Moving sustainability concepts to on-the-ground improvements – the Sustainable Water Service Delivery project in Ghana

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Abstract

Great strides forward have been made in recent years on the concept of sustainability in the WASH sector. Previously, the rate of failure of infrastructure created a fixation with addressing the durability or otherwise of water and sanitation hardware. This is now recognised as treating the *symptoms* of unsustainability rather than its *causes*.

A next step has been to translate this new understanding of concepts into an on-the-ground M&E (Monitoring & Evaluation) mechanism of analysing actual sustainability of systems and service delivery, and even going a step further, to predicting the likely sustainability of systems and therefore, service provision.

This has been achieved in the Sustainable Water Service Delivery (SWSD) programme in Ghana. This programme has seen a major data collection effort in order to understand better the realities among the various parameters that are now known to be of importance in creating sustainability. This was followed by the derivation and creation of a decision support tool ("model") to analyse and predict sustainability, on behalf of Ghana's Community Water Supply Agency (CWSA).

The model has been completed and tested in a number of communities in Ghana. This testing was very positive and points towards the potential for successful deployment by CWSA in Ghana as part of their wider M&E system. Challenges remain to ensure that the model adds value in an increasingly cluttered environment of sustainability indicators.

Keywords

Sustainability, data, decision-support, model, prediction, causes.

Introduction and context

One of the major steps forward made in the WASH sector in recent years is the understanding of the concept of sustainability. For years, sector professionals and decision makers had identified a lack of water point hardware durability as a problem, with alarming failure rates being quoted across the developing world. To a degree, this led to a fixation with addressing the symptoms of this failure, seeking to place responsibility for looking after water points with communities themselves, the thinking being that if a pump failed, and as a pump is a fairly simple piece of technology, then this

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can be fixed quickly and cheaply by community members themselves. However, this made little difference to the unacceptable failure rates which arose due to a lack of support for community based management, and a lack of understanding of the complex nature of the causes of failure.

It was subsequently recognised providing sustainable water service to users has its basis in such "soft" issues as institutional support, finance provision and community structures, as much as the "hard" elements relating to environment and technology.

It is one thing understanding that there are a large number of parameters at play; it is another making some use of this on the ground. Recognising this, WSA approached CWSA in Ghana to work with them to develop a decision support system to analyse and predict system and service delivery sustainability, on the basis of a major data collection effort.

Funded by the Conrad N Hilton Foundation, Water and Sanitation for Africa (WSA) with local partners is nearing completion of Phase 1[2] of the Sustainable Water Service Delivery (SWSD) project. This project, which is the subject for this paper, is being undertaken on behalf of CWSA, with the intention that the output from this project will form an input into its national M&E system.

Methodology

The basis of the work has been that the decision support tool should be based upon evidence from a combination of emergent sector knowledge, practitioner experience and an extensive, multi-parameter data collection effort. This data collection and manipulation effort comprised the following:

A major quantitative data collection exercise using the Field Level Operations Watch (FLOW) handheld data collection system, resulting in clean data from 4,670 households, with 441 Watsan Committees and at 1,509 water points, in three regions of Ghana.

- In-depth interviews with officials; focus groups with stakeholders.
- Transfer of quantitative data from FLOW via Excel into SPSS, prior to full analysis.
- Research on social, anthropological and economic factors affecting sustainability.
- Analysis of the technical aspects of delivery at fifty water point, including of hardware performance, water quality, groundwater issues.

All of these elements fed into the construction of a decision support tool (a "model") which facilitates:

- The analysis of why systems are failing or succeeding, and

[2] Phase 2, is envisaged to take this approach into other countries in the CNHF sphere: Mali, Burkina Faso and Niger. See, however, commentary in the Next Steps section of this paper.

- The prediction of the likely sustainability or otherwise of systems which exist or are being planned.
- Therefore, the model development had an extremely broad base, with its critical parameters being bought together in a series of workshops, in which the disparate elements were coalesced into a unified analytical system to indicate likelihood of sustainability of delivery of services.

Initial steps

In order that adequate and relevant data and information was gathered, and coupled with the fact that similar initiatives were on-going both in Ghana and further afield, the project commenced with consultations with government officials, I/NGOs and the private sector to try and avoid duplication of efforts. A national launch aimed at sensitising key actors in the sector was organised, which attracted very high level of interest, buy-in and support from sector actors at different levels, including the Ministry for Water Resources, Works and Housing which provides the necessary government leadership and ownership that is crucial to the success of this project.

A rapid assessment and parallel literature review of institutional roles for water services delivery in Ghana and sustainability issues – particularly in the Greater Afram Plains area - were conducted. These enabled key stakeholders to better appreciate the relevance of the project, and to understand the variables to focus on in the field survey using the Akvo FLOW tool. It also directly involved the key players in water services delivery in this project.

An all -inclusive stakeholders workshop for the conceptualisation of tools and research questions was then carried out resulting in a clear definition of the overall project context and mapping of key stakeholders such as government institutions-CWSA, Conrad N. Hilton Foundation, private sector and WSA's external partners (Water for People and Hefren Water). This workshop was used to introduce FLOW as the practical option for field level data collection and was fully accepted and appreciated by the Ghanaian stakeholders. Key research questions were also presented and agreed, the field management and coordination of the entire process were mapped out and a schedule for the field survey was developed.

Analysis of socio-anthropological and economic factors

While it is understood that the parameters under this heading are important, it was considered vital to understand these in more detail in the particular context of Ghana. So experts from the University of Tamale were deployed to conduct a survey of these elements across three regions in Ghana. The information and understanding generated through these surveys were incorporated into the decision support system through an exhaustive discussion process prior to model construction.

The main factors found, which were felt to have a potentially significant impact upon sustainability, and which therefore needed to be addressed in the model, included some which are now well-known, for example, the presence and internal workings of a

Watsan Committee, including its gender composition, and the agreement to make financial contributions for construction and maintenance of the water point. It also pointed towards such elements as community structure, particularly the inclusion or exclusion of non-local ethnic groups, the extent of immigration/emigration, the role of elders in settling disputes over rights to use water points and the authority of the Watsan committee in the overall authority structure of the community.

Water quality and functionality testing

While the array of non-technical factors contributing to un/sustainability is rightly receiving vastly increased consideration, it is also necessary to retain attention upon the technical issues that remain contributory building blocks of sustainability. Additionally, in order for the remainder of the data collection and analysis to make sense, it was necessary to collect extensive data upon the basics of water point functionality and water quality. So, pumping tests were performed on fifty boreholes fitted with hand pumps and water quality analysis for forty of those wells in the communities.

The water quality results show that the physical and chemical parameters were generally very good for drinking water standards. But the sanitary conditions in the area around the wellheads were commonly very poorly. This combined with the fact that the borehole depths were shallow, make the wells and/or aquifers vulnerable to microbial contamination.

Quantitative data collection

A training of trainers and subsequently regional level trainings were conducted before commencement of field work. The trainings focused on survey techniques, technical skills to use (Android application) smart phones and FLOW technologies for water lifting devices, as well as community entry and interview skills.

Field surveys were then conducted in total of 570 communities in thirteen districts by trained district base enumerators using FLOW. Three categories of quantitative surveys were conducted at the community level: a questionnaire about the water point itself, household surveys and surveys with Watsan committee. In total 4,670 households, 441 Watsan Committees and 1,509 water points were surveyed, across three regions (Eastern, Ashanti and Brong Ahafo). The quantitative data was collected in 540 communities, in 13 districts across these three regions.

Preliminary analysis was done using the flow dashboard with simple Excel tabulations, while the detailed analysis including cross tabulations was later done using SPSS software. A process issue arose of the speed and efficiency of data transfer from the FLOW dashboard, via Excel into SPSS; this was an issue of questionnaire design, data specifications and data transfer rather than any problem with FLOW or the off-the-shelf data manipulation software.

It is worth noting that the data collection exercise just described was a one-off, needed to inform the content, structure and weightings within the model. So, it is not a necessity to recalibrate thorough large scale data collection and analysis.

While this paper is largely about process, it is worth highlighting some of the main results, merely to give some idea of the range of data collected:

- Out of the 1,391 boreholes surveyed on the day of the visit, 79% were functioning.
- Nearly 70% communities reported that they had sufficient water all year round for their needs.
- Older facilities were harder to use and there was a direct co-relation between age and breakdown rates.
- There was low regular water quality testing on the facilities.
- Water points for which users paid, (and therefore raised revenue), were likely to be rehabilitated more quickly than those that did not have user fees.
- Nearly a quarter of the communities which did collect user fees did not have a bank account.
- The majority of the water points (1,020 out of 1,388), are managed by Watsan committees.
- Two thirds of the Watsan committees have put in place facility maintenance plans with records of the plans available. Most of these plans were also developed in line with the CWSA guidelines in Ghana.

Model development

With the inputs into model development coming from a variety of different sources, there needed to be a substantial attempt to weld these into a coherent shape to then form the input into the analytical tool. This took place around two workshops: in Accra and Ouagadougou, in which the outputs were agreement upon:

- The main parameters for inclusion.
- The indicators to be used for each parameter.
- The relative weighting of each indicator.

So it can be seen that the model was formed based upon consideration of the output from the various surveys, allied to the knowledge and experience of the participants – so this was far from a mechanical exercise. These were then transformed into questionnaire form, so that it could be administered easily and answers given by a combination of Watsan committee members, community members and staff with more technical knowledge of matters, such as groundwater. The questionnaire is provided as the Annex to this paper.

The job of the model is to provide statistical output, based upon the combination of answers given, that indicates the likelihood of sustainability under each parameter and for the system as a whole. This “model” incorporates all the parameters of sustainability as it is currently understood, with weights attached according to perceptions of their importance. After the questionnaire has been answered, the model generates an overall (aggregated) sustainability ‘answer’ in numeric form but also provides this at a

disaggregated level, for each main parameter of sustainability – thereby, providing a graduated assessment for each element of sustainability and, for example, pointing towards potential failures even in well performing systems.

One point worth bearing in mind is that although the model takes the form of a questionnaire (one that is being shortened and simplified), it is not a data gathering device that requires repetition to stay up-to-date or analysis to obtain tabulations. The answers gained are inputs into a quite simple arithmetic structure which creates probabilities of system continuity under the main headings of sustainability, and overall.

After model development, it was tested as a desk exercise firstly and then taken to "live" situations in Eastern and Brong Ahafo regions. The testing took the form of using the model questionnaire in respect of an existing system, as if it was *going to* be implemented and then comparing the model's response with the visible and reported reality of the system in the community being visited. In every case, the model was found to provide the correct answer at the aggregate and disaggregate levels.

Here are some examples

In one community where the single water point was seen to be performing well, it produced sufficient water for everyone, every day, no technical problems had been experienced in the eighteen months since installation; the community were well aware of the benefits of reduced incidence of diarrhoea, girls went to school etc. But the model predicted, strongly, that the service was not sustainable. This was because the Watsan committee was not functioning well and there was no preventive maintenance being undertaken. It was not clear if the tariff that had been agreed was actually being collected. So, this was a clear example that functionality does not equal sustainability. It also pointed towards some simple actions that needed to be undertaken to retain service continuity.

In another community, a water point was functioning generally well, with sufficient water for everyone to get at least 20 litres, and even up to 60 litres per day, but sometimes not during dry seasons, when lifting is difficult. People reported wear on the pump. Now it is not hard to predict trouble ahead on that basis but the questionnaire also asks people whether or not they know what to do in such situations, whether or not they collect money for heavy capital maintenance (as against routine maintenance); it also asks whether or not there is a functioning mechanism for support from the local authority. The fact that these were answered negatively in this instance allowed an insight into the problem ahead, facilitating an ameliorative response, avoiding an otherwise inevitable service interruption.

This brings us to the time of writing this paper: with the model having been tested and found to be satisfactory, the final touches are being made, with some rewording and simplification of the questionnaire to make it easier to use and comprehend. It will then be ready for handover and roll out to the authorities and deployment as part of their

wider M&E system. It will also be ready for use in other countries, a goal of the Conrad N Hilton Foundation (see also next steps, below).

Embedding and training

The model has been developed by WSA on behalf of the CWSA in Ghana. The intention is for them to use this within their wider M&E system. So, an embedding process has been underway but will gather momentum now. This comprises a degree of 'selling' of the model to its potential users in CWSA, as well as training them in its application.

In parallel, but at a smaller scale, is an attempt to inform the wider WASH sector in Ghana about the model, its application and benefits, principally through the national Learning Alliance but also through other advocacy efforts.

A key to these efforts, in the Ghanaian context, is generating an understanding of the role of this model alongside other products that are available or are mentioned as being relevant. Avoidance of duplication is important, and we return to this issue in the "Next Steps" section at the conclusion of this paper.

Reflection and conclusions

While the model performed successfully in the limited field trials, a question arises specifically relating to its potential "positioning". Which decisions will this system relate to, and who will be in a position to make them? We view the model as allowing a potentially significant forward in predicting rural water service sustainability or assessing reasons for failure where this is encountered, at a system or community level. The implication is that its use is at that level – to predict sustainability of new (or existing) systems and to assess reasons for failure of existing ones.

So, it follows that this should best be deployed by district level governments, ideally feeding into a national monitoring system. In the case of Ghana, this decision support tool is seen as feeding into the DIMES system. The model can be deployed in every District in a country and each District can use it on a rolling programme in each community over a number of years. Whether or not this can "cover" all systems or whether some sampling or other means of prioritisation is needed remains to be seen.

To conclude, the SWSD model:

- Will assist in identifying if new systems will be sustainable.
- Will pinpoint reasons for service discontinuities and system failures in existing systems.

By doing so it enables the community and relevant support agencies and authorities to identify the requisite measures to be taken which will enable service success and continuity. Thus, it can support increasing service coverage, help to ensure equality of future provision and prevent wasteful slippage.

Next steps

Aside from the embedding and training items mentioned above, there is one further element that is worth highlighting. Several organisations have seized upon the conceptual step forward in sustainability and embarked upon creating sustainability measuring, predicting and analysis systems of various sorts.

Whilst these have been developed largely in isolation from each other, it is felt that there is potentially much to be gained by ensuring that duplication is avoided, mutual sharing and lesson learning is undertaken and any possibilities for coalescence grasped. This event in Addis offers an opportunity for the protagonists to do exactly that.

The model developed in this project has been found to be of value and is suitable for use in other locations. However, we would wish to work with other leading agencies who are working on sustainability issues to see if we can coalescence our work on this area with theirs, to the benefit of the next generation of users.

Annex 1 – SWSD Model Questionnaire as at 30th October 2012

SUSTAINABILITY MODEL TEMPLATE FOR PRINCIPLES, CRITERIA AND INDICATORS			Critical Indicators	Ranking	Weighting
Principle 1: Socio-economic context					
Criteria	*Indicators*				
1: Actual Water Demand	Are there 75 or more people in this community?	PE	Critical	1	0.4
	Was the design of the system undertaken out on the basis of projected demand over the next 10 years?	PE		3	0.2
	Is the water to be used only for domestic purposes?	PE		2	0.25
	Is the water used for other purposes?	PE		4	0.15
2:Population Growth	Is the population of the region and district growing significantly	PE		1	0.7
	Is significant immigration occurring and likely to continue?	PE		2	0.2
	Is significant emigration occurring and likely to continue?	PE		3	0.1
3: Socio-economic Benefits	Is the community aware of the possible increased in agriculture activities that may result?	PE		8	0.05
	Is the community aware of the possible increase in school attendance that might result?	PE		4	0.15
	Is the community aware that it may have time for other activities as a result?	PE		6	0.05
	Is the community aware that it will have more water available for personal hygiene uses as a result?	PE	Flag	1	0.2

	Is the community aware that it will have more water available for sanitation uses as a result?	PE	Flag	2	0.2
	Is the community aware that it will have more water available for economic activities requiring water as a result?	PE		5	0.1
	Is the community aware that as more water will be available then household income may increase?	PE		7	0.1
	Is the community aware that it the prevalence of water borne diseases may decrease as a result?	PE	FLag	3	0.15
Principle 2: Service Delivery					
Criteria	*Indicators*				
1: Accessibility	Does the water source provides sufficient for each person to have 20l per day	PE	Flag	1	0.3
	Does the water source provides sufficient for each person to have 60l per day?	E	Flag	4	0.15
	Does the community have the ability to collect enough potable water for its needs?	E		2	0.25
	Is every home in the community within 500m of the water point?	E	Flag	5	0.05
	Does the water point yield water all year round?	PE	Flag	3	0.2
	Is everyone able to collect water within 30 minutes	E	Flag	6	0.05
2: Water Use	Domestic water use	PE		1	0.7
	Other water uses	PE		2	0.3

Principle 3: Water resources, quality and environment & management					
Criteria	*Indicators*				
1: Quantity of Water	Is there sufficient available ground water for current and future needs?	PE	Flag	1	0.35
	Is there sufficient available surface water for current and future needs?	PE	Flag	4	0.1
	Is the recharge rate sufficient?	PE	Flag	2	0.25
	Is the rainfall sufficient to replenish the water sources?	PE		3	0.25
	Is there a local reservoir, sufficient to store water for dry periods?	PE		5	0.05
2: Quality of Water	Does the water meet physical guidelines?	PE	Flag	3	0.1
	Does the water meet chemical guidelines?	PE	Critical	1	0.5
	Does the water meet bacteriological guidelines?	PE	Flag	2	0.4
3: Environmental Considerations	Land Use	PE	Flag	1	0.3
	Is the water point sufficiently distant from sanitation facilities?	PE	Flag	2	0.2
	Is the watershed adequately protected from pollution?	PE	Flag	5	0.15
	Is the water point sufficiently protected from animal effluents and other emissions?	PE	Flag	3	0.1
	Has the area (especially the water point) been affected by floods recently?	PE	Flag	6	0.05

	Has the location been affected by abnormal droughts recently?	PE	Flag	4	0.2
Principle 4: Technical (and technology)					
Criteria	*Indicators*				
1:Water Supply Technology	Is the borehole fitted with a hand pump (for population range 301 – 1,200)?	PE		1	0.3
	Is the hand dug well fitted with hand pump (for population range 75 – 300)?	PE		3	0.05
	Is there a mechanised borehole/s with simple piped schemes and PVC tanks (population range 1,201 – 2,000)?	PE		2	0.3
	Is there a spring or highland surface water system with simple piped scheme (gravity or pumped scheme) and with simple treatment?	PE		4	0.2
	Do the households in the community have rain water harvesting, with simple treatment?	PE		5	0.05
	Does the community use local surface water (polluted) with simple treatment?	PE		6	0.05
	Are other technologies used, adopted where necessary?	PE		7	0.05
2: Functionality of System	Has a stroke test been carried out recently?	E	Flag	1	0.5
	Has a leakage test been carried out recently?	E	Flag	2	0.5
Principle 5: Finance					

Criteria	*Indicators*				
1:Beneficiary Contribution	Is the community willing to make a cash contribution to the construction of the water point?	PE		1	0.5
	Is the community willing to contribute in-kind to the construction of the water point?	PE		2	0.5
2: Payment for Service	Is the community fully agreed to pay a tariff for the water used?	PE	Flag	2	0.25
	Is the community always able to pay the agreed tariff?	PE	Flag	1	0.35
	Is the tariff: pay as you fetch?	PE		3	0.2
	Is the tariff: a household levy	PE		4	0.1
	Is the tariff: on an *as and when* basis?	PE		5	0.1
3: Appropriate Tariff Structure	Does the tariff align with current sector guidelines?	E		1	1
4: Capital maintenance finance	Is there an agreed method to obtain and pay for unforeseen heavy maintenance?				
Principle 6: Operation and Maintenance					
Criteria	*Indicators*				
1: Appropriate Management System	Is there a functioning community based water and sanitation management team in place?	PE		1	0.6
	Has service delivery management been contracted out to a private sector management organisation?	PE		2	0.25
	Is there a different service delivery management plan in place?	PE		3	0.15

2: Quantity and Quality of Human Resources	Does the Watsan Committee have the number it is supposed to have?	PE		2	0.25
	Are they all trained?	PE		1	0.4
	Is at least 50% of the committee comprised of women?	PE		5	0.1
	Is training held frequently?	PE		4	0.1
	Do any of the Committee members have relevant professional qualification (Small towns/Urban ONLY)?	PE		3	0.15
3: M&E	Is M&E being conducted by the community?	PE		1	0.6
	Is M&E being conducted by the MMDAs?	PE		2	0.2
	Is M&E being conducted by the national water agencies?	PE		3	0.2
4: Supply Chain	Are spare parts available (anywhere)?	PE		1	0.4
	Are spare parts affordable?	PE		3	0.25
	Is access to spare parts reasonably easy?	PE		2	0.25
	Are the spare parts of sufficient quality?	PE		4	0.05
	Are the spare part suppliers accredited	PE		5	0.05
5: Ownership and Management	Does the community leadership have the necessary authority to make decisions on the Watsan service?	PE	Flag	1	0.35
	Is there active participation of women in the Watsans or community affairs	PE	Flag	2	0.25

	Are there women in leadership roles in Watsans and/or community affairs?	PE	Flag	4	0.15
	Is the ownership and management plan in alignment with community choices?	PE	Flag	3	0.15
	Are vulnerable groups included in Watsan decision-making?	PE	Flag	5	0.1
6: Maintenance	Is there a maintenance plan?	PE	Flag	1	0.4
	Is the frequency of maintenance sufficient?	PE		2	0.3
	Is there an accepted method of ensuring corrective maintenance within an agreed time limit?	PE		4	0.1
	Does the maintenance plan specify the type and frequency of preventive maintenance?	PE		3	0.2
7: Replacement	Is there an agreed plan and method to replace and finance infrastructure when it becomes life expired?				
Principle 7: Institutional aspects					
Criteria	*Indicators*				
1: Governance Structure	Community leadership and authority	E		1	0.2
	Presence of Board	E		2	0.15
	Training and re-training of Board	E		3	0.15
	Representation of men, women and minority group on Board	E		8	0.1
	Does the Community (Watsan Committee) have a bank account?	E		6	0.1

	Are the financial records/books available for scrutiny by the community?	E		7	0.1
	Are there WASH related bye laws and policies in place?	PE		4	0.1
	Are these bye laws and policies actually applied?	E		5	0.1
2: Support to Service Providers	Is there capacity at the District level (technical and resources) to support communities with WASH issues and problems?	PE	Flag	1	0.4
	Is the local CWSA able to support to MMDAs?	PE	Flag	2	0.3
	Are other forms of support in place for the community?	PE		3	0.3