The Role of Non-Governmental Sector in Community Water, Sanitation and Hygiene Technologies and Services in North-Western Ghana

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Abstract

Despite the Sustainable Development Goals which have been adopted since September 2015, research findings on sectoral achievements of the gaols are inadequate. This study ascertained the approaches, effectiveness, implications and challenges of the Centre for Indigenous Knowledge and Organisational Development as a Non-Governmental Organisation (NGO), in promoting access to water, sanitation and hygiene (WASH) through its water for resilience project in rural communities of the Lawra Municipality and Nandom District of the north-western corridor of Ghana. A before-and-after study design with mixed methods research approach was used, and theoretically dictated by the Malongza's model. Sample sizes of 400 for ex-ante evaluation and 260 at the ex-post evaluation stages were used. It was found that the intervention improved WASH technologies and services, provided schools with vegetables, equipped women with livelihood opportunities and reduced diarrheal diseases, but challenged by implementation deadlines. Joint public and private sector interventions to make WASH services sustainable in rural communities were recommended.

Keywords: Water, Sanitation, Hygiene, Rural Communities, Schools

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Introduction

The international community has been implementing the Sustainable Development Goals (SDGs) since their adoption on the 25thSeptember, 2015. However, research findings on progress towards achievement of the SDGs are inadequate (Kitzmueller et al., 2021). The broad nature of the sectors contributing towards the achievement of the SDGs compels this paper to limit itself to the Non-Governmental Organisational (NGO) sector.

NGOs are independent of national or international organisations, but could receive funding from national and international levels (Davies, 2014). This study focused on the roles of NGOs in achieving SDG 6, on Clean Water and Sanitation for all (United Nations [UN], 2015). Sustainable Brands (2016) identifies several internationally acclaimed NGOs using various approaches in the WASH sector. Examples are DIGDEEP. which plans water access projects based on human rights approach; WaterAid, which uses participatory approaches for the provision and management of community WASH projects, while 'Water: Charity' partners with local stakeholders for community needs assessments and location of water points. The 'Instituto 4 Elementos' of Brazil, and CeTAmb Lab of Italy, initiated projects for improving the WASH needs of Anapolis public schools (Action Network, 2016). However, all these remain institutional reports on existing roles, with little or no published details of the implementation process towards achieving SDG 6.

The effectiveness of WASH interventions is measured by the reduction in risk of disease (Yates et al., 2018). Thus, accessibility, quality and user satisfaction with WASH facilities, depend on how they promote good health, by the prevention of water-wash diseases such as skin infections and water-borne diseases such as cholera. It also promotes physical, emotional and social potentials (Bukari, 2017; Coffies, 2014; Odonkor et al.2019).

Theoretically, the Multi-factorial Pro-poor Community Water Service Model (Malongza's Model) explains how an organisation could identify a development challenge in community water services, initiate partnership formation, define specific water problems to be addressed in a defined geographical area, and the use of tri-sector partnership approach for proposed project implementation (Bukari & Abagre, 2013). The tri-sector approach involves three sectors, namely the NGO, the public or local government sector and the target communities (The Netherlands Development Organisation [SNV], 2009). Although this model is relevant, the literature does not report an instance of its application in the assessment of WASH projects. The Transtheoretical Model also explains how development is undertaken through pre-contemplation, contemplation, preparation, action, maintenance, and termination stages of change (LaMorte, 2018). Prochaska and DiClemente (1983) originally used the model to explain changes in addiction to tobacco in the 1970s, but it was Rainey and Harding (2005) who modified it to explain decision-making on adoption of WASH technologies. They could not however, account for the place of participation, policy and sectoral roles on the outcomes. Dau-Scmidt (2001) and Reynolds et al. (2006), in their interpretation of the Stakeholder Theory, asserted that stakeholders of an organisation cannot achieve the goal of the complex whole in isolation, because the absence of any member affects the whole organization adversely. But the theory was propounded for organisational management, and later found application to participatory water tariff determination by Bukari (2017). However, its tenets offer little guidance for the analysis of NGOs in WASH technologies and service interventions. A survey of mainstream literature on participatory models in the WASH sector thus far, shows that the Malongza's Model is more suitable for describing the relationships between sectoral stakeholders, services, technology and policy contexts (Bukari & Abagre (2013). Since this model was not originally linked to any international development policy context, its application could help to address the literature gap.

Practically, local NGOs are active in the WASH sector, but their activities have not been formally studied and published. The Centre for Indigenous Knowledge and Organizational Development (CIKOD) is a Ghanaian NGO developing methodologies to strengthen traditional authorities and civil society organisations to facilitate pro-active, equitable and sustainable community development by giving voice to the poor and vulnerable rural households (International Tree Foundation, 2018). This paper uses CIKOD's provision of WASH technologies and services, with beneficiary communities and schools in the Lawra Municipality and Nandom District in north-western Ghana as a case study.

CIKOD's intervention was through the Water for Resilience project, involving the mobilisation of local resources for WASH technologies and dry season gardening for schools and women for livelihood improvement and meeting WASH needs for good health by promoting resiliency to drought or climate related vulnerabilities (CIKOD, 2016). The project covered 24 months (2017 to 2019). Other stakeholders were HELVETAS Swiss Intercooperation and Groundswell International as initiators and facilitators with CIKOD, and funded by Margaret A. Cargill Foundation. It became necessary to access the effectiveness of CIKOD as an NGO in the WASH sector in a global policy context by addressing the following research questions.

What approach does the Centre for Indigenous Knowledge and Organisational Development use in its roles for the planning of water, sanitation and hygiene technologies and services for the communities?

How effective is the approach used by the Centre for Indigenous Knowledge and Organisational Development in the implemented projects for water, sanitation and hygiene technologies and services?

What are the implications of the relationships between water, sanitation and hygiene on the livelihoods of the people?

What challenges does the Centre for Indigenous Knowledge and Organisational Development face in its water, sanitation and hygiene technology and services project?

Conceptual Contexts

Clean water is water that is safe for drinking by humans because it is protected at source and free of mineral and biological contaminants (Greenhalgh, 2001; Pickut, 2015).Sanitation refers to an environmental management, involving the provision of facilities and services for the collection, storage, treatment and safe disposal of excreta, liquid and solid wastes (World Health Organisation, 2018).Hygiene covers teeth brushing, clothing, hand and face washing and bathing with soap and water, in order to improve cleanliness for good health (Centres for Disease Control and Prevention, 2016).

For a unified statistical model, we adapt the collective concept of water, sanitation and hygiene (WASH), because when these are addressed together, they reduce morbidity, mortality, poverty, and improved educational outcomes (Kooy &Harris, 2012). However, the individual concepts were measured separately. Inadequate access to, and the use of unsafe water, poor sanitation and hygiene cause 1,800 deaths daily among children under five years old (United Nations Children's Fund [UNICEF], (2013). With the effectuation of the SDGs, it becomes necessary to ascertain efforts towards addressing such problems, focusing on roles of NGOs in WASH technologies and services.

Baumann et al. (2010) disclose that WASH technologies (which are the facilities that make WASH needs producible) linked to UNICEF, include hand pumps for drinking water, boreholes and drilling equipment for rural water supply, solar powered pumping, motorized piped systems and faecal sludge emptying equipment. However, this exposition documents guidelines on how a programme using the UNICEF WASH technologies could be

implemented, leaving more to be desired about the results of NGOs which have implemented WASH technologies.

WASH services are actions directed at helping or working to ensure that WASH needs are met, and composed of the provision of the physical infrastructure (hardware) and the social and economic impacts (software) (WaterAid, 2021). But WaterAid was rather advocating for appropriate management models that could make WASH services and technologies more sustainable, which emphasises the inadequacy of literature on practical results of NGO interventions in WASH services and technologies.

Having down-scaled the theories and models to the most suitable one in the introduction section, we settled on the Malongza's Model (Figure 1), to guide the exploration of how the interventions of a typical NGO such as CIKOD, contributes to the achievement of SDG 6 by examining its activities in WASH services and technologies. The model is among the cluster of community development models that advocate for joint implementation of rural water projects and poverty reduction schemes (Bukari & Abagre, 2013). It explains the potentials of an individual organization to identify a development problem and initiate for partnership; tripartite partnership formation; identification of low-income communities with sector specific problems for intervention; and project implementation or intervention in pro-poor water services.

The Malongza's Model is of the tripartite partnership category, which advocates for partnership involving the public, private and community level institutions, and prescribes multiple factors for execution by the partners. These include provision of physical infrastructure, opportunities for technology choice for low-income communities, funding of projects, joint management by all stakeholders, capacity building and economic empowerment, positive attitudinal development, and beneficiary responsibility for quota contribution in terms of project funding and system maintenance (Bukari & Abagre, 2013).

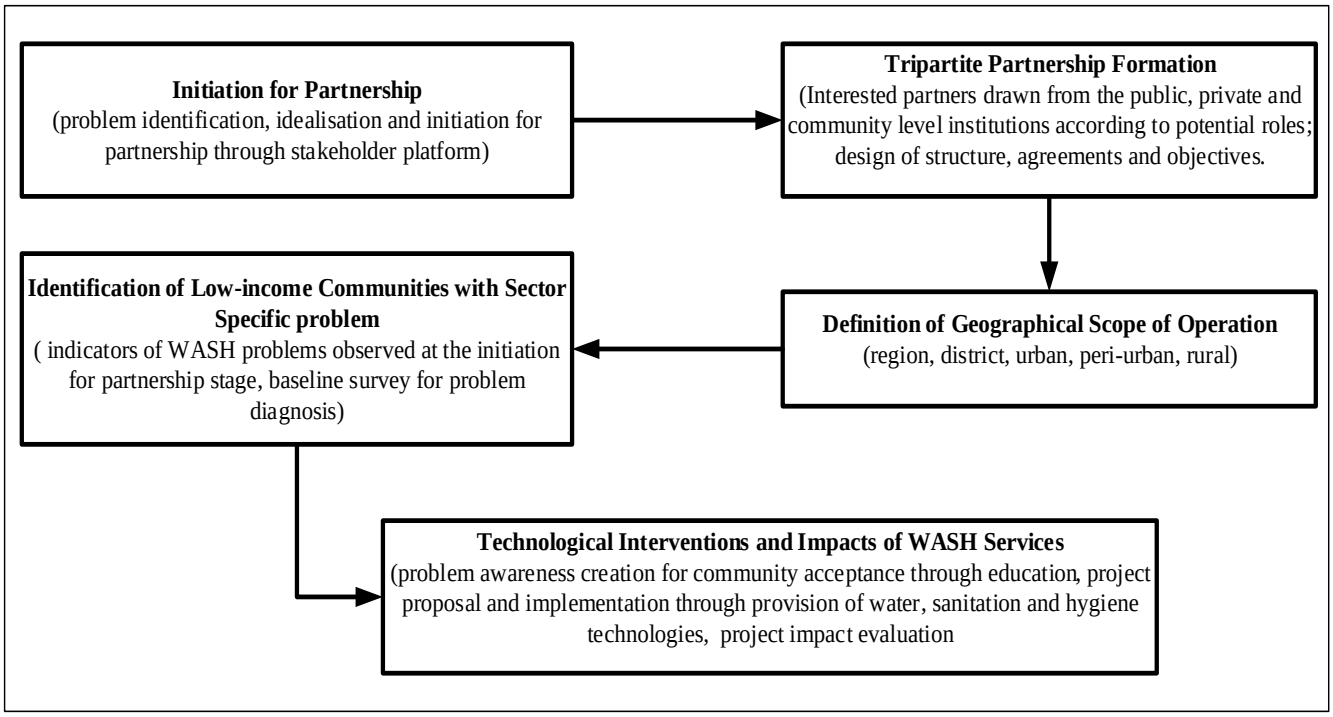

Figure1

Multi-factorial Pro-poor Community Water Service Model in WASH Context

Source: Based on the Malongza's Model (Bukari & Abagre, 2013)

We expand the Malongza's Model to include sanitation and hygiene interventions, in order to assess the roles of CIKOD in WASH. From Figure 1, we derive a function expressing the relationship between satisfactory WASH services and specific aspects of NGO (CIKOD) interventions. The function is as follows:

$$C = f(E, R, Z) \qquad \text{eq.1}$$

C represents meeting of beneficiary needs of WASH through NGOs as the dependent variable, E represents education (training, sensitisation) of people in target communities on WASH projects, R for provision of the technologies that satisfy the WASH needs, Z for other explanatory variables such as the stakeholder participatory process and inclusion of poverty

reduction schemes for the sustainable WASH projects. This function is a modification of the effective demand function by Munasinghe (1992).

Research Methods

Sampling, research design and methods of data collection

The study areas, purposively selected because of CIKOD's intervention were Nandom District and Lawra Municipality. Households, students and school authorities in the beneficiary communities were the sample frame. The before-and- after study design was used. This involved a baseline survey of the existing WASH technology and service situation in the CIKOD's intervention in 2017, followed by an evaluation of the situation after the intervention in 2019 (see Galaa & Bukari, 2014).

During the baseline survey, Lawra Municipal population was 87,525, with 47% males and 53% females, and Nandom had 46,040 comprising 48.4% males and 51.6% females (GSS, 2014a & b). The sampling unit was the household. The Tanchara, Kasegra and Eremon rural communities in the Lawra District, and Goziir in the Nandom District had no known population sizes. The sample size was therefore estimated with the formula below.

$$Sample\ size\ (n) = \frac{t^2\ x\ p(1-p)}{m^2}$$

Source of formula: Interceptum (2017).

Where n = required sample size
t = Confidence level at 95% (standard value of 1.96)
p = Estimated prevalence of population either aware of, or benefited from WASH projects in the study areas. These were unknown, so best decision is 50% or 0.5
m = Margin of error at 5% (standard value of 0.05).

The formula yielded 384, which was rounded off to 400 and equally distributed among the eight communities (50 households each) in the two districts.

Table 1*:* Distribution of respondents by communities

District	Community	Number of household respondents
Lawra	Tanchara,	50
	Gbengbee	50
	Kasegra	50
	Eremon	50
Nandom	Ko	50
	Goziir	50
	Brutu	50
	Mornyupelle	50
	Total	**400**

Source: Field survey, 2017.

According to Interceptum (2017), the above formula is used for study populations without a known size, such as online market surveys, and sample sizes between 200 and 400 increase results' reliability. It is justified by its provisions for estimated prevalence of the phenomenon under investigation, margin of error and confidence level. Snow-balling was used to select 50 households from each of the eight communities in the sample frame to respond to structured household interview schedules with close-ended questions for quantitative data.

Using the mixed research design, qualitative data were obtained from focus group discussion (FGD) guides administered to Community Water and Sanitation Committees, Traditional Leaders, Women's Market Gardening groups and pupils of beneficiary schools selected by the school authorities. Key informant interview (KII) guides were administered to officials of CIKOD, Community Water and Sanitation Agency Officers, the District Water and Sanitation Team (DWST) officials at Lawra Municipal and Nandom Districts, Community Development Officers, health officials, Agricultural Science Teachers in charge of project school gardens and Head Teachers. Responses from FGDs and KIIs were transcribed into field jotters for storage.

Purposive sampling was used to select respondents for qualitative data collection. Observation check list and cameras were used to record observable information and take pictures of WATSAN technologies, project gardens, and sanitation and hygiene practices in the

communities. Semi-structured items were listed for observation, while open-ended questions were used for interviews and focus group discussions, based on themes derived from the research questions as in the quantitative tools for cross-triangulation.

At the 'after' stage of the study, design ex-post evaluation was conducted in 2019 to assess the achievement of the objective of promoting access to WASH technologies and services and the livelihood impacts. Houses around each new project boreholes and gardens in each community were taken as a cross-section and totally enumerated. This gave 138 for Lawra Municipal and 122 for Nandom District Communities. A beneficiary household was selected from each house in the cross-sections. The first beneficiary household member we met in a house who was 15 years or older was accidentally selected. Other members of the same household could join in answering the questions.

At the ex-post evaluation stage, questions sought to compare the existing situation to the situation before the CIKOD's interventions in WASH technology and services and the challenges, using similar instruments as before. Table 2 shows distribution of the sample size by communities and schools in 2019.

Table 2*:* Number of household respondents in the project areas and selected schools

Municipality/District	Village	Number of households	Beneficiary Schools
Lawra Municipal	Eremon	25	Naburnye Primary School
	Gbengbee	21	Eemon D/A Primary School
	Kalsagri	48	Kalsagri D/A Primary
	Tanchara	43	Tanchara Primary School
	Sub-total	138	
Nandom District	Brutu	20	Brutu Junior High School (JHS)
	Gozir-Naayir & Goziir Duropuo	30	Goziir Primary School
	Ko	42	Ko RC Primary School
	Monyupelle	30	Monyupelle Junior High School
	Sub-total	122	
	Grand Total	260	

Source: Field survey, 2019.

The justification for the before-and-after study design was to facilitate the measurement of changes in access to WASH services and technologies and the implications on household livelihoods before and after the CIKOD'S interventions. Its limitation was the lack of record keeping by households, which impacted on the accuracy of retrospective answers. The remedy was by cross-triangulation of responses from different sources. There was also a desk review as detailed in Table 3.

Table 3: Desk review strategy

Area of review	Documents Required	Source
Project background and objectives, implementation strategies	Project Proposal	CIKOD
Project Activities	Project Proposal	CIKOD
Field activities	Project activity report	CIKOD
State of project communities before commencement of project	Baseline study report	CIKOD
Demographic characteristics of the communities	Population and Housing Census reports	Ghana Statistical Service

Model specification

From eq.1, we further developed specific binomial probability distribution models for binary logistic regression (binary logit) for the various aspects of CIKOD's interventions in WASH. Binary logit uses a logistic function to measure relationships between a dependent and an independent variable by estimating binomial discrete probabilities (using only two values). We hypothesised that:

> H_{01}: CIKOD's role in the education of communities has no significant relationship with good WASH practices by households.
> H_{02}: CIKOD's role in the provision of technological facilities in the communities has no significant relationship with household satisfaction with accessibility to WASH services.
> H_{03}: CIKOD's role in the engagement of community members in WASH services has no significant relationship with livelihoods of households

H_{01}, H_{02} and H_{03} are stated to test E for education, R for provision of facilities and Z for other explanatory variables in the function: C =*f (*E, R, Z) or eq.1.

We consider C as the dependent variable and c_i as the realisation of C with respect to the probability of the i^{th} respondent's expression of awareness of the impacts of CIKOD's interventions on WASH, which could take the values 'No' or 'Yes', coded 0 and 1 respectively for specified aspects of WASH interventions. Similarly, e_i, r_i, *and* z_i are the responses on the effects of the independent variables E, R, and Z respectively on CIKOD's interventions on WASH. The response c_i is defined as:

$$c_i = \begin{cases} 0: \text{if a respondent } i \text{ does not recognise the effects of CIKOD interventions on WASH (No)} \\ 1: \text{if a respondent } i \text{ recognises the effects of CIKOD interventions on WASH (Yes)} \end{cases}$$

Similarly, the responses e_i, r_i and z_i have the same encodings, and are defined as:

$$e_i, r_i, z_i = \begin{cases} 0: \text{if a respondent } i \text{ does not choose the option of interest} \\ 1: \text{if a respondent } i \text{ chooses the option of interest} \end{cases}$$

(See Powers & Xie, 1999).

The probabilities of the i^{th} respondent choosing 0 and 1 are $1-\pi_i$ and π_i respectively. This implies that if c_i=0, we obtain $1-\pi_i$, and if c_i=1, we obtain π. Furthermore, there are n_i observations that take on the values 0,1.....n_i. . The probability distribution function of C is:

$$\Pr\{C_i = c_i\} = \binom{n_i}{c_i} \pi_i^{c_i}[1-\pi_i]^{n_i - c_i} \qquad \text{eq. 2}$$

Here $\pi_i^{c_i}[1-\pi_i]^{n_i-c_i}$ is the probability of obtaining c_i successes, and the discrete binomial probability distribution functions for binary logit for the independent variables E, R, Z are expressed as:

$$P_r\{E_i = e_i\} = \binom{n_i}{e_i} \pi_i^{e_i}[1-\pi_i]^{n_i - e_i} \qquad \text{eq. 2.1}$$

$$P_r\{R_i = r_i\} = \binom{n_i}{r_i} \pi_i^{r_i}[1-\pi_i]^{n_i - r_i} \qquad \text{eq. 2.2}$$

$$P_r\{Z_i = z_i\} = \binom{n_i}{z_i} \pi_i^{z_i}[1-\pi_i]^{n_i - z_i} \qquad \text{e.q. 2.3}$$

For $e_i, r_i z_i$ =0, 1.....n_i

Equations eq. 2.1, eq.2.2 and eq.2.3 aided the design of questions that provided data to test hypotheses $H0_1$, $H0_2$ and $H0_3$ respectively. The Statistical Package for Social Sciences

(SPSS) v.20 software was used to analyse the data. References were made to the P-values with cut-off point of 0.05.

Data analysis

Qualitatively maps, pictures, narrations and direct quotation of respondents were used to present data, while quantitatively, descriptive statistics (frequency tables and charts) and inferential statistics (hypothesis testing) were used. Analyses was based on the thematic areas derived from the research questions and hypotheses. Philosophically, the mixed methods research approach made it possible to apply post-positivism, which combines subjective and objective positions concurrently for enhancing understanding of results (Creswell, 2011).

Ethical considerations

At the pre-community entry stage, a bibliographic documentation of the study communities, distribution of letters for permission to conduct the study and expected roles of target recipients, getting contact persons, instrument design and pretesting were done. At community entry, identifying the first person to pass through into the community (Chiefs), learning the acceptable morals of the people, how to ask questions for easy understanding, transcription, field data cleaning and storage were carried out to improve quality of responses and normality of research results (Flick, 2013). At community exit, gratitude was expressed local authorities for granting permission for the survey, and anonymity of information provided by individuals was pledged.

Results and Discussion

This section analyses and presents the data under appropriate themes based on the research questions, guided by the adopted designs and the conceptual framework.

Approach used in Planning of WASH Services

This section addresses the first research question about approaches used by CIKOD in WASH interventions. CIKOD initiated the Water for Resilience Project in 2016 after realising that

drought and climate change posed threats to access to surface water resources in rural communities and schools of the Lawra Municipality and Nandom District. This was manifested by drying up of dams/streams and wells during the dry season, causing water shortage for domestic uses, personal hygiene and dry season irrigation. The access to urinals, latrines, water points and hand washing facilities also constrained the running of basic schools, while community sanitation required further improvement (CIKOD, 2016). This marked the first tenet of the Malongza's Model, about identification of a development problem and initiation for partnership (Bukari & Abagre, 2013).

During a focus group discussion at Tanchara with women's group, a participant responded to a question on how the water for resilience project was arrived at as follows:

> *CIKOD came and mobilised community members, chiefs and women's groups to participate in the identification of water, sanitation and hygiene challenges and the formation of community Water and Sanitation Committees, construct water, sanitation and hygiene facilities and dry season gardening for women.*

The mobilisation of community members for participatory management of the WASH project manifests CIKOD's contribution to the achievement of SDG 6, Target 6B. This aims to support and strengthen the participation of local communities in improving water and sanitation management (United Nations-Ghana, 2023). In line with the above, WaterAid-Japan initiated interventions in WASH, with the roles of governments, businesses and civil society in funding for climate-resilient WASH infrastructure Japan International Cooperation Agency [JICA], 202). However, this approach lacked evidence of consultation with beneficiaries and their involvement, deviating from provisions of the Malongza's Model for beneficiary engagement at the initiation for partnership phase of Figure 1.

To illustrate the tri-sector partnership formation as a tenet of the Malongza's Model, an official of CIKOD stated that:

> *CIKOD drew in other external NGOs including Margaret A. Cargill Foundation as the funder, HELVETAS Swiss Intercooperation and Groundswell International as co-*

> *facilitators which together constituted the civil society. Lawra Municipal and Nandom District Assemblies represented Government for policy directive and support of NGO for development initiatives. Traditional Leaders, Committees and groups represented the community level. The committees and groups were launched in 2017 to climax the formation of partnership.*

This above tri-sector partnership approach with both international and local NGOs illustrates CIKOD's contribution to the achievement of SDG 6, Target 6A, which aims at expanding international cooperation and capacity-building support to developing countries in water-and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies (United Nations, Ghana, 2023).

Figure 2 shows distribution the target communities for CIKOD's Water for Resilience Project in the district and regional contexts. In conformity with the tenet of the Malongza's model on identification of low-income communities with sector-specific problems, CIKOD (2016), justifies the choice of communities in the Upper West Region for the WASH project because the region is drought-prone and had the highest poverty incidence of 70.7% in Ghana as of 2016, and the extreme north-western corners (Lawra and Nandom areas) was the most affected (Cooke et al., 2016).

Figure 2. Communities in the Lawra Municipality, Nandom District and Upper West Regional Contexts (Source: This study, 2017)

Figure 3, indicates that 90% of the CIKOD project beneficiary households in the Lawra Municipal and 94% of those of the Nandom District depended mainly on borehole with hand pumps before the intervention, while Figure 4 indicates the physical state of boreholes.

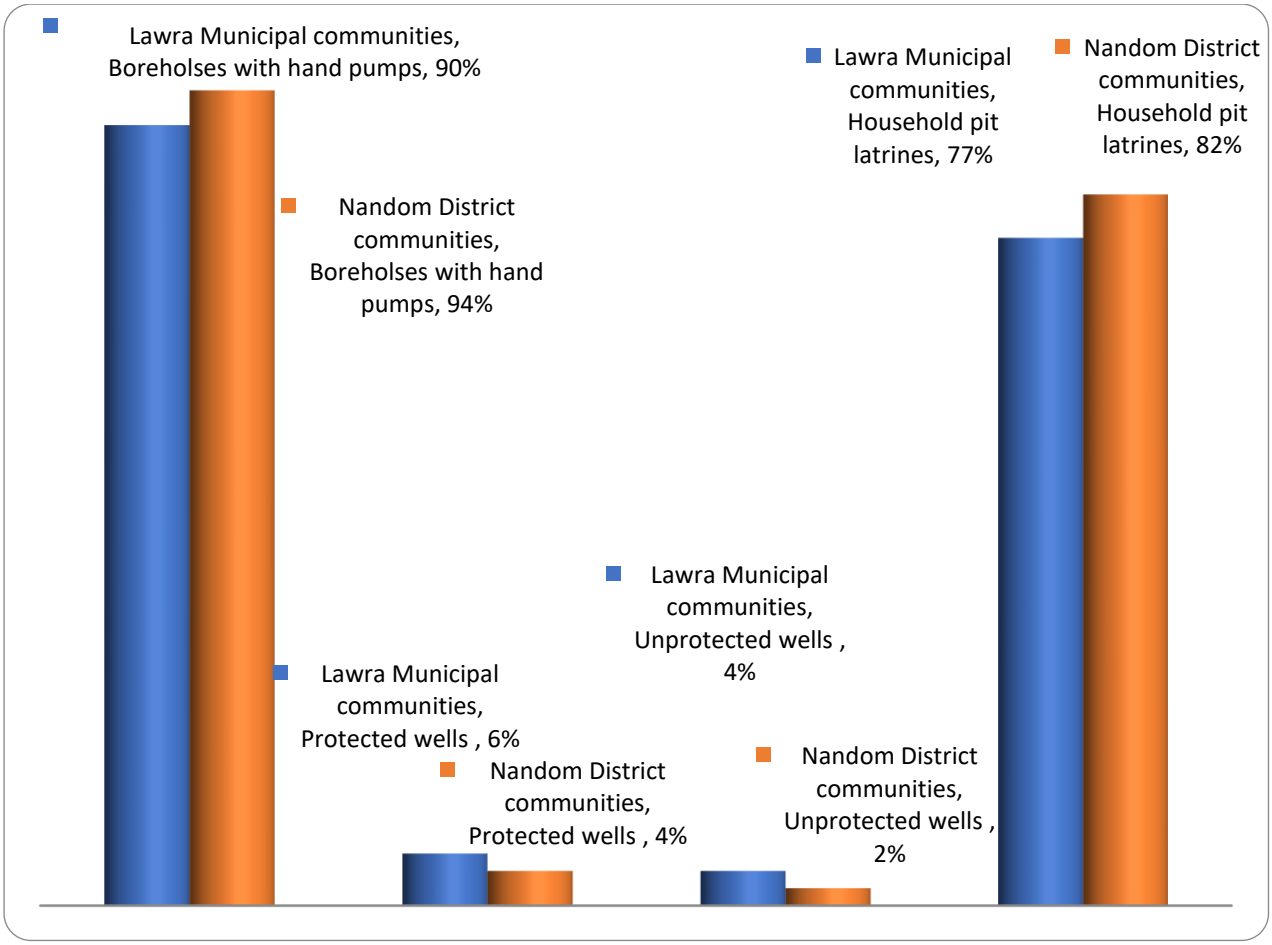

Figure 3. Water and Sanitation Facilities in the Lawra and Nandom project communities

Source: Field survey, 2017.

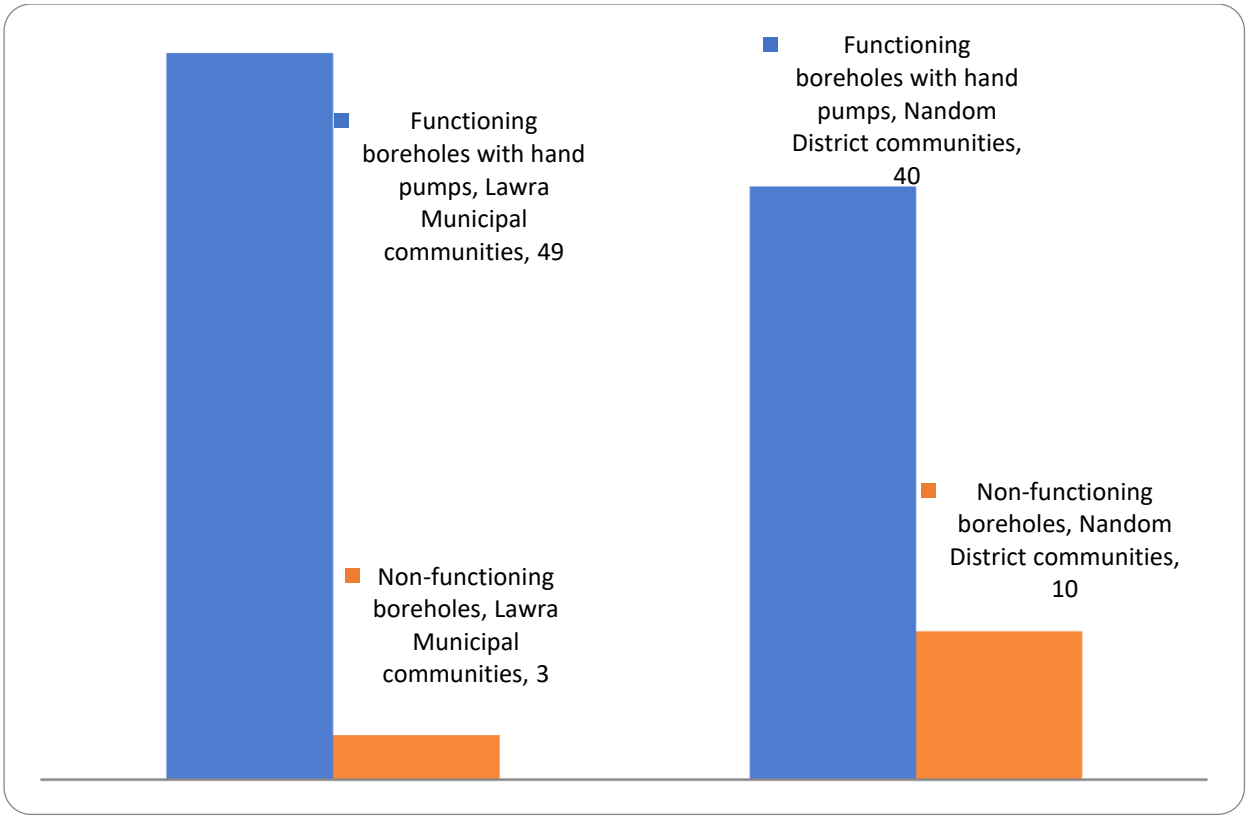

Figure 4. State of boreholes in the Lawra Municipality Nandom District communities

Source: Field survey, 2017.

One borehole fitted with hand pump is capable of serving 300 people (Community Water and Sanitation Agency [CWSA], 2010). In Figure 4, the 46 functioning boreholes in the four Lawra communities could therefore serve 13,800, while the 30 in the Nandom Communities could serve 9,000 people. Both schools and communities depended on these water sources for drinking and domestic uses. Although the populations of the rural communities studied were composite of other larger communities and so not stated by GSS, comparing with the district populations stated in the introduction, the boreholes were already adequate in terms of absolute numbers before the intervention target rural communities.

In terms of sanitation (see Figure 3), 77% households in the Lawra and 82% of those in the Nandom project communities had their own locally improvised pit latrines in conformity with the guidelines of CWSA (2010) for sanitation management in rural communities. This was

previously achieved under a collaborative project for Open Defecation-Free Communities by WaterAid Ghana and CIKOD among others, before CIKOD's 2017 – 2019 WASH project. According to Jewu (2021) literature on the contribution of NGOs in sustainable WASH projects in rural Sub-Saharan Africa lack evidence of the impact on WASH needs, requiring further evaluation studies. The findings above achieved this literature gap.

Effectiveness of the Approach used by CIKOD in the Implementation of WASH

The second research question, partly informed by the tenet of technological interventions in WASH (Figure 1) dictated the analysis of this section. It covers the impact of CIKOD's WASH project by comparing the situation before, to the post-intervention period in 2019. Table 4 shows the technological components of WASH before and after CIKOD's intervention.

Table 4: Technological components of CIKOD's intervention in WASH

Lawra Municipal communities	Functioning boreholes before intervention	Functioning boreholes after intervention	Function wells before intervention	Functioning wells after intervention	Hand washing points before intervention	Hand washing facilities after intervention
Tanchara	16	18	0	1	-	1
Kalsagri	14	16	1	2	-	1
Gbengbee	4	6	0	1	-	1
Eremon	12	14	1	2	-	1
Total	46	54	2	6	-	4
Nandom District communities						
Ko	9	11	1	2	-	1
Goziir	9	13	0	0	-	2
Brutu	7	9	0	1	-	1
Monyupelle	5	7	0	0	-	1
Total	30	40	1	3	-	5

Source: Field data, 2017 and 2019.

Table 4 indicates that the number of functional boreholes, wells and hand washing facilities (tipper taps) respectively increased from 46 to 54, 2 to 6 and 0 to 4 respectively in the Lawra Municipal Communities. The corresponding figures for the technologies for the Nandom District were 30 to 40, 1 to 3 and 0 to 5. For hygiene, tipper tap hand washing facilities were

constructed, basically for beneficiary schools (see Table 2). The community members equally have access to the hand washing facilities. Figure 5(extreme right) shows pupils at Eromon Primary School in the Lawra Municipality washing hands at a tipper tap. The extreme left of the picture shows a newly constructed borehole at Goziir in the Nandom District.

Figure 5. CIKD borehole and Dry season Garden at Goziir and Tipper Tap at Eromon Primary School

In the area of sanitation, it has already been indicated that households owned improvised pit latrines and hand washing technologies (see also, Figure 6). In an interview with a CIKOD official on the effectiveness of the sanitation interventions, he said:

> *The improvised household pit latrines are so widely used to the extent that the project communities were declared open defecation free in 2018.We train households to construct the latrines and sensitize them on dangers of open defecation, through collaboration with WaterAid Ghana, USAID and other stakeholders.*

This constitutes an aspect of the 'E' variable in equation 1 (eq.1), which is about the effects of education on WASH projects and practices. In an interview with a medical assistant at Nandom Hospital about the implications of CIKOD's intervention in WASH projects in rural areas of the District, the response was: Between 2017 and 2019, fewer cases of diarrheal and asthmatic

diseases have been reported from the rural out-patients reporting to this hospital. This is a sign of improved sanitation and personal hygiene. The United Nations- Ghana [UN- Ghana] (2023), supports this claim by asserting that the use of latrines and hand washing practices promote water quality by reducing contamination of water sources with faecal coliform, which causes diarrhoea. The findings on sanitation and hygiene further show CIKOD's contribution to the achievement of the SDG 6, Target 6.2. This seeks to achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations, as well as Target 6.3, which aims to improve water quality by reducing water pollution (UN- Ghana, 2023).

Figure 6. Locally improvised pit latrine at Tanchara, 2017

CIKOD also added compost making to its project as part of a dry season market gardening facet of the intervention. Households were trained to make compost involving the use of solid

wastes such as ashes from their kitchens, livestock droppings and crop residue. Figure 7 shows a compost pit (A) and the various types of solid waste being processed at Gbengbee community in the Lawra District. Composting relates to energy recovery, which also reduces the volume of solid waste that ends in the landfill (Bukari et al., 2017), adding to the benefits of improved sanitation as discussed above.

A **B**

Figure 7. Composting as a form of Solid Waste Management at Gbengbee

Table 5 summarises other efficiency parameters of CIKOD's interventions in WASH, as well as livelihoods impacts and the challenges associated with each. It shows that average distances to access water reduced from 0.82km to 0.5kmin both project districts, meeting the ideal distance of 500m or 0.5km to access a rural waterpoint in Ghana of (CWSA, 2010). Reduced distance to water points promotes accessibility (Pickering & Davis, 2012). During an interview with a Community Development officer in Lawra, about adequacy of point source water facilities in the rural areas, he stated that:

There are adequate boreholes and wells in the communities to meet expected standards, due to the support of NGOs. However, the boreholes are not evenly distributed and water yield is low in the dry season. Further interventions are therefore needed to ensure even distribution of the boreholes and the identification of the right sites for borehole constructions for all year-round water yield.

Table 5: Other efficiency parameters of CIKOD's interventions in WASH

Aspect	Identified threats	Project impacts	Outcomes	Challenges
Sanitation	Airborne and other disease outbreak	Conversion of solid waste into compost manure for gardening	Prevention of diarrheal and asthmatic diseases	Lack of waste containers for waste storage
Water supply	Dehydration, pupils fainting at school, poor hygiene	Ensuring regular supply of drinking water through borehole and well constructions	Prevention of water-borne and water-wash diseases and maintaining pupils in school	NA
Hygiene	Contamination and pollution of water due to congestion at the boreholes	More water points provided, emphasis on the practice of hand washing with soap	Disease prevention	No funding for provision of soap for hand washing in schools
Livelihood improvement	Seasonal unemployment and malnutrition	Establishment of the dry season garden for women groups and schools caters for household nutrition and school feeding programme	Improve the nutritional status of pupils.	Inadequate water for the school garden, poor quality and quantity of food from the school feeding programme.
Aspect	Before intervention	After intervention		
Average distance to Access water in Lawra Municipal communities	0.90km	0.5km		
Average distance to Access water in Nandom District communities	0.82km	0.5km		
Household satisfaction with water service quality in Lawra and Nandom communities	65% not satisfied.	54% satisfied		

Source: Field data, 2017 and 2019.

On affordability, a focus group discussion participant with Women's Market Gardening group said that:

Borehole water services for gardening and household uses are free. It is the Water Committee members who take contributions to repair and maintain the boreholes.

Water is affordable if it costs no more that 3% of household income, hence tariff-free water is affordable (Truslove et al.,2020). About 54% of the respondents in the study communities were satisfied with the outcome of the interventions in the water situation, compared to 65% not satisfied at baseline. The data in Table 5 constitute evidence of achieving the project evaluation facet under the technological interventions and impact of WASH services at the bottom part of the conceptual framework (Figure 1). The improved satisfaction with water services also contributes to the achievement of SDG 6, Target 6.1, which seeks to achieve universal and equitable access to safe and affordable drinking water for all by 2030 (UN- Ghana, 2023).

Table 6 presents the simulation outcomes. Leech et al. (2005) and Pallant (2005) aver that in logistic regression, presentations that focus on the B, S.E. Wald, df, Sig., Exp(B), 95% CI elements are adequate. We downscale these to B, S.E. Wald, df, Sig. and Exp(B), because they relate specifically to the models developed for this study. Table 6 shows that all the Wald coefficients are greater than zero (0), meaning all the variables contributed to the model. The values of the contributions are indicated in the B column.

Table 6: Results of hypothesis testing

Hypothesis	Independent variables	B	WALD	Df	Significance	EXP(B)	Remarks
$H0_1$	Community education	-1.147	12.7884	1	0.001	0.318	$H0_1$ is rejected
$H0_2$	Provision of WASH technology	-0.821	9.580	1	0.002	0.440	$H0_2$ is rejected
$H0_3$	Livelihood	-0.353	1.924	1	0.165	0.707	$H0_3$ cannot be rejected

$H0_1$: CIKOD's role in the education of communities has no significant relationship with good WASH practices by households.
$H0_2$: CIKOD's role in the provision of technological facilities in the communities has no significant relationship with household satisfaction with accessibility to WASH services.
$H0_3$: CIKOD's role in the engagement of community members in WASH services has no significant relationship with livelihoods of households.

At a p-value cut off point of 0.05, null hypotheses $H0_1$ and $H0_2$ are rejected in Table 6 because the significant values of 0.001 and 0.002 respectively are lower than 0.05, implying significant relationships between education of the communities and the provision of technologies to meet WASH needs. However, the B values are negative, suggesting inverse relationships. For example, the negative B value -1.147 at $H0_1$ means that most respondents who chose the option '0' (CIKOD does not educate households in the community on good WASH practices) for the dependent variable C, contrarily chose the option 1 (answered 'yes' to the question: Does the education of the community members by CIKOD promote the provision of technologies to meet WASH needs?) for the independent variable E. Same applies to null hypothesis $H0_2$. However, null hypothesis $H0_3$ could not be rejected because the p-value was 0.165. In other words, it is true that there is no significant relationship.

The EXP(B) column presents the odd ratios, which are all less than one, implying that as the predictor variables such as community education, provision of WASH technologies and livelihoods increase by one unit, the probability of the expected outcome (a respondent will choose 'yes' for CIKOD's intervention leads to improved provision of WASH technologies) reduces. Although livelihood was insignificant at a p-value of 0.165, its EXP(B) value was greatest (0.707), implying a unit increase in livelihood would be associated with improved WASH technologies than the other variables (see Leech et al., 2005).

Implications of the Water, Sanitation and Hygiene Interventions on Livelihoods

This section addresses the third research question on the effects of WASH on the livelihoods of the people. The analysis was shaped by the last tenet of the Malongza's Model (Figure 1), especially project impact evaluation. In line with the livelihood's aspects, Figure 5 shows dry season market gardens at Kalsagri and Tanchara in the Lawra Municipality, provided by CIKOD.

During focus group discussions with women gardeners in Tanchara, a participant disclosed that: "The patriarchal nature of the Dagaaba culture does not give women the right to inherit family lands, because we are customarily supposed to be married and become part of our husbands' families". However, according to the United Nations Development Programme [UNDP] (2011), the short duration of the rainy season (five months) and inadequacy of rainfall (988mm) make food crop farming unreliable as a household occupation in northern Ghana. CIKOD's project therefore included irrigated dry season market gardens for women to alleviate their vulnerability to poverty (see Figure 8). By this, women access land in the demarcated areas allocated by traditional Chiefs for the gardens. Thus, the water facilities provided under the project were for consumption, personal hygiene and production.

Figure 8. Dry season market gardening at Kalsagri and Tanchara

Source: Field data, 2019.

The gardens were constructed with iron fences. Each hada borehole with hand pump and a well. The perimeter of fencing ranged from 199m to 352m, while individual garden areas ranged from 0.10 to 0.05 ha. Each women's group was also given sets of gardening tools as displayed in Figure 8. The products were common vegetables such as tomatoes, pepper, onions,

beans, okro, cocoa yams, garden eggs, pumpkin and cassava. Other local vegetables with local names include ayoyo, alefu and bira, cultivated for sale.

During the post-intervention study, products of most gardens were not ready for sale because the gardens were newly constructed. However, during focus group discussions before the project was implemented, the women expressed their previous experiences in gardening and expectations of how sustainable dry season market gardening under the CIKOD project could improve their livelihoods as presented in Table 7.

Table 7: Benefits of women's dry season market gardening

Communities	Benefits of dry season market gardening
Eremon	Improved ability to meet some basic needs such as school fees, health and food. It also prevents household members from migrating to the south for employment opportunities.
Gbengbee	Provision of fresh vegetables in the dry season to improve household food It averts seasonal unemployment and makes income generation possible in the dry season, Poverty reduction
Kalsagri	Dry season employment, Poverty reduction
Tanchara	It promotes increased access to food and ensures good household nutritional requirements Improves income levels Increases ability to acquire basic needs, including health, child education, etc.
Brutu	Access to vegetables to improve household nutrition. Women also get income to support their husbands in terms of basic needs, e.g., health insurance, school fees, etc.
Goziir	It reduces household expenditure on vegetables. It also promotes household nutritional needs.
Ko	Dry season gardening provides vegetables during the dry season and prevents seasonal unemployment among women in the dry season.
Munyupelle	Dry season market gardening could reduce household expenditure on vegetables and generate income for women. But for now, these are not fully realistic, since market-oriented gardening is yet to start.

Source: Field data, 2017.

The major findings in Table 7 include provision of vegetables for household nutrition needs, income, dry season employment, meeting other basic needs such as the ability to buy books

and uniforms for school children and also health needs. These finding on the impacts of the water points on livelihoods further show CIKOD's contribution to the SDG 6, Target 6.4, which is about substantially increasing water-use efficiency across all sectors and ensure sustainable withdrawal and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

Challenges Faced by CIKOD in the Implementation of the WASH Project

This section addressed the last research question about challenges faced by CIKOD in the WASH project. In a focus group discussion with women gardeners at Tanchara, a participant said that:

> *We are happy CIKOD provided the gardens, boreholes and wells. But our vegetables are still growing and not due for harvesting yet (see Figure 5). Also, when many gardeners come in the morning to draw water to for irrigating the crops, because it is dry season the water yield reduces due to over pumping. We have to wait a while for recharge.*

Figure 3 shows evidence of vegetables still growing in the gardens. In terms of sanitation and hygiene, in an interview with the Head Teacher of Eremon Primary School, she lamented that:

> *CIKOD provided the school with tipper taps for hand washing. But the intervention does not include soap. The Ghana Education Service does not also provide soap for schools. Soap is needed for effective hand washing. We don't also have waste storage containers, so we resort to burning all the time, which causes smoke in the environment. We do not also have a changing room for school girls for menstrual hygiene.*

The challenges observed above corroborate with the findings of Jewu (2021) that in Sub-Saharan Africa, 30 to 50% of NGOs WASH projects fail after two to three years, but apart from lack of government support, the root causes of the failures in rural areas are not known. This makes evaluative studies such as this one imperative.

Conclusions

CIKOD's approach involved initiation, formation of the partnership, geographical scope and community selection, technological interventions and impact assessment, which reflect the practical application of the Malongza's Model. The technological components of the WASH project included boreholes fitted with hand pumps, dug wells, tipper taps, and composting for re-use of solid waste. Community sensitization and provision of WASH technologies by CIKOD had significant relationship with good WASH use practices by households.

CIKOD's approach was effective in terms of improving an access to WASH technologies and services, leading to a decline in related disease incidences, and thus, contributing to the achievement of SDG 6. The water project also promoted dry season gardening as a source of livelihood for women. The major challenge CIKOD faced was the failure to meet deadlines for the completion of the project due to material shortage, lack of government's support to schools, and experiences of dry wells in the dry season.

Recommendations

CIKOD should expand its partnership with geological surveyors and borehole engineering firms for the detection of right location of water aquifers with ideal depths, thickness and transmissivity, as well as enhanced technology for digging deeper boreholes. Since CIKOD partly seeks to promote rural livelihoods through dry season garden irrigation by boreholes, but faced with dry well challenges, it should link up with the Ghana Irrigation Development Authority to extend the One-Village-One Dam Policy to the project communities to reduce pressure on the boreholes for the purpose of WASH only.

Local Government Authorities and Chiefs of the communities should promote the compost making technology in the project communities through award schemes such as National Farmers' Day, and also advertise the process during the Kobine and Kakube festivals of the

chiefs and people of Lawra and Nandom Traditional Areas respectively. This would increase sensitization and adoption.

Since the gardens had not yet started impacting on the livelihoods of the beneficiaries as of the time of this project evaluation, further project impact evaluation studies should be sponsored by CIKOD with its external partners and the District Assembles for a better measurement of the impact of the project on the livelihoods of the women. A comprehensive project evaluation results would determine if alternatives are required for livelihoods improvements apart from the gardens.

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