry going to community animal health workers or using traditional remedies or going to private veterinarians (q1415, after the intervention $45.07 \pm 2.05\%$; $24.83 \pm 1.78\%$; and $11.22 \pm 1.30\%$, respectively)

The basic veterinary services used by the households are shown in Figure 1 (q1418).

Figure 1. Basic veterinary services used for poultry.



In both instances (Baseline and Final Evaluation), respondents reported that the main causes of poultry losses were due to infectious diseases, predators, theft and parasites (q1419, after the intervention $32.59 \pm 1.53\%$, $31.95 \pm 1.52\%$, $15.12 \pm 1.17\%$ and $19.70 \pm 1.30\%$, respectively).

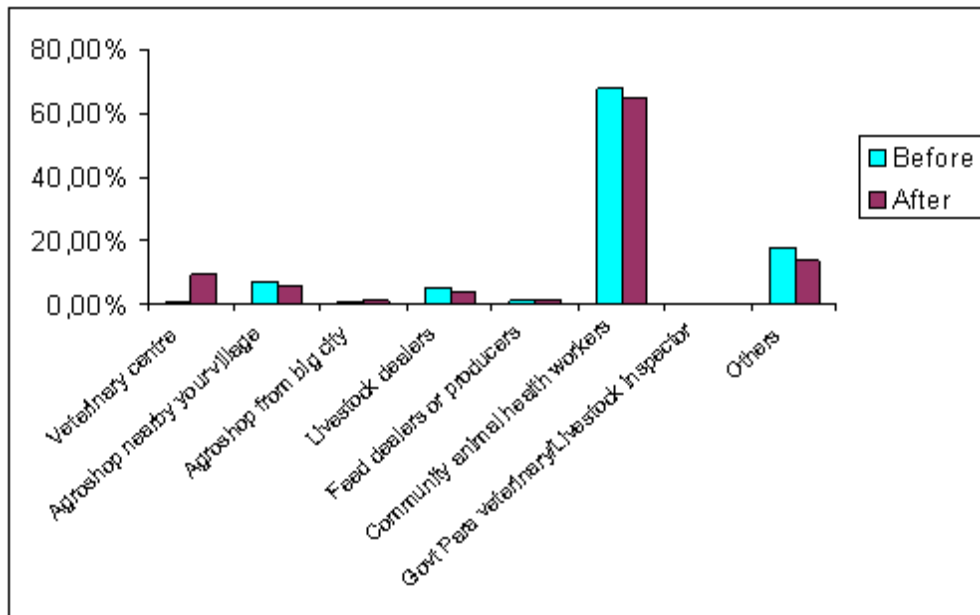
When poultry were ill, the major signs were: gasping, coughing, twisted necks, green diarrhoea, white diarrhoea and swelling of eyes and head (q1420). The preventive measures taken to avoid disease or outbreaks were very variable (q1429) although vaccination was the main option (q1429, $19.06 \pm 1.03\%$ and $17.78 \pm 0.96\%$, before and after intervention). The intervention has helped to increase the sensitivity in rearing poultry. This likely reflects positively on the training and services provided during the intervention, as the respondents are now more capable of discerning which diseases are killing their poultry. This assessment should be taken with care and confirmed in the field (q1416).

Basic biosecurity measures were implemented during and after the intervention to avoid the transmission of the poultry diseases (q1416). Newcastle disease, fowl pox, cholera and fowl coryza were the notable causes of poultry loss in the study area (q1416, after the intervention $22.37 \pm 1.13\%$, $20.09 \pm 1.09\%$, $17.22 \pm 1.02\%$ and $15.01 \pm 0.97\%$, respectively). Poultry are dying within 1 to 2 days after the onset of clinical signs (q1421), and most of them were disposed off by burial (q1426).

Before the intervention most of the household vaccinated poultry against ND (q1424 and q1431) but around 70% of the respondents reported to have had an outbreak of ND the 12 months previous to the baseline evaluation (q1434). The reasons provided by 5% of the households for not using the ND vaccine were that vaccines and vaccinators were not available and the high cost of the vaccines (q1431, $27.78 \pm 7.47\%$, $16.67 \pm 6.21\%$, and $16.67 \pm 6.21\%$, respectively).

Vaccines were distributed in a variety of ways (q1436), but community animal health workers and veterinary centers were the main providers (see Figure 2).

Figure 2. Newcastle vaccine providers (q1436).



Before the intervention, poultry were vaccinated by direct injection (q1430, $92.13 \pm 1.54\%$) mainly on a non specific location and secondly at the farmer’s homestead (q1424, $74.72 \pm 2.29\%$ and $18.06 \pm 2.03\%$, respectively) along the year, but more frequently on January, February, September, October and November (q1432). In general, the respondents did not buy the ND vaccine (q1425, $94.85 \pm 1.34\%$).

The main changes occurred as a result of the intervention, were that poultry were vaccinated at the private veterinarian doctors or by the community animal health workers (q1427) by eye drops (q1430) in February, June and October (q1432). The respondents who reported to have had an outbreak of ND decreased from 72.55% before to 20.92% after the intervention period (q1434, $p < 0.001$).

The average number of ND vaccine doses per vial purchased was 100 doses per vial (q1423) and the average price was 60.15 CFA per bird (q1428).

e) Livestock population before and after the intervention

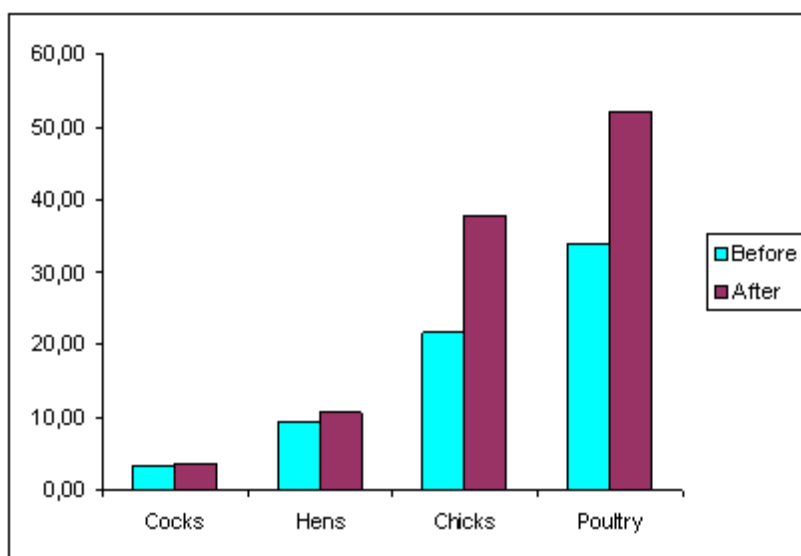
Table 8 and Figure 3 provide the summary of the different livestock population in the area before and after the intervention. The number of poultry has significantly increased after the project.

Table 8. Livestock population per household.

	Before	After	Difference	SE	Lower CI	Upper CI	p-value
Number of male poultry	3.42 Cocks	3.64 Cocks	0.23	0.05	0.12	0.34	<0.001
Number of female poultry	9.18 Hens	10.61 Hens	1.46	0.16	1.14	1.77	<0.001
Number of chicks	21.56 Chicks	37.70 Chicks	16.24	1.16	13.95	18.53	<0.001
Total number of poultry	34.05 Poultry	51.95 Poultry	17.90	1.22	15.49	20.30	<0.001
Number of ducks	0.68 Ducks	0.71 Ducks	0.03	0.02	0.00	0.06	<0.001
Number of Guinea fowl	5.41 Guinea fowl	5.73 Guinea fowl	0.32	0.07	0.18	0.46	<0.001
Number of dairy cattle	0.15 Dairy cattle	0.26 Dairy cattle	0.12	0.12	-0.11	0.34	<0.001
Number of cattle	3.11 Cattle	3.12 Cattle	0.01	0.00	0.00	0.02	<0.001
Number of dairy goat	0.11 Dairy goat	0.11 Dairy goat	0.00	0.00	0.00	0.00	N/A
Number of goat	7.79 Goat	8.04 Goat	0.25	0.05	0.14	0.35	<0.001
Number of sheep	7.34 Sheep	8.25 Sheep	0.91	0.19	0.53	1.30	<0.001
Number of donkey	1.38 Donkey	1.38 Donkey	0.00	0.00	0.00	0.00	N/A
Number of pigs	1.65 Pigs	1.78 Pigs	0.12	0.05	0.02	0.23	<0.001

SE: Standard Error. CI: Confidence Interval

Figure 3. Livestock population per household.



Cock, hen, chick, poultry, guinea fowl, goat, sheep and pig population increased significantly after the intervention. The number of dairy cattle, cattle, dairy goats and donkey remained almost unchanged during the intervention period.

Weekly egg production per household remained unchanged in around 13 eggs per week (q1449 transformed to weekly production), Confidence Interval (CI) of difference, -0.03 to 0.10, $p > 0.05$). The price of one egg increased slightly from 42.28 to 45.19 CFA per egg (q1455). Around 65% of the respondents did not sell eggs but when they did, eggs were sold to village grocery shops, or to the market (via an agent who collected them at the doorstep) and to other households in the village (q1412, $14.69 \pm 1.88\%$, $7.63 \pm 1.41\%$ and $3.67 \pm 1.00\%$, respectively).

Poultry production increased slightly from 1.18 to 1.35 poultry produced per household per month (q1451, CI 95% of the difference 0.02 to 0.08 poultry produced monthly, $p < 0.01$). The sale of poultry remained unchanged, selling 2.88 poultry per month (q1452, CI 95% of the difference, -0.01 to 0.30, $p > 0.05$) and the sale price of one bird increased from 2,060.76 to 2,141.78 CFA per month (q1456 CI

95% of the difference, 53.06 to 110.85, $p < 0.001$). The poultry production in the project area increased significantly but it is only a slight increase. The replacement of poultry remained unchanged in 2.33 poultry (q1453, CI 95% of the difference, -0.02 to 0.08, $p > 0.05$), and the price for one replacement bird increased from 1,442.62 to 1,499.34 CFA (q1457, CI 95% of the difference, 35.03 to 81.75 CFA, $p < 0.001$). For replacement of poultry there is a habit to exchange poultry (cocks and hens).

Finally during the study period, households interviewed spent more money in poultry feed per month, from 728.51 to 759.34 CFA monthly (q1458, CI 95% of the difference, -2.55 to 54.33 CFA, $p < 0.05$). The project sensitised farmers on better taking care of the chicks by buying food for them. The monthly expenditure for poultry medication increased in 4,258.33 CFA per household (q1459, CI 95% of the diff. 775.63 to 1141.67 CFA, $p < 0.001$). This increase in monthly poultry health expenses was also seen in veterinary or other professional fees increasing from 3,975.74 to 4,947.16 CFA per month (q1460, CI 95% of the diff, 437.46 to 1518.15 CFA, $p < 0.001$).

3. Cost Benefit Analysis

Table 9 presents the average values in the pre and post intervention questionnaires. The period between these two questionnaires was one year. These data has been used for the cost-benefit analysis (CBA).

Table 9. Data from the questionnaires used for CBA.

No Q	Question	Units	Before	After
q1437	Number of male poultry that you keep in the household	Cocks	3.42	3.64
q1438	Number of female poultry that you keep in the household	Hens	9.18	10.61
q1439	Number of chicks that you keep in the household	Chicks	21.56	37.70
q1458	How much money do you spend in poultry feed per month?	CFA per month	728.51	759.34
q1449	Number of eggs produced daily	Eggs per day	1.89	1.92
q1454	Price of one kg of feed bought	CFA per kg	170.81	171.26
q1450	Number of eggs sold weekly	Eggs per week	6.18	6.66
q1455	Price of one egg	CFA	42.28	45.19
q1451	Number of poultry produced monthly	Poultry per month	1.18	1.35
q1452	Number of poultry sold monthly	Poultry per month	2.35	2.88
q1456	Price of one poultry sold	CFA	2,060.76	2,141.78
q1453	Number of poultry bought for replacement during the last 12 months	Poultry	2.30	2.33
q1457	Price of one poultry for replacement	CFA	1,442.62	1,499.34
q1459	Value of the medicines or vaccines bought for poultry during the last 12 months	CFA	3,303.80	4,258.33
q1460	Veterinary or other professional fees paid for poultry during the last 12 months	CFA	3,975.74	4,947.16
q1461	If you have a specific poultry house which is the estimated value of the poultry house	CFA	13,572.92	13,949.17

Note: Poultry and eggs used for own consumption, hatching or as gifts, are calculated as the difference between poultry/eggs produced and poultry/eggs sold.

Table 10 shows the total annual net income in CFA during last year. It is the difference between data obtained in the Baseline Survey and the Final evaluation after the intervention. The increase in the average annual net income is CFA 21,714 (approximately USD 43 at the time of the report, May 2013). Inflation for that period is not accounted for (see under methodology section).

Table 10. Average annual net income from poultry per household in local currency (CFA)

Income and expenses in local currency during the last 12 months	Before	After
Poultry income	58,162	74,070
Eggs income	13,587	15,651
Poultry feed expenses	-8,742	-9,112
Poultry replacement	-3,319	-3,494
Value of the medicines or vaccines bought	-3,304	-4,258
Veterinary or other professional fees paid	-3,976	-4,947
Cost of repair and maintenance in the poultry house	-4,027	-3,965
Sub-Total cash	48,382	63,945
Eggs self-consumption income	15,560	16,045
Poultry self-consumption income	29,107	34,772
Sub-Total non-cash	44,668	50,818
Total annual net income	93,049	114,763*

* Increase of net annual income is CFA 21,714 (approximately USD 43 at the time of the report – May 2013).

Table 11 shows the difference in the assets in the interviewed households before and after the project.

Table 11. Average poultry assets value per household before and after the intervention (in CFA).

Assets	Before	After
Animals	25,972	30,524
Fixed assets	13,573	13,949
Total	39,545	44,473

All calculations have been done in nominal local currency.

4. Limitations

The purpose of the Baseline and Final Evaluation was to assess the impact of the project at farmer level. However, because there were no control households, it cannot be categorically said that the improvement in poultry production/health was entirely a result of the project. However, the absence of other poultry interventions in the area during the period, combined with the fact that the project targeted poultry production/health, strongly indicates that the differences observed are mainly due to the project intervention.

5. Conclusions and way forward

a. Conclusions

The main conclusions from the data collected after administration of the questionnaire to 306 households in Burkina Faso are:

1. The training offered by the intervention team has improved the knowledge in livestock husbandry practice and production methods which enhanced the health care of poultry and shoats.
2. During the study period, the outbreaks of ND observed during the intervention period decreased significantly. However, around 20% of households interviewed still claimed to have had an outbreak of ND. Previously ND outbreaks occurred twice a year in the months of January through February and another outbreak in the month of September through October.

3. The project was designed to work directly with the with both men and women, but the males in the households were the owner and the main responsible for caring poultry and for taking decision regarding monetary decisions, hence they were the majority of the participants in most activities. However, after the intervention the women participate more actively in poultry activities.
4. The number of poultry per household has increased from 34.05 in the Baseline Survey to 51.95 on the Final Evaluation. The increase is mainly due to the number of chicks managed to be protected from Newcastle Disease.
5. Monthly poultry production per household has increased slightly, from 1.18 to 1.35 poultry produced per month per household, as well as the number of poultry sold (from 2.35 to 2.88).
6. Annual poultry feed expenses increased by 759.34 CFA per household and annual medicines expenses increased by CFA 4258.33 per household. The increase in expenses is explained by the increase in poultry production.
7. The annual net poultry income has been increased on average by 21,714 CFA (approx. USD 43) per household after the project intervention.
8. This model will be sustainable because all the actors involved have an obvious interest in its perpetuation since everybody enjoyed some level of profit.
9. Demand of service from poultry keepers outside of the project area is growing due to increased awareness and consistency of disease control message sent to them by various stakeholders of the project.
10. Poultry keepers are ready to buy efficient vaccine to protect their birds the fact that they have seen how protective the vaccine is to their chicken against Newcastle Disease.
11. Farmers who received the training on poultry husbandry better raise their birds. The project extended the benefits to vaccinators and poultry keepers alike by training poultry vaccinators in the use of small ruminant dewormers. This has increased the profits of vaccinators and it will be one of the major areas of concentration to future intervention on poultry health and husbandry to ensure that farmer realizes a greater deal of using animal health products.
12. The project has contributed to increased incomes along the delivery chain. Each member along the chain enjoys some benefits and realized a certain level of profit which is a good indicator of sustainability.
13. It was also noted that distribution of animal health products for poultry has increased and the overall activities of the private veterinarian increased from 15% to 35%.
14. The project improved the knowledge of all key players who are selling animal/ poultry vaccines through training them on cold chain maintenance and business train. Those kind of training has never been carried out before and it turn to be very useful to all participants trained.

b. Way forward

The future actions as identified by Veto-Impact, must focus on the main actors in the distribution chain, namely poultry vaccinators and livestock keepers.

➤ Poultry vaccinators

- There is a need to train more vaccinators to cover a broader area and to neighbouring regions (Centre South region)
- Vaccinators need to expand their activities to include small ruminant vaccination and fowl pox vaccination
- Providing these actors with hatcheries to produce and sell chicks to poultry keepers is another route to enable them to better develop their businesses
- It would be valuable to provide vaccinators with business/entrepreneurial training to strengthen their network

➤ Backyard livestock keepers

- There is a need for capacity building in proper poultry husbandry to help poultry keepers realise more profit from their birds and start raising them as a business
- To provide backyard poultry keepers with a more organized framework for them to organize their markets. This will allow them to be organized into groups for bulk service demand and bulk commercialisation of their products
- There is a need to conduct a test on little guinea fowl production. In some households guinea fowl compete with chickens but their raising faces a lot of constraints mainly the high mortalities of little guinea fowls