Synthesis report on stakeholder baseline studies on technology selection process and the stakeholders' attitudes

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WASHTech, 2012

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The **Water, Sanitation and Hygiene Technologies (WASHTech)** is a three-year action research initiative that aims to facilitate cost-effective investments in technologies for sustainable water, sanitation and hygiene services (WASH). Through action research and the development of a set of methodological tools and participatory approaches, WASHTech embeds the practice of multi-stakeholder learning, sharing and collaboration – instilling individual and collective ownership and responsibility for sustainable WASH services.

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Collaborative partners: IRC International Water and Sanitation Centre, Cranfield University, Skat, WaterAid, TREND, WSA (formerly known as CREPA), NETWAS and KNUST.

Acronyms and Abbreviations

Acronyms

ACORD	Agency for Cooperation and Research in Development
CREPA	*Centre Africain pour l'Eau Potable et l'Assainissement*
CWSA	Community Water and Sanitation Agency
DANIDA	Danish International Development Agency
DWD	Directorate of Water Development
EHSD	Environmental Health and Sanitation Directorate
HTN	The Hand Pump Technology Network
JICA	Japanese International Cooperation Agency
KNUST	Kwame Nkrumah University of Science and Technology
KVIP	Kumasi Ventilated Improved Pit (latrine)
MLGRD	Ministry of Local Government and Rural Development
MMDA	Metropolitan, Municipal or District Assembly
MWLE	Ministry of Water, Land and the Environment
NETWAS	Network for Water and Sanitation
NGO	Non-governmental organisation
ONEA	*L'office national de l'Eau et de l'Assainissement*
PEHD	Poly-ethylene high density
SWTS	South Western Towns Project (SWTS)
TAF	Technology Assessment Framework
TARA	Balaji Direct action Pump
TREND	Training, Research and Networking for Development
UDDT	Urine diversion dry toilet
UNBS	Uganda National Bureau of Standards
UNICEF	United Nations Children's Fund
UWASNET	Uganda Water and Sanitation NGO Network
UV	Ultraviolet
VIP	Ventilated Improved Pit (latrine)
WASHTech	Water, sanitation and hygiene technology

1. Introduction

This report is the conclusion of WASHTech Work Package 7.1. The work package has two aims:

1. To understand the current situation for technology approval in Uganda, Ghana and Burkina Faso, including the Knowledge, Attitudes and Practice of various sector stakeholders.
2. To assess the need for the Technology Assessment Framework (TAF) that is being developed in Work Package 3.

This report describes the baseline of the technology approval process in Uganda, Ghana and Burkina Faso. The WASHTech consortium, through the development of the TAF and the Learning Alliances, is trying to improve the situation for innovative technology approval in these three countries. By asking stakeholders at this stage whether they perceive a need for the TAF, whether they would use it and exactly what role it should fulfil, the TAF can be developed to suit their needs. At the end of the project (2013) another survey will be done to see what WASHTech has been able to achieve, measured against expectations and present KAP.

To fulfil aim (1), above the report details

- extant national standards for water and sanitation technologies
- existing formal approval processes for water and sanitation technologies
- the role of governments and other stakeholders in technology introduction
- attitudes of stakeholders to new technologies, and
- gaps in currently available technologies perceived by stakeholders.

Examples of how specific technologies have been approved or introduced are given in text boxes throughout the report.

To fulfil aim (2) the report details the stakeholders' attitudes to the current proposal for development of a TAF.

This report has been compiled as a synthesis of three reports, one for each focus country prepared by NETWAS, TREND, KNUST and CREPA. The reports were prepared to common Terms of Reference, although some subsequent details were added to clarify particular points for the synthesis. The reports were compiled from a literature review in each country, and interviews with key stakeholders. These reports are included as Appendices, and should be referred to for further details, including lists of interviewees.

2. National standards and guidelines for water and sanitation technologies

Burkina Faso
In Burkina Faso there are no guidelines or criteria which water or sanitation technologies have to meet. The consequences of this regarding hand pumps are explained in box 1.

Uganda
Uganda has well defined national guidelines. For water technologies:

- Appropriate low cost technologies should be selected that offer community participation in decision making, implementation and operation and maintenance.
- Point water sources are preferred for rural and peri-urban areas.
- Motor and engine driven pumps are normally reserved for use in urban areas where there is regular power supply and trained operation and maintenance staff.
- Only well known and tested technologies preferably locally made or available shall be used.
- Standardization of equipment will only be applied as a means of safe guarding the community based maintenance system. Types of pumps should be limited and technical specifications available in the 'public domain'.

There are only three approved hand pumps: U2 (the Uganda version of the India Mark II), U3 and U3 modified. However, the only agency enforcing exclusive U2 pump use is the police so the reality is that enforcement is weak if not non-existent, and no penalties for use of other pumps have been recorded. For more details on Ugandan hand pumps, see box 3.

For sanitation technologies guidelines also do exist. Even though there is a national strategy to promote ecosan there are no standards for construction.

The only guidelines for sanitation state that:

- The community should be involved in selection of technology, and emphasis should be on acceptability (both financial and cultural).
- Preference should be given to low cost on-site methods.

Ghana
Ghana has guidelines for water supplies in small towns. The main water supply technologies recommended for adoption include:

- Groundwater based piped systems
- Spring or highland water supply systems (gravity systems)
- Surface water/slow sand filtration piped systems
- Package Treatment Plants
- Small conventional treatment plants
- Other technologies to be adopted, where necessary.

Selection of water sources shall ensure minimum development costs, and shall be in accordance with the following order of preference:

1. Groundwater abstraction (for details on handpumps see box 2).
2. Springs
3. Relatively unpolluted surface water sources
4. Polluted surface water sources

Selection of energy sources shall be in accordance with the following order of preference:

1. Grid Electricity
2. Solar Energy
3. Diesel Generator.

For sanitation, options for households in small towns include:

- 1 or 2 seat KVIP latrines
- Pour flush latrines
- Ecosan
- VIP latrines

For institutions in small towns 6 to 10 seat KVIP latrines should be used.

Box 1: hand-pumps in Burkina Faso

Implementing agencies (both donor and government funded) choose a handpump to use in their projects, and a lack of national co-ordination of this process has resulted in there being twelve different hand pumps in use throughout the country, none of which have been formally approved. National guidelines were produced in 2000 on the management and maintenance of boreholes and the delegation of responsibility, but these guidelines did not recommend any particular hand pumps.

Box 2: hand-pumps in Ghana

Throughout the 1970s, 1980s and early 1990s various donors supplied six different types of handpump. After the establishment of the Community Water and Sanitation Agency in 1998, four pumps were selected as national standards – the Vergnet, the Afridev, the India Mark II (Ghana Modified) and the Nira AF 86 and a spare parts distribution network for these pumps was established. The Vergnet was used by French donors and was widely used by Ghana's francophone neighbours. However, women found it hard to use. The India Mark II had been used on 3000 boreholes by KfW, who used stainless steel and brass underwater to prevent corrosion by acidic Ghanaian groundwater. The Nira handpump had previously been tested by UNICEF.

Box 3: Hand pumps in Uganda

Bush pumps were one of the first hand pumps to be widely used in Uganda, although according to UNICEF by 2002, 75% were non-functional. Since 1999 the Uganda National Bureau of Standards defines the U2 (the Uganda version of the India Mark II) as the standard handpump for deep boreholes, as it can be extracted and managed at a village level. This policy was introduced by the Directorate of Water Development (DWD) under the Ministry of Water, and Environment (MWE). The intention was to improve the statistics that only 50% of handpumps were functional.

The introduction process was influenced by UNICEF and the Handpump Technology Network (HTN), boosted by experiences from India and Bangladesh. U2 pumps were piloted in Luwero for one year, with some experimentation with different hand tools for fixing the pump, although this pilot was not well publicised within the sector.

U2 pumps are manufactured in Uganda by Victoria Pumps, and have been modified to have a longer handle to make them more similar to the Bush pump. There are other companies who are importing pumps directly from India, and undercutting Victoria Pumps in price, and the government is not limiting this because of their policy of economic liberalisation. This threatens the sustainability of local manufacture. There is also some manufacture of the pump head by local artisans. Again there is no attempt to control this by the government, despite the low quality of these products.

Bush pumps have been removed and replaced with U2 pumps. This campaign faced opposition where the Bush pumps were still working well, and locals were told that Bush pump spares were no longer available. Technicians needed to be retrained, and were supplied with tools and bicycles. The whole scheme, including hydrogeological surveying, drilling, pump testing, installation, minor and major repairs was initially managed by UNICEF and DWD, but has since been decentralised.

Currently the U3 modified and U2 light handle are the standard pump for shallow boreholes, although the U2 light handle pump fitted with GI is one of the standard shallow well pumps, it has been found to be corrodible, hence the U3 modified with PVC pipes is preferred.

The Busoga Trust still uses the Consallen pump despite the fact that it is not a national standard, but they have not been penalised for this.

3. Process of approval by governments for technology introduction

No governments have a documented formal process for approving technologies for use in the country. Ghana has the strongest process although it is not formally documented anywhere, not all stakeholders are aware of it and not all technologies are approved. Indeed, there is no penalty for a technology which is not approved.

For water technologies the process in Ghana is:

- The Community Water and Sanitation Agency (CWSA) have published guidelines on technologies which any developers can consult prior to entering the approval process.
- The first step is to submit the proposal on the new technology to the Ministry of Water Resources, Works and Housing through the Water Directorate.
- The Ministry of Water Resources, Works and Housing will direct the proposal to CWSA for consideration.
- The proposer is invited by CWSA to provide literature and make a presentation on the technology. The CWSA claims to have cooperated with every individual or organization that has approached them.
- CWSA then sets up a technical committee on the basis of the presentation to study the theory of the technology, any similar technologies in the past and the likely acceptance by users. The committee can ask questions of the proposer. The committee provides a report to the Chief Executive of CWSA. If the technical committee finds the technology to be promising, they recommend piloting of the technology at the cost to the proposer of the technology. However, the CWSA will help in identifying pilot sites with the help of district assemblies.
- At the end of the piloting, CWSA would write a report on how well the proposed technology performed and indicate whether it should be taken on and in which cases and to what applications they should be put. Generally, the assessment looks at four areas including: technical performance; acceptability and user friendliness, capital cost; and operation and maintenance cost. If the technology is not appropriate, the proposer is informed what needs to be addressed to make it appropriate.
- When the technology is accepted, consultants and NGOs are engaged to do the education on the technology. The education is aimed at showing the community the advantages and disadvantages, safety and breaking of cultural barriers. This is done when the technology is being replicated under a project in which case there are funds provided for consultant to carry out community mobilization and training.

For sanitation technologies the process in Ghana is:

- Anyone who wants to introduce a sanitation technology has to write to the Ministry of Local Government and Rural Development specifically the Minister.
- The Minister refers the letter to the director of the Environmental Health and Sanitation Directorate (EHSD).
- The Director of the EHSD puts together a technical team which usually comprises programme officers from within the directorate as well as district staff. The team is formed based on the type of technology that is proposed.
- The person or organization introducing the technology makes a presentation on the technology to the technical group and explains details of the technology and its performance.
- Based on the presentation the technical group will make a recommendation to reject the technology or to pilot the technology to further assess its suitability for the Ghanaian context. They do not assume because it has worked elsewhere it will work in Ghana – the socio-cultural behaviour of Ghanaians needs to be considered. The criteria for accepting or rejecting a proposed technology is not standardized, but generally cover the capital costs, operation and maintenance costs and the ease of usage.

- After the technical evaluation, if the technology is approved, the organisation introducing it into the country is asked to fund the first pilot. The Metropolitan, Municipal or District Assembly (MMDA) within which the pilot is carried out assesses the technology throughout the piloting period. An assessment report of the pilot technology is written by the MMDA and is made available to the MLGRD through the EHSD based on which a final decision is reached on whether the technology was successful or failed.

Similarly to the case of water, there is no documentation of this process.

The only problematic cases are when businessmen, who may not be technically qualified, try to get approval for technologies that have been successful elsewhere. However when they meet the technical team, they cannot answer the technical questions. They are also discouraged by the cost of piloting. Further lessons learnt through experience are described in box 4.

Box 4: Lessons learnt from the government approval process in Ghana

Some technologies have been approved only for use in certain situations, for example:

- Water Health International's water treatment units were approved for use as a last resort. They were piloted in communities close to Accra under CWSA's guidance. The pilot was audited by a three man technical team from CWSA. The team did not recommend it for use everywhere because it is expensive. It is only approved for use in areas without groundwater and where surface water is of such low quality slow sand filtration would be ineffective. As yet it is not used on a national scale.
- KVIPs latrines were approved for household use only in Ghana. KVIPs are vulnerable to overuse, hence they are only recommended for household use, not communal use.
- Aborloos were approved only if there is available land. Aborloos can prevent environmental pollution, but they need a large land area, hence they are only approved for this context.

Some technologies were not approved at all, for example:

- A Finnish team presented their Water to Energy plant to the EHSD, but it was not approved. The technical specification showed that the types of waste needed to power the plant are not produced in Ghana and hence the technology was not approved.
- A German team wanted to install underground dustbins in Accra, which would come to the surface with a pedalling mechanism, but this was not approved because it was not appropriate in the socio-cultural context of Ghana. People were not using the simple bins already provided because they could not be bothered to remove the cover so they certainly would not have the patience to pedal the bins to the surface.
- The private sector wanted to install urinals in the Central Business District of Accra, but this was not approved because there is not enough space. This decision was appealed and eventually they were permitted to do a pilot, but a year later not one urinal had been installed.
- The Rope pump has not yet been approved for use. The original designs for the rope pumps meant that it frequently broke down and hence the CWSA had a negative attitude towards it and would not approve it. It has since been modified and will be reconsidered by the CWSA.

Some technologies were approved by the CWSA but not scaled up. This includes:

- Ferrocement tanks, for which no standard designs were produced and there was no capacity building.
- Hand-drilled wells, for which communities found manual operation difficult, despite training by the CWSA.

Despite this process some technologies are introduced without receiving formal approval, for example:

- The Envirloo was observed in South Africa and an entrepreneur decided to try and introduce it to Ghana. The Enviroloo is built from low density UV treated polyethylene and is supplied with a ceramic bowl. The design makes use of radiant heat and wind to evaporate and dehydrate waste matter into a safe, stabilised and odourless dry material. It started going through the approval process, but the field pilots are lengthy, and there was political pressure to introduce the technology quickly. It was thus approved without completing the formal process. However, subsequently the technology has not performed well and has been abandoned.
- On small town projects, it is common for project managers and consultants to introduce technologies such as submersible pumps, treatment systems and water quality testing systems without going through the formal government process. After being used in one location these technologies can get replicated elsewhere.

4. Process of selection for technologies used in government funded projects

The governments of both Uganda and Burkina Faso select technologies for use in government funded projects. Uganda has a set of guidelines for technologies, but there is no formal process for assessing technologies against these guidelines. Neither government attempts to regulate technologies funded by other donors. However, in all three countries the government is the largest financier in the sector. If the government identifies that a technology has certain advantages and funds its installation in a number of projects, that technology tends to become widely used by all stakeholders. An example from Ghana is given in box 5, although here international donors also have a large influence.

In Burkina Faso, the General Directorate of Sanitation have a compendium of recommended sanitation technologies as part of the national sanitation strategy, but there is no capacity within the strategy to adopt new technologies.

In Uganda and Burkina Faso the government have been able to overcome opposition to new technologies from locals by skills transfer and setting up local manufacture of spares and community based maintenance. In Uganda the local government have spare human resource to introduce and disseminate new technologies, although no funds to do so. For past examples of technologies introduced in this way, see box 6. In 2010 the government set up an Appropriate Technology Centre which it is hoped will play a role in the selection and development of appropriate water and sanitation technologies. It is envisaged that it will eventually start approving technologies.

In Burkina Faso ad hoc commissions are set up to select technologies for particular implementation projects and they may recommend an evaluation of the technology to identify its potential for future projects. A positive result from this evaluation is the closest to government approval a technology could reach – there is no further process. They base their selection on the technical description of the technology and the results of any pilots. This is a committee decision and no one individual has undue influence. Some examples are provided in box 7.

Box 5: Slow sand filters introduced by the Ghanaian government

CWSA piloted slow sand filters between 1995 and 1999, with funding from the World Bank. They were used in small towns in conjunction with a borehole, electrically powered submersible pump, PVC and HDPE piped distribution network, elevated reservoirs and standpipes. The initial design was improved by consultants, who produced standard designs which made replication easy. This is very attractive to donors.

Box 6: Technologies introduced by the Ugandan government

Both tippy taps and Urine Diverting Dry Toilets (UDDTs) have been introduced by the Ugandan government. A team from the Ministry of Water and the Environment and the Ministry of Health visited Zimbabwe to learn about hygiene promotion under the Saara approach, and they observed the tippy taps in action. They liked the technology and piloted it in Uganda, supported by DANIDA and UNICEF. It has subsequently been scaled up by local governments and NGOs, supported by a multi-channel media campaign on hand washing. This mechanism of technology introduction is an exception in Uganda.

Urine had been traditionally used as fertiliser in Uganda, and fruit trees are planted on filled latrines, so the Ecosan concept was not new. However, the formal introduction of UDDTs was done by the Ministry of Water and Environment, supported by the Austrian Development Agency under the South Western Towns Project (SWTS). They had to overcome negative attitudes, particularly from medical practitioners who preferred sewered systems, and those who had vested interest in VIP latrines, like masons.

The initial trials were with simple composting toilets, but there were problems with odours so urine diversion toilets were introduced instead. Pilots of UDDTs underway by 2003 in Kabale and Kisoro were particularly successful because mountainous landscapes and rocky soils were unsuitable for the excavation of traditional pit latrines, and porous rocks meant that local water sources became contaminated. The longevity of UDDTs was also valued as they did not have to be abandoned when they were full. However, costs were considered to be high, despite a 50% subsidy provided by MWE. Since 2004 these successful pilots have been scaled up nationwide by other NGOs who have recognised the benefits of Ecosan. However cultural reservations about putting ash on faeces, handling faeces and high costs are still a barrier.

However, the Ugandan government played only a minor role in promoting ferrocement tanks; their introduction more widely is attributed to ACORD in the 1970s, who tested different sands for use in the cement. They trained local artisans in tank construction. Later other NGOs and private companies trained masons as well. Construction has remained the domain of NGOs as the government wanted to focus on providing communal tanks at institutions, rather than on household tanks. However the government has made grants to promote the technology.

Box 7: Technologies selected by the Burkina Faso government for use in projects

PEHD pipe networks and VIP latrines have been selected for use in projects by the government of Burkina Faso.

The national water utility (ONEA) and the municipality selected PEHD pipe networks to supply water to four slums in Ouagadougou. Their selection was based on a technical description of the technology, rather than any piloting.

CREPA carried out initial research on VIP latrines which have since been taken up by many households and NGOs. VIP latrines will be used by the national water utility (ONEA) in the World Bank funded sanitation plan for Ouagadougou, following successful pilot trials.

5. Role of other organizations in technology introduction

In Uganda NGOs such as UNICEF, HTN, WaterAid and ACORD have introduced technologies in consultation with the ministry of water and environment and to a lesser extent the Uganda National Bureau of Standards; see an example in box 8. However, some stakeholders said they would approach organizations like UNICEF, UWASNET or JICA rather than the government to introduce a technology, and there are examples of technologies being introduced without any government consultation at all. The private sector has played a minor role too; see box 9.

In Burkina Faso, research institutions play a key role in testing and piloting technologies, and, without consulting government, will promote them through exchange workshops and other advocacy activities if they can find funds; for an example see box 10. NGOs also select technologies for their implementation projects, and this is another way of introducing a technology to the country, even if this was not the original aim of the donor, see box 11.

In Ghana it is possible to introduce technologies without government approval, but this is not a common route; see an example in box 12.

Box 8: Uganda NGOs learn about rope pumps

An exchange visit was set up for two WaterAid staff who visited workshops and installed rope pumps in Ghana. They have installed three pumps in collaboration with a local NGO and the DWD. However, the plan to scale up and install rope pumps on hand dug wells constructed by the private sector was delayed by DWD, as they thought the pump could contaminate the water, and would not be appropriate to serve communities of up to 300 people (the rope can break if overused). The current status of the national programme is unknown, but it is used for self-supply particularly by farmers. It is not regarded highly by most stakeholders.

Box 9: The private sector introduces plastic water and sanitation technologies in Uganda

Crestanks have a range of plastic water and sanitation products. They ran a national sensitization campaign to overcome fears of plastics. They met UNBS standards and built their case on successes in other countries like Kenya and Rwanda. The government has been a major buyer of plastic tanks for schools and health centres.

Box 10: Research institutes promote water technologies in Burkina Faso

Research institutions tested these technologies in Burkina Faso, and found funds to start promoting them more widely to implementing organizations.

Box 11: NGOs promote technologies in Burkina Faso

Both rope pumps and sand dams were initially installed by NGOs and tested by research institutions. There has been a lot of interest from other NGOs.

Box 12: The private sector introduces the Biofil Toilet System in Ghana

In 2008 a private developer launched with the Ghana Institution of Engineers, the Biofil Toilet System after 10 years of development, though without seeking government approval. The developers claim that this was not deliberate; they were not aware of the approval process which after all is not documented.

6. Attitude of stakeholders to new technologies

In Ghana the CWSA are very open minded to new technologies and will always engage with technology developers and promoters. The only technology where there is a really negative attitude is the rope pump. The original designs for the rope pumps meant that they frequently broke down and hence the CWSA had a negative attitude towards them and would not give approval. However, the design has since been modified and will be reconsidered by the CWSA.

In Burkina Faso stakeholders are influenced by both the availability of funds to promote a technology, and the evidence base that it works both technologically and in other aspects. They are happy to import technologies which have the potential to solve water and sanitation problems.

In Uganda the attitude of stakeholders depends on the technology, for example standardized hand pumps, UDDTs and tippy taps were viewed positively, whilst rope pumps were viewed negatively. The government has not been keen to engage with household ferrocement tanks as they believe there will be conflicts over the ownership of the water. There was little evidence that stakeholders are actively seeking new technologies from overseas.

7. Gaps in technology perceived by stakeholders

In Uganda the main gap identified by stakeholders was technologies that exploit renewable sources of energy such as wind and solar to power water facilities, although the theft of solar panels remains a challenge. Other gaps included rainwater harvesting from rock catchments, motorised borehole pumps to replace hand pumps and iron removal treatment systems. It is also possible that as urbanisation increases, more technologies will be required to serve urban areas.

In Burkina Faso there are not enough latrine technologies available to give the population sufficient choice. There are also insufficient hygiene technologies.

8. Attitude to decision making tool

There was an overall positive response to the potential for a decision making tool. In Uganda all the interviewees implied they would use a tool, though did not comment directly. In Burkina Faso 82% of interviewees said they would use the tool, as government agencies could not play a regulation role without a formal framework to approve technologies. Interviewees said the tool should:

- guide technology uptake (Uganda, Burkina Faso)
- ensure compliance with government procedures and guidelines (Uganda)
- ease the decision making process (Uganda, Burkina Faso)
- allow comparison between existing and new technologies (Burkina Faso)
- evaluate technologies to allow replication and scaling up (Burkina Faso)
- provide information about previous users' experiences (Burkina Faso)
- provide a scientific and legal process for the acceptance of new technologies (Burkina Faso)

In Uganda, interviewees said that a paper based tool should come first and a computer based tool should follow after a few years. In Burkina Faso 70% of interviewees wanted both a paper based and a computer based tool due the range of expertise and capacity in the sector.

9. Conclusion

Uganda has a clear set of guidelines for what water and sanitation technologies are appropriate. Technologies are approved for government funded projects, but there is no formal mechanism for assessing technologies against these guidelines. Ghana has a technology approval process, although it is not formally documented and there are no defined criteria for technologies to meet. The government of Burkina Faso does select technologies for use in government funded projects, but there is no set of criteria or approval process.

All the stakeholders recognised the shortcomings in their country's technology approval and introduction process, and would welcome the introduction of a Technology Assessment Framework to help them select and regulate technologies.

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I. Introduction

WASHTech project is an initiative of IRC in partnership with the Centre for Water Science of Cranfield University, Skat Foundation from Switzerland, Wateraid and CREPA in Burkina Faso, TREND, KNUST in Ghana and NETWAS-Uganda.
The overall development objective of WASHTech is to increase effective investment in new technologies in order to contribute to the achievement of MDG targets. WASHTech strategy will be to strengthen sector capacity to make effective investment in new technologies, through development of a framework or a tool which assesses the potential of new technologies introduced into innovative centralized systems. The project is implemented in the following three countries by key sector actors under the supervision of IRC. : Burkina Faso, Ghana and Uganda. In Burkina Faso, the regional Center for Water and Sanitation (CREPA) and WaterAid are responsible for the implementation of the project.

The present report accounts for the baseline study carried out in the framework of the project. It presents the basic results of the consultation of the sector actors on the knowledge attitudes and practices related to the introduction of new WASH technologies in Burkina Faso. The study has answered the following research questions :

- What is the process (tools and frameworks) for making decisions in country when a new technology is proposed?
- Is it possible to circumvent this process in the introduction of new technology in the country?

An ad hoc methodology was designed to collect the required information for analysis. The results from this analysis are presented in the current report.

II. Methodology

In order to respond to the above research questions, CREPA and WaterAid Burkina Faso have set a methodology for this baseline study. The methodology consists of :

- Prior discussions and desk study on the existing technologies which are in use in the WASH sector in the country. These comprise both wide spread technologies and those which have not been largely promoted, in addition to technologies under demonstration. A preliminary list was issued and was submitted to sector actors for validation through a process of large consultation, in a participative way, during a workshop.
- Organization of a workshop with key sector actors who have been involved or linked to the WASH technologies development. The workshop intended to share and exchange knowledge of sector actors on the technologies and their process of introduction. The workshop offered opportunity to collect more baseline information on the attitudes and practices of actors regarding new technologies. Both individual and collective points of view were collected to feed the baseline study. The participants of the workshop came from various components of the WASH sector: NGOs, central governmental departments, local authorities, research centers, academic institutions, CBOs, resource centers, water utility in charge of promoting sanitation in urban areas, University and private sector. The reason for this large consultation is that many organizations are closer or far involved in the WASH technologies introduction in Burkina Faso. This confirms the practices in use in developing countries, consisting of spreading water and sanitation responsibilities over many ministries. During the workshop, the preliminary list of technologies was amended and a shared and agreed final list was issued for the continuation of the study and the project activities in general.
- The study made use of the existing framework regarding learning alliance initiated in the context of WASHCost, a previous project implemented by CREPA. The aim of the learning alliance is to achieve the participatory implementation of the project in order to improve upon the project results uptake in the country. The use of the learning alliance framework ensures that key sector actors are involved in the project activities allowing them to contribute to the decision making process in the project and to ensure the achievement of acceptable embedding of the project results in WASH Sector. Finally, CREPA and WaterAid have associated the learning alliance members to the current study to ensure sustainable endorsement of the study outputs and later on, the dissemination of the project result.
- Two type of questionnaire were designed for the study. The first one is individual questionnaire in which sector actors were asked to appreciate their knowledge in the process of new technology introduction in the country. In the second type of questionnaire, participants were split into 6 groups according to their knowledge on the technologies. Each group was asked to comment a single technology and to describe how they have been introduced in the country. The analysis results of the questionnaires were used in the description of the formal and informal process of new technologies introduction.
- In-depth interviews were carried out with few key sector actors for their relevant roles that they play towards specific technologies uptake and promotion in Burkina Faso. Some interviews were carried out during the workshop, as others have been scheduled according to the arranged appointments.
- Analysis of the collected data and report writing.

The combination of the above methods has led to a huge quantity of information which has been cross checked and triangulated before the analysis.

III. Results

III.1 Selection of WASH technologies included in WASHTech research

The baseline study was carried out on the selected technologies which are more or less familiar to the sector actors for having being piloted or experimented in the country at a given time in WASH sector. The first concern of this study was about the categories of new technology to consider in the survey. A prior inventory made by CREPA and WaterAid has led to a number of technologies both on water, hygiene and sanitation. This preliminary list has been brought to the workshop to feed discussions. However, one of the objectives of the workshop was to achieve a common understanding of the technologies to be considered in the project and to arrive at an agreed list which will be the consensus of key sector actors.

During the workshop, the selection of the final list of technologies started from the participatory inventory of all new technologies of WASH sector in Burkina Faso.

The inventory of sample technologies was made using the criteria based on the knowledge of the participants of the workshop. The inventory was guided by the classification of the technologies in three groups, namely :

- Opportunity technologies
- Successful technologies
- Failed technologies
- Promising technologies

For each category, a range of new technologies were identified and listed, taken from existing ones including un-tested and those which have been piloted. In the course of the exercise, the trend was to consider successful technologies as those which have been taken up to scale through both adoption into national sector strategy or not. Other arguments considered the level of contribution of the technology to the access to basic WASH services. The failed technologies were considered as those which have not been taken up by sector actors. Participatory discussions were engaged to bring participants to a common understanding for the sake of the inventory. This classification has resulted into the identification of a wide range of technologies covering many aspects of the WASH sector including, multiple use, environmental concerns, recycling even technologies under research were considered as promising.

The first round of inventory resulted in to more than 20 groups of technologies. Through prioritization and discussions, the list was narrowed down to three categories and six technologies as follows :

Table 1: Technologies selected for this review

Successful	Promising	Opportunity
VIP latrines	Ecosan Latrine	Sand Dam
Hand Pump (India Mark)	Rope Pump	PEHD network

Legend:
- VIP : Ventilated Improved Pit : a pit latrine equipped with a vent pipe
- Ecosan : Ecological : It is an urine diversion latrine with reuse of the byproducts

- PEHD : Poly Ethylene High Density : It is water supply network using PEHD pipes and to slums and unplotted and congested areas
- Rope Pump : A simplified hand pump made up with rope and wheel
- Sand Dam : It is a simplified dam realized in the minor bed of rivers to allow retention and infiltration of water in order to create local ground water for some time.
- Hand Pump : Mostly, it is the pump installed in the boreholes. The Indian mark is the one considered in the study.

The category related to the failed technologies has been finally dropped down due to lack of consensus among sector actors. Almost no technology was identified in this category.
This final list has the merit to have been adopted by consensus by key sector actors, contributing to prepare them for the endorsement of the future project's results.

The above list of technologies was taken through the process of the Knowledge Attitudes and Practice study, for which questionnaires were designed to collect data.

III.2 Informal process

The survey has assessed the informal processes for approving WASH technologies in Burkina Faso. Analysis of the survey revealed many informal processes which vary from simple demonstration models to scientific testing of the prototypes prior to the scaling up phase. The choice of a given process does not follow any rule and depends only on the organization plan. The following processes have been identified

- Technology oriented projects : most of the hand pumps in use in Burkina Faso have been introduced in favour of the water supply projects funded by donors. The process is very simple and consists of a project funded by a donor who recommends a specific technology. Then the bidding committee analyses the relevancy and the efficiency of the technology using criteria logical criteria presented in section III.2 (formal process). The committee undertakes the analysis on the basis of the technical descriptions provided by the dealer of the technology. Once the deal award committee appreciates favorably the technology, an approval is given to the donor or to the dealer (who wins the bid) to implement the project. If necessary, the departments of technologies development (at Water resources and Sanitation Directorates) set up a follow up mechanism to evaluate the performance of the newly introduced technology. The final decision of the introduction is made either by the committee, or the donor or the governmental department. This informal process has been used many times for the introduction of most of the hand pumps and some hygiene technologies. The performance of the technology will determine it's up take by sector actors.

- Pilot or demonstration project of technology : from the initiative taken by a NGO, a given technology can be imported from abroad. The technology has been previously assessed by the promoter who decided to bring it to Burkina Faso. A pilot or demonstration project is therefore implemented to show case the technology in order to test its performance. The demonstration phase has involved a number of sector actors (government, university and research center, NGO) to ensure the participatory approach in the technology development. During the test, the technology is taken through an improvement process for its adaptation to socio cultural conditions, for the purpose of improving the performance of the technology and ensuring its ownership at users' levels. Once this phase is successful, the technology is therefore proposed to sector actors as a solution to improve assess to basic services. This is the case of Rope Pump and Sand Dam technologies. The demonstration projects can be multiplied and replicated in other areas under different socio cultural conditions, for the purpose of measuring the acceptability and the ownership requirements. Next step will be the uptake, and the scaling up of the technology. Meanwhile, some communication actions will be required to disseminate information on the technology. In the case of the Rope Pump, the take up is still expected and does not occur yet.

- Research oriented project: the third informal process identified in the context of this study is the introduction of the technology through research. The process starts from the acquisition of the technology by a research organization. Limited prototypes are therefore set up for the purpose of research activities. A number of scientific tests are then carried out according to a set of protocols elaborated by the researcher. In the case of Ecosan, ecological latrines, number of CREPA network countries have jointly conducted the research on the facility in order to cover as many as possible different socio cultural conditions in Africa. Some time the research involves more than one organization. CREPA has associated universities and agricultural research centers to the development of Ecosan in Africa. The research phase has helped in the identification of all socio cultural barriers that can prevent the technology from its take up by the populations. It has taken to CREPA about 3 years to conclude the research and to assess the acceptance level of the technology. Number of papers and documentation outputs were produced with the research partners. Once this was done, the dissemination phase started in favour of the European Union Facitlity projects for which CREPA, Universities and Agricultural research centers have submitted proposals. A project of on thousand latrines in peri urban of Ouagadougou and other thousands in rural areas in Burkina Faso for example has contributed to boost the technology. It can be concluded that the technology has been taken up from there.

The above presented processes are considered as informal because they are related to the promoters' practices and they do not follow any standard previously agreed by WASH actors. Taken individually, every identified informal process has the potential to arrive at the take up of the technology. Finally, it can be seen that there are many processes which actually are drawn from the sector actors' practices

III.3 Formal process

The formal process related to the introduction of new technologies in Burkina Faso was assessed trough the following questions:

- Are there any national standards that WASH technologies need to comply with before they are tested or are approved by government?
- Is there a national process for introduction of WASH technologies?

During the study, the question was addressed using practical examples of the introduction of the selected technologies of the project. It has been noticed that according to the technology, the approval steps vary and did not follow any existing formal standards or agreed framework defined at national level. Besides, the approval of the government does not always determine the take up of the technology, as many technologies have been widely promoted prior to their introduction in the formal process of the government. The followings provide an overview of process through which selected technologies have been adopted.

- Technologies introduced by research institutions: most of the time, research and academic organizations introduced innovative technologies in the country according to their ability to improve access to basic services of populations. Some the technologies might previously have been promoted in other countries and might have proven efficiency. This was the case of VIP, Ecosan, Rope Pump. The research organizations take the initiative to test it in the country and to start promoting it provided that funds are available to support the process. Gradually, the technology is known by sector actors in favour of communication and information/dissemination actions. No national standard steps were followed in the promotion of this category of technologies.

- Technologies introduced in the framework of projects: Many technologies have been introduced by development projects. In the case of the present study, Hand Pumps, all marks combined, have been widely disseminated in the country in the favour of WASH projects. Sector actors have confirmed that many of the hand pumps in use in Burkina Faso have been promoted in the framework of the project. There too, the approval process did not follow any standards. However,

the 37'607 boreholes (DEIE, August 2010) of Burkina Faso have been equipped with hand pumps from different marks without any prior formal approval process. According to recent studies, there are currently about 12 different marks of hand pump in use in Burkina Faso. Most of them have been introduced by water supply projects funded by donors or national budget, with technology oriented approach.

- Technology introduced by NGOs : Rope Pump and Sand Dam have been introduced in Burkina Faso by NGOs which have installed the first prototype. The above two technologies are ranged in the categories of promising and opportunist facilities. They have not yet gone though any wide promotion project. But, many NGOs' and individuals have expressed demands the Rope Pump especially. The Sand Dam is still under experimentation. Both technologies have not been examined and approved officially though any official standard.

- Technology introduced by governmental institutions : the survey revealed that some technologies have been promoted by governmental related organizations. ONEA the national water utility and the municipality of Ouagadougou have joined hands to promote the PEHD (Poly Ethylene High Density) network technologies in slums areas of Ouagadougou. The technology has not been tested by research institutions, but it is currently used to provide water services to, at least, four slums areas of the capital city. At this stage, it can be noted that the project has actually passed pilot phase.

In the same category, the VIP latrine has been widely promoted by ONEA the water utility, in Ouagadougou and in the main towns of the country. The process through which the technology was channeled is different. Years after the research activities conducted by CREPA on the VIP latrines, the technology has been taken up by many households and NGOs. In the frame work of the World Bank project, the water utility has selected the VIP latrines in the sanitation strategic plan of Ouagadougou, in addition to other facilities also tested by CREPA. After technical studies and demonstration prototypes in project areas, the VIP latrines were taken up by households for the improvement of their living conditions.

In either case, no formal standard was used to approve the technology prior to their introduction by the two governmental organizations.

1. What do these national standards specify in relation to Water, Sanitation and Hygiene hardware/approaches respectively?

- In the absence of formal standard, WASH technologies and approaches are approved based on the technical appreciation of the WASH departments and project promoters. The main criteria used are related to the ability of the technology to provide services to population, the availability of spare part and the maintenance expertise at local or national levels. No formal standard was issued in WASH sector to approve technologies and approaches.

2. What are the institutions concerned and what is their role in the process?

Two main institutions can be mentioned for their roles in the process of new technologies adoption, in the context of total lack of formal standards.

- **DGRE** (General Directorate of Water Resources) where the department of facilities development and the department of bidding and new project follow up, are tasked to appreciate new projects including the technologies which are suggested in the projects. Usually, the appreciation of the new technologies is done by an ad hoc commission set up for this purpose. The two departments have the possibility to associate external technical experts to provide technical and in depth analysis if the suggested technology is very new and unknown in the sector. The commissions play only consultative roles in the process. They may argue against or for the introduction of the technology and do not have the power to forbid it. Most of the time the commissions recommend

to the department to follow up the performance of the new technology and document it for the purpose of learning lessons for the future projects.

It is worth to mention that none of the departmental staff or the ad hoc commissions have national standard that they use to appreciate the new suggested technologies. The evaluation is done on the basis of the common sense criteria as follows :

- ability of the technology to provide services to the population
- availability of repairers and spare parts for maintenance purposes
- performance of the technology and its operation requirements
- Health issues related to the new technology

Depending on the technology under study, other criteria can be added to the list.

If WASH sector is lacking official standard to approve new technologies, it does not mean that nothing is done. An attempt was made to regulate the management of the existing boreholes and their hand pumps. A reform intended to reduce the high rate of break downs of the hand pumps (up to 30% some times), was adopted in 2000 (décret n°2000-514/PRES/PM/MEE). It provides guidance in the management of the boreholes and delegation of responsibilities if any, in the context of the decentralization. In this reform, no selected and limited technologies were recommended to the sector actors. Whatever the pump technology is, the reform states the institutional arrangements to set up and the types of operation and maintenance contracts to be considered in order to achieve durability and lasting impacts to the populations.

- **DGAEUE** (General Directorate of Sanitation): the department of technology development and sanitation facilities is in charge of promoting technologies which can provide basic services to populations. The same process as in DGRE takes place in this department. Ad hoc commissions are set up to analyze project based on given criteria of which main ones are as follows:

    - Durability of the technology and resistance to natural bad weather,
    - Security issues related to the slab and pit protection,
    - Environmental protection and ability to break up with the transmission of the diseases.

    The list is not exhaustive and new criteria can be added when necessary.
    At the sanitation directorate level, no official standard does exist for the approval of new sanitation technologies.

    In addition to the commissions system, the general directorate of sanitation has elaborated a sanitation strategic plan which is the formal Implementation of the sanitation strategy of Burkina Faso. The document is a compendium of the selected sanitation technologies which are recommended to sector actors in frame work of the Millennium Development Goals plan. As it can be seen, it is not a standard to adopt new technologies.

3. What technologies have been introduced using this process over the past 30 years?

4. Has the process ever been circumvented?

    Sector actors have been using various processes according to their pursued goals. Thus, in case where no formal process does exist, it can be concluded that no technology has been introduced using formal agreed channel, nor the process been circumvented.

III.4. Attitudes

The session is addressed in two ways, the first one is related to the attitudes of key stakeholders to specific technologies and the second one is the attitudes of key stakeholders to technologies approval process.

III.4.1 Attitudes of key stakeholders to specific technologies

The attitudes to specific technology vary according to the stakeholder and the context in which the technology is introduced. These attitudes are assessed on the selected WASH technologies both for water and sanitation.
From the above comments, it has been noticed that many factors determine the attitudes of the stakeholders, some of them are:

- the availability of funds to promote the technology
- the research capacity of the organisation
- the performance of the technology to be introduced in the country

Governmental departments approve the technology on the basis of the assessment that ad hoc committees carry out to appreciate the performance of the facility. There, a series of criteria are set up to evaluate the technology from two angles :

1. either from the technical description of the technology, this seems the case of most of the hand pumps introduced in Burkina Faso. The PEHD network promoted by ONEA is another case.
2. or from the pilot or demonstration actions where data are collected on the performance of the technology and its acceptability at users level, this has been applied to Ecosan and VIP latrines which were included in some sanitation strategies in Africa.

However, the evaluation only is not determinant for the take up of the technology. After agreement or approval of the technology has been achieved, the availability of funds determines the scale up of the facilities.

The second type of attitude noticed during the survey is related to research. Research and academic organisations tend to carry research activities. The technologies promoted by this group were tested and experimented before scaling up through projects and consultancy activities. Therefore, standard scientific procedures are followed. They are made up with enquiries and assessments, pilot projects, sharing and exchange workshop at all levels of the stakeholders, advocacy and awareness raising activities and finally, adoption of the technology in strategic plans and policies documents. This attitude is observed toward VIP, Ecosan, and to some extent, the rope pump.

In the third group, the attitudes of the key NGOs to specific technology are just related to the ability of the technology to provide service to populations. Appropriate technologies were imported from abroad to solve WASH problems in Burkina Faso. NGO invest in the pilot projects but do not necessarily organise research actions through scientific procedures. The sand dam facility introduced by WaterAid is under experimentation in the country. CRS (Catholic Relief Service) is trying to promote the "hand pump India mark 3". It has been noticed from the survey that, some NGOs encourage participatory mechanisms of promoting new technologies. WaterAid,CREPA, 2IE, and DGRE are involved in the promotion of rope pump in Burkina Faso. Under the same conditions, Helvetas has collaborated with CREPA in the experimentation of the clay water filter imported from Ghana.

In any case, no individual has been identified to have played key roles in WASH technologies promotion. Interviewers have confirmed that even if it were the case, the person should act on the behalf of its organisation. In conclusion, any technology has been identified as individual endeavour.

III.4.2 Attitudes of key stakeholders to technologies approval process

The attitudes of key stakeholders to technologies approval process are described in this section using the following questions which have guided the interview during the study. Yet, it is important to point out that the WASH sector does not have any formal written guidance which the sector actors can use to

appraise the technologies they plan to introduce in Burkina Faso. As it was mentioned above, the attitudes are more or less informal and each actor is tempted to use any process appeared relevant to the goals behind the project.

- Do they personally follow any formal written guidance, where it exists?

In general, many sector actors have participated in the process of introduction of a given technology in Burkina Faso. The following graph shows the extent to which the interviewees have been associated to the process of the studied technologies introduction in Burkina Faso. The first technology which has involved sector actors is the hand pump (60%). This confirms how old is the hand pump (since independent in fifties) and the place it occupies in the park of WASH technologies in Burkina Faso. It is followed by the VIP and Ecosan latrines in which more than 40% of the sector actors are involved in their introduction. The newly introduced technologies by ONEA and municipal assembly (PEHD), rope pump and sand dam are at the same level of the appreciation. Less than 20% of the samples are involved in their promotion.

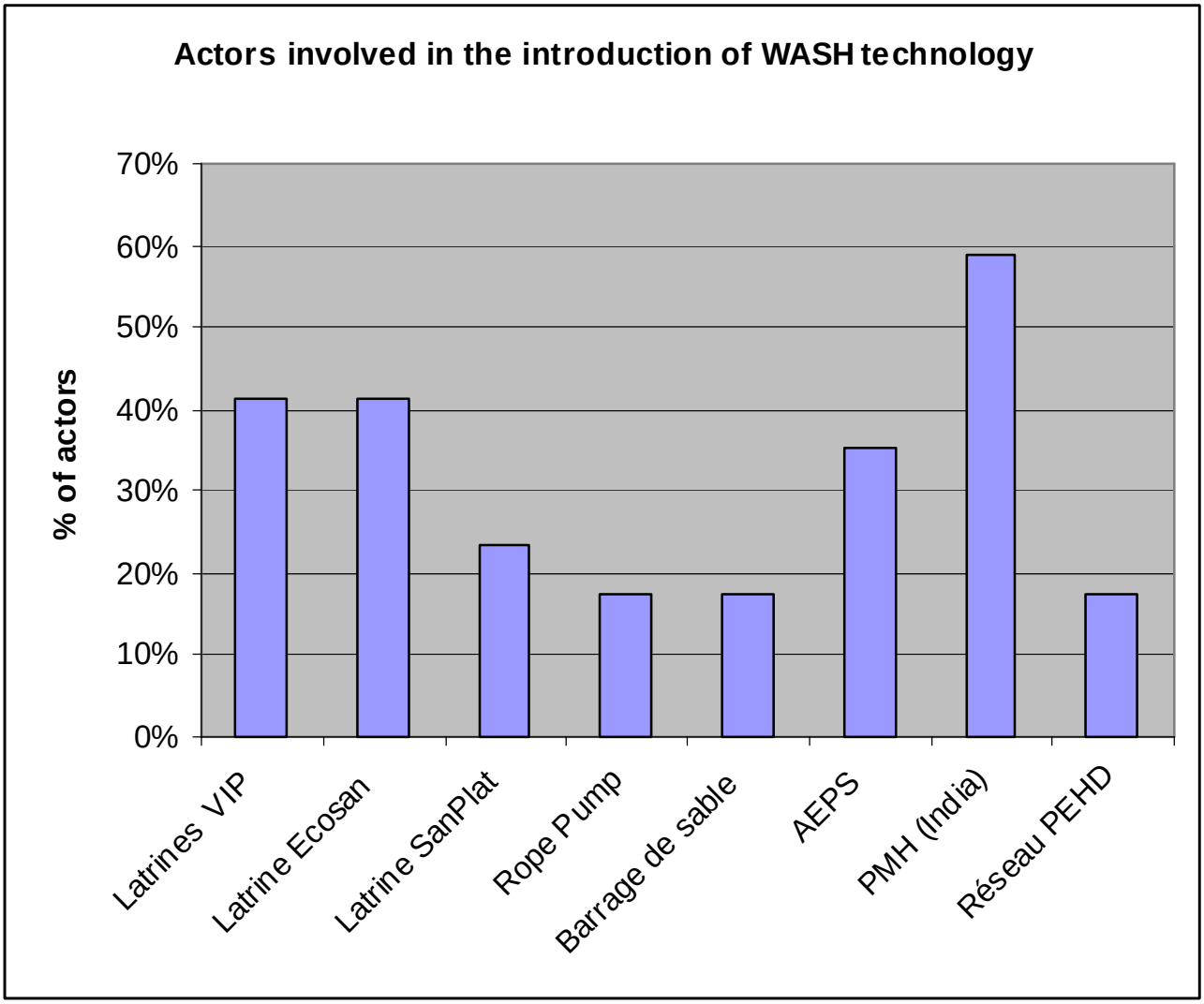

Figure 1: Actors involved in the introduction of WASH Technology

The contexts in which the sector actors were involved in the promotion were assessed and the result shows that various processes are used. Basically they include :

1. Training : capacities are developed on the technology in a context of a project
2. Participation to policy and strategies elaboration
3. Implementation of donors projects in which the technology is promoted
4. Research activities (test or piloting of the technology)

5. Demonstration projects

From the above development, it appears clearly that no actors has made mention of any formal guidance. The list confirms that different processes are used during the introduction of the technologies.

- Are they part of the approval process, and what has been their experience?

In absence of formal approval process, the question was assessed on the basis of their involvement in the informal process. The study has identified three main informal processes in use in the sector. For each of the process, they interviewed actors are more or less part of it, depending on the category of organisation they work for.
Experiences vary too from one actor to another one. But in general, it has been mentioned the following:

1. lack of formal guidance to appraise the new technologies,
2. the trend is to rely on the research organisations and the endorsement of the new technologies,
3. in some circumstances, once the performance of the technology is well appreciated, it may receive approval without any process a part from the evaluation done by the ad hoc award committee.

To conclude this session, it has been noticed that the elaboration of the sanitation strategies is considered as the formal process of approving the technology. But normally, all new technologies do not need to be included in the strategic plans prior to their promotion to wide extent or their scaling up.

- Is there a specific agency they would approach to approve a technology?

Research organisations are mentioned to play key roles in the approval process. However, according to the technology, some sensitive issues related to people's security in latrines construction and water quality, the final approval should include governmental department. In case of WASH, the two main directorates of Water Resources and Sanitation were mentioned. So DGRE and DGAEUE would be approached in the process of technologies introduction.

- Would they be prepared to use a decision-support tool?

The assessment of the need for decision support tools has lead to very fewer actors declining the offer (18%). Most of the sector actors (82%) are aware of the gaps related to the formal approval process. Witness from the survey has indicated that governmental agencies could not play their regulation roles in the absence of the formal framework to approve technology. Therefore, the need to dispose of decision support tools is very urgent and officials will be eager to support any initiative towards that.

- If so, would they prefer this to be paper or computer based?

The need for decision support tools in WASH technologies approval process has been identified at all levels : governmental, NGOs, research organisation, Private, local authorities, development agencies. Looking at the variety of expertise and capacities available in the sector, they two types of the decision support tools will be required. This figure has been confirmed by the survey which shows that 70% of the interviewees have opted for the two versions of the tool.

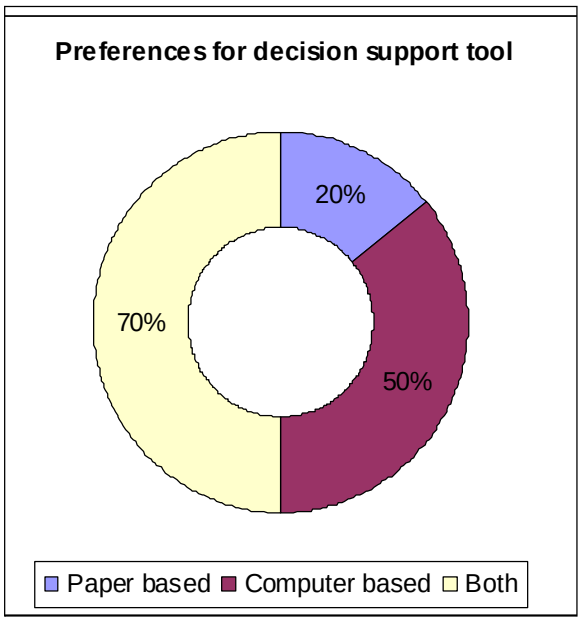

Figure 2: Preferences for decision support tool

In addition to the above preferences, the following have been suggested to guide the development of the future decision support tools:

Table 2: Potential tools and their roles

Tool name	Roles
Decision support tool	- Comparison between existing and new technologies - Follow up and evaluation of technologies in order to allow replication and scaling up - Guide local actors in the choice of technologies and competences transfer - Provide in depth information from users experiences for the best decision making - Avoid failures during dissemination
Referential framework	- For the ownership of the technology - Scientific and legal process for the acceptance of new technologies
Awareness raising tool	- Facilitation of the adaptation of the technology - Sensitization of actors on the dissemination of the technology
Referential document	Tools for the adoption of the new technologies in the policies and strategies

- Are they influenced by their personal experiences?

Many experiences have been shared on the technology introduction. They cover many areas from financial to institutional. Key elements from these experiences are :

- Lack of financial capacities of population to take up the promoted technologies despite subsidy schemes provided by the projects.
- When the projects are fully funded, the dissemination does not suffer from any difficulty;

During new technology promotion, organisations have to deal with number of suspicions from populations. Most the time, this dimension is not considered in the technology introduction process.

IV. Conclusion

Intended to answer the following questions :

- What is the process (tools and frameworks) for making decisions in country when a new technology is proposed?
- Is it possible to circumvent this process?

The present study was carried out in the framework of the WASHTech research project. It has assessed the knowledge, attitudes and practices of the sector actors towards the introduction of new WASH technologies in Burkina Faso. About 30 sector actors from hide variety of institutions were consulted on the issue.

Basically, the study has revealed a lack of formal framework for appraising the technologies which sector actors intend to introduce in the country. However, the practices have shown that different categories of actors are using different processes depending on their interests and the objectives of the technologies promotion.

Besides, it has been identified that availability of funds is determinant in the speed up of the introduction of the technologies and their fast scaling up. Governmental departments however participate to technologies approval not with formal process but with some ad hoc criteria, prevailing the well performance and the efficiency of the facilities.

Finally, research organisations play major roles in these informal processes. Technologies tested and piloted at demonstration scales, present potentials for scaling up and are appreciated by almost all sector actors.

The idea of decision support tools has been supported by 80% of the surveyed actors, it appears very relevant to support any formal approval process. Witnesses from the survey have indicated that governmental agencies could not play their regulation roles in the absence of the formal framework to approve new technologies. Government officials have acknowledged the necessity of providing the sector with official standard to approve new technologies prior to there wide promotion in the country.

Not only have the WASH sector officials approved the ideas. At the ministry of scientific research and innovation, professionals from technical innovations fairs' organizers have indicated that they will be interested in the development of such formal process which are lacking currently but, will help them to select and to approve innovations and technologies to be largely promoted in Burkina Faso, in all development sectors.

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Annexes

List of actors interviewed

Name	Title	Department	Date
OUEDRAOGO Moussa	Interviewed on behalf of the Director or Technology Development and Sanitation Facilities	DGAEUE General Directorate of Sanitation	18/07/2011
AKIALA Baguiawan	Department of Bidding contracts follow up and monitoring	DGRE General Directorate of Water Resources	18/07/2011
WEREM Alhadi	Counselor of Minister CNRST	Ministry of Scientific Research and Innovation	19/07/2011
TRAORE Simon	Project Officer	OCADES	14/07/2011
MOULOKI Christian	Program Coordinator	HELVETAS	14/07/2011
KABORE/KARA Aminata	Project Officer	DRAH-C	14/07/2011
WOZUAME Kossi	Head of Department	WaterAid	14/07/2011
DAKOURE Denis	Program Advisor	GIZ/PEA	14/07/2011
AMEGNRAN Yaotrée	Project Coordinator	CREPA	14/07/2011

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Water Sanitation and Hygiene Technology Assessment Framework: Baseline study on stakeholder's Knowledge, Attitude and Practices

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The **Water, Sanitation and Hygiene Technologies (WASHTech)** is a three-year action research initiative that aims to facilitate cost-effective investments in technologies for sustainable water, sanitation and hygiene services (WASH). Through action research and the development of a set of methodological tools and participatory approaches, WASHTech embeds the practice of multi-stakeholder learning, sharing and collaboration – instilling individual and collective ownership and responsibility for sustainable WASH services.

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Abbreviations

TOR :	Terms of Reference
KAP :	Knowledge, Attitude and Practices
WASHTech :	Water, Sanitation and Hygiene Technologies
CWSA :	Community Water and Sanitation Agency
EHSD :	Environmental Health and Sanitation Directorate
WASH :	Water, Sanitation and Hygiene
COM :	Community Ownership and Management
MWRWH :	Ministry of Water Resources, Works and Housing
MLGRD :	Ministry of Local Government and Rural Development
GWSC :	Ghana Water and Sewerage Corporation/Company
CIDA :	Canadian International Development Association
VLOM :	Village Level Operations and Maintenance

Executive Summary

This report presents a baseline study of the Knowledge, Attitudes and Practices (KAP) of stakeholders involved in Water, Sanitation and Hygiene technology assessment. It is part of the WASHTech action research on a Technology Assessment Framework (TAF), which looks into technologies in the Water, Sanitation and Hygiene (WASH) sector in Ghana.
The report is based on a survey and discussion of both formal and informal processes that have been used in introducing Water, Sanitation and Hygiene (WASH) technologies in Ghana. This study commenced with an expert group meeting with key informants from the main stakeholders. Government agencies present included representatives from:

- The Ministry of Local Government and Rural Development (MLGRD),
- Ministry for Water Resources, Works and Housing (MWRWH)
- The Environmental Health and Sanitation Directorate (EHSD)of the MLGRD
- The Community Water and Sanitation Agency of the MWRWH

This was followed with a series of detailed interviews with selected key informants in both the private and public sector.
The report describes the process of introducing new WASH technologies in Ghana. It reveals that although there is a process for the introduction of WASH technologies, which involves the MWRWH and the MLGRD, the process is neither explicit nor is it documented. The unavailability of an explicit framework and a documentation of procedures for introduction of new WASH technologies means that most of the other stakeholders, primarily the private entities, were unaware of it.
The study also identifies key factors that affect the success of new WASH technologies which are; community acceptance, ease of use, private sector involvement, training on the technology, availability of standard drawings and related guidelines, aesthetics, technology durability, ease of replication and finally willingness of donors to fund the technology.

1. Introduction

This report presents the baseline study on stakeholder's Knowledge, Attitude and Practices (KAP) on Water, Sanitation and Hygiene (WASH) technology assessment framework in Ghana. The study is part of the WASHTech project and was conducted in accordance with the TOR for work package 7.1 developed by Cranfield University.
The objective of the baseline study is to describe the process (tools and frameworks) for making decisions when a new technology is proposed for the rural and peri-urban WASH sector in Ghana. The report describes both formal and informal processes that have been used in introducing WASH technologies in Ghana. The report is based on interviews with the key stakeholders from both the government agencies and the private sector.

2. Methodology

The WASHTech Task force meeting on May 12, 2011 was the starting point for the study. A presentation on the approach for carrying out the baseline study was presented to the WASHTech Taskforce. The taskforce team is made up of key informants from the government and private sector who are involved in rural WASH service delivery in Ghana. After the presentation there were discussions on the processes of accepting and approving technologies. This provided the basis for selecting key informants for the study.
A series of interviews were conducted with the key stakeholders from the government agencies and the private sector on the process of introducing WASH technologies. The guides provided in the TOR formed the basis of the questions. The interviews were conducted with three key informants of Community Water and Sanitation Agency (CWSA), one key informant from the Environmental Health and Sanitation Directorate (EHSD) of the ministry of local government and rural development, and three key informants from the private sector who have introduced or considered introducing WASH technologies in Ghana. The list of people interviewed is shown in Appendix A.

The report is structured as follows:
Section 2: presents the process for approval of water technologies
Section 3: presents the process for approval of sanitation technologies
Section 4: Stakeholder attitude to WASH technologies
Section 5: Stakeholder attitude to technologies approval process
Section 6: Process and outcome of WASH technologies introduced in Ghana
Section 7: presents the conclusion of the study

3. Water Supply Technology Approval Processes in Ghana

This section describes the process of approving water technologies in the community water sub-sector by focusing on both the formal and informal processes. The first sub-section provides a succinct overview of the roles and responsibilities of the key actors in the rural and peri-urban WASH sector. The second sub-section presents the historical development and the process of developing and standardising water technologies for the rural and small towns in Ghana. The third sub-section describes the process of introducing new water technologies in Ghana.

3.1 Overview of the rural WASH sector

The government institutions responsible for approving WASH Technologies are the sector ministries, the Ministry of Water Resources Works and Housing with responsibility for water and the Ministry of Local Government and Rural Development (MLGRD) for sanitation and hygiene. The Water Directorate is the focal point within the Ministry of Water Resources Works and Housing for water.

There is also the Community Water and Sanitation Agency, the government agency responsible for facilitating water and sanitation services delivery in rural and small towns in Ghana. The responsibility for providing water and sanitation services lies with the District Assemblies (local authorities). The strategy employed by CWSA to enhance the sustainability of rural and small towns water supply delivery is the use of the Community Ownership and Management (COM) approach. The COM approach gives community members a sense of ownership by contributing to the capital cost and also gives them the responsibility of management of the water facilities by forming gender balanced community boards/committees.

CWSA as part of its facilitating role, provides technical assistance for the planning and implementation of water and sanitation facilities in the districts. In addition, the Community Water and Sanitation Agency (CWSA) takes the lead on behalf of the Ministry of Water Resources Works and Housing (MWRWH) for the day to day management of the process of approving water technologies for the rural and small towns water sub-sector.

The Environmental Health and Sanitation Directorate (EHSD) under the Ministry of Local Government and Rural Development (MLGRD) has oversight responsibility for sanitation and hygiene in Ghana (urban and rural). The EHSD collaborates with Community Water and Sanitation Agency to facilitate the implementation of rural water related sanitation. The EHSD of the MLGRD takes responsibility for the day to day management of the process.

3.2 Historical development of rural water supply technologies in Ghana

The Ghana Water and Sewerage Corporation (GWSC) was responsible for both urban and rural water supply from 1965 to 1994. In 1994, the rural water department of GWSC was converted into a semi-autonomous department, the Community Water and Sanitation Department. The Community Water and Sanitation Department was subsequently converted

into an autonomous agency, the Community Water and Sanitation Agency (CWSA) in 1998 to facilitate community water and sanitation services in rural and small towns.
During the Ghana Water and Sewerage Corporation (GWSC) era, the rural water department implemented various projects such as 2500 boreholes fitted with hand pumps project which was executed by Canadian International Development Association (CIDA) in northern Ghana (1978 - 1980) and 3000 Boreholes fitted with hand pumps in southern Ghana also executed by German GTZ/KfW between 1980 and 1983. The projects led to different handpumps such as:

- Hand pumps supplied from Canada (Beatty, Moyno, Mono pumps) in the 1970s
- Hand pumps of Indian origin- the standard Indian Mark II hand pumps in the early 1980s
- hand pumps of French origin (Vergnet HPV-60) early in the 1990s
- UNDP/World Bank Piloted the VLOM Concept and used Afridev Pump
- CIDA 1994 - Converted existing hand pumps (Beatty, Mono, Moyno) to Afridev (VLOM) pumps in 1994

CWSA adapted four standard handpumps based on the experience of implementing rural water supply from GWSC era. CWSA also facilitated the establishment of spare parts distribution network from the national level to the district level to stock parts of these pumps. The standard handpumps are:

- Vergnet (a foot pump)
- Afridev (lever action pump)
- Indian Mark II (Ghana modified- stainless steel rods and brass cylinder because of the nature of the water) (lever action pump)
- Nira AF 86 (direct action pump)

The NIRA is a shallow well application VLOM pump introduced into the Greater Accra Region by UNICEF together with hand-dug wells and hand-drilled wells. UNICEF funded the first few facilities and then provided for training to scale it up. The NIRA handpump and hand-drilling rigs were tested. Of these three technologies only the NIRA and hand-dug wells went to scale at the national level.

The Indian Mark II was introduced on a large scale during the KfW (German) funded boreholes project where 3000 boreholes were drilled in 6 regions. The modifications made were because of the problems they ran into. The Afridev was being used in various countries in Africa, it was developed in association with SKAT as a handpump for African countries. The Vergnet was a French pump being used in former French colonized African countries. In Ghana it was based in the Central Region because that was where the French funded projects were being implemented.
For piped systems, small towns systems in general and slow sand filters (SSF) in particular, CWSA piloted these technologies with projects from 1995 to 1999, under the World Bank funded project. A typical small towns' water system consists of a source (usually a mechanised borehole), Pump house (a submersible pump powered by a 3-phase voltage transformer), Source of power (AC power from the national grid, local diesel Power

generator or Solar panels - only few cases in the northern region), Pipelines (transmission and distribution pipes made of PVC and HDPE), and an elevated reservoir, standpipes and appurtenances. After piloting, CWSA trained consultants to help improve it. The consultants together with the technical team of CWSA produced standard tender drawings and design guidelines for the SSF. This made the technology easy to replicate. Suddenly, all donors who were not initially interested in small towns got interested in it and the small towns water supply system and SSF blew up to national level.
In summary, the main water technologies in use were developed and/or standardised by CWSA based on their experiences in the rural water supply in Ghana.

3.3 Process of approving new technologies

In recent times people have tried to introduce technologies in the community water sub-sector. The procedure of approving new technologies by the CWSA is as follows:

- The first step is to submit the proposal on the new technology to Ministry of Water Resources, Works and Housing through the Water Directorate.
- The Ministry of Water Resources, Works and Housing will direct the proposal to CWSA for consideration.
- The proposer is invited by CWSA to provide literature and make a presentation on the technology.
- CWSA then sets up a technical committee on the basis of the presentation to study the technology and provide a report to the Chief Executive of CWSA. If the technical committee finds the technology to be promising, they recommend piloting of the technology at the cost to the proposer of the technology.
- At the end of the piloting, the length of which is dependent on the individual project designed, CWSA would write a report on how well the proposed technology performed and indicate whether it should be taken on and in which cases and to what applications they should be put. Generally, the assessment looks at four areas including: technical performance;
    - Acceptability and user friendliness,
    - capital cost; and operation and
    - maintenance cost.
- When the technology is accepted, consultants and NGOs are engaged to do the education on the technology. The education is aimed at showing the community the advantages and disadvantages, safety and breaking of cultural barriers. This is done when the technology is being replicated under a project in which case there are funds provided for community mobilization and training.

The above procedure has been an internally developed process to approving new technologies. However, there is no document with a written down formal process that explains how technologies are assessed and approved for the community water sub-sector. There are also informal aspects to the technology introduction relating especially to small towns water systems where projects/consultants bring in technologies such as submersible

pumps, treatment systems and water quality testing systems. These do not go through any approval process but once they work on one project other projects adopt it.
This process has been applied to the water treatment unit introduced by Water Health Ghana. The water treatment technology by Water Health has been approved by the CWSA. It has not gone to national scale but it has been used in the areas where it is relevant. The water treatment unit by Water Health is not recommended by CWSA for every place that wants piped water for the simple reason that it is expensive. So it is used as a last resort for areas where the standard system cannot provide the water.
CWSA gives priority to the use of groundwater for provision of drinking water in rural areas and small towns. In areas where hydrogeological conditions do not permit the use of groundwater, surface water is resorted to. CWSA uses slow sand filtration in treating surface water for piped systems. In instances where the quality of surface water will make slow sand filtration ineffective in treating water, high cost treatment alternatives such as Water Health's system are permitted.

4. Sanitation Technology Approval process

This section describes the process of approving and introducing new sanitation technologies in Ghana by focusing on the formal procedures. An example of a situation where the formal procedure was not used is also described.

4.1 Formal process of introducing sanitation technologies in Ghana

The key stakeholders involved in approving sanitation technologies that are introduced in Ghana are the Ministry of Local Government and Rural Development, the EHSD and the Metropolitan/Municipal/District Assemblies. The Ministry of Local Government and Rural Development will take a decision on a sanitation technology when the technology has been referred to the EHSD. The ministry always refers proposed technologies to the EHSD. There are instances that the EHSD refers technologies to appropriate institutions such as Ghana Standards Board and Food and Drugs Board for extensive technical support to do the necessary tests. The Standards Board and Food and Drugs Board don't approve technologies within the sanitation sector but only advise the EHSD based on their own standards when they are consulted. The Environmental Health and Sanitation Directorate leads the process of approving sanitation technologies in Ghana. The procedure for approving sanitation and hygiene technologies by the EHSD is as follows:

- Anyone who wants to introduce a sanitation technology has to write to the Ministry specifically the Minister.
- The Minister refers the letter to the director of Environment Health and Sanitation Directorate.
- The Director of the EHSD puts together a technical team which usually comprises programme officers, within the directorate as well as districts staff. The team is formed based on the type of technology that is proposed.
- The person or organization introducing the technology makes a presentation on the technology to the technical group and explains details of the technology and its performance.
- Based on the presentation the technical group will make a recommendation to reject the technology or to pilot the technology to further assess its suitability for the Ghanaian

context. The criteria for accepting or rejecting a proposed technology is not standard, but depends to a very large extent on the issues presented in the proposal. These usually border on three basic issues and these are:

- Cost of the technology
- Operation of the technology (ease of usage)
- And the operation and maintenance cost

An example of a technology that has gone through the formal procedure is the Waste to Energy plant that was brought by a team from Finland. The technical evaluation showed that the kinds of wastes needed to power the plant were not produced in the Ghanaian environment meaning the technology is not suitable for the Ghanaian context. Similar to the case of water, there is no documentation of this process.
After the technical evaluation, if the technology is approved, the one introducing it into the country is asked to fund the first pilot. The Metropolitan, Municipal or District Assembly (MMDA) within which the pilot is carried out assesses the technology throughout the piloting period. An assessment report of the pilot technology is written by the MMDA and is made available to the MLGRD through the EHSD based on which a final decision is reached on whether the technology was successful or failed.

4.2 Informal process of introducing sanitation technologies in Ghana

There are cases where some sanitation technologies did not follow the formal process. The main reason for this was mainly due to political interference in the process. An example is the Enviroloo toilet technology that came about as a result of a political arm pushing it. According to the EHSD, someone saw the technology in use in South Africa and decided to introduce it in Ghana. It was therefore not taken through the normal approval process before its introduction at the MMDA level with the help of a political arm. There was undue political pressure to get the technology introduced within a short time. As a result the EHSD could not complete the piloting process. Eventually the Enviroloo was allowed entry without following the due process.
The Enviroloo toilet facilities have not functioned properly. The case of the Enviroloo justifies why it is good to go through the formal process. The Enviroloo is built from low density UV treated polyethylene and is supplied with a ceramic bowl. The design makes use of radiant heat and wind to evaporate and dehydrate waste matter into a safe, stabilised and odourless dry material. It failed because the design did not work as it was intended to function, leading to it being abandoned at places where it was introduced. The Enviroloo experience gave the EHSD the eye opener to sit up and look at some of the technologies that were being implemented in Ghana.

5. Stakeholders Attitudes to specific technologies

5.1 Community Water and Sanitation Agency

The community ownership and management (COM) strategy was adopted at the end of the International Drinking Water and Sanitation Decade (IDWSD) to mark the beginning of the community water supply sub-sector in Ghana. The need for COM friendly pumps led to

standardization of four pumps by the CWSA for borehole and hand-dug wells in Ghana. The CWSA has a positive attitude towards all the technologies in use. The CWSA has technically supported most of the technologies that are being used in Ghana. Some of the technologies that are in Ghana have been developed by the technical team of CWSA. The other technologies introduced into the country were assessed by CWSA and in some cases modifications were made to suit the Ghanaian context.

According to the informant from CWSA, the technology that did not work well was the rope pump. The problem with the rope pump was the frequent breakdowns. At present, the rope pump has been modified and plans are underway to re-consider it for assessment and approval. There were complaints about the Vergnet, a foot pump that users, especially the women found it difficult to use.

5.2 Environmental Hygiene and Sanitation Directorate

The aim of the EHSD in approving a technology is to provide an appropriate technology for the local environment. The EHSD therefore looks at technologies in the context of Ghana and not that because it has worked in another country, it can work in Ghana. They use the Ghanaian context to evaluate the technologies being introduced. Technologies are also analysed looking at the socio-cultural behaviour and attitudes of Ghanaians to assess if the technology is appropriate.
The ability of a technology to stand abuse is preferred by the EHSD for communal use. For example even though the KVIP is a wonderful technology it cannot stand abuse, which is overuse. Therefore the EHSD does not recommend it for communal use but for household use. Another example is the Aborloo which has a very good way to prevent environmental pollution but requires a large land area. As a result the EHSD would recommend Aborloo it so long as there is available land.

6. Stakeholders Attitude to technology approval process

6.1 Community Water and Sanitation Agency

The CWSA has since its inception maintained its mission of facilitating the provision of water and water-related sanitation services to the rural areas. The CWSA has therefore cooperated with every individual or organisation that has approached them with new technologies to help address the challenges in the water and sanitation sector. The CWSA has also through its technical team developed some technologies and guidelines for technologies which are being implemented across the country.
The attitude of the CWSA has been to provide the technical support for the implementation of projects that are brought up by NGOs, donors and government. When these project proposals are received, the CWSA initially pilots the project. The piloting enables the CWSA to study the appropriateness of the technology for the local environment. In some cases modifications are made to the technology before implementation. After the successful piloting of the small towns water system, CWSA prepared design standards, standard drawings, and trained consultants for the implementation of the small towns at scale.
In approving a technology, the technical team is interested in the theory behind the technology to make decisions. Also the experiences of past projects are used in assessing

the suitability of the technology. Finally the ability to get the technology accepted by the users is important in the decision making process. Therefore the CWSA subjects the technology to critical assessment through interviews, piloting etc to finally decide on the technology.

6.2 Environmental Hygiene and Sanitation Directorate

Due to the huge deficit in solving sanitation problems in Ghana, the stakeholders involved in the approval process have always shown the willingness to obtain appropriate technologies for the sanitation sector in Ghana (both urban and rural). The stakeholders have all provided the necessary support for new technologies during the approval process. The technical team gives opportunity for those introducing the technology to answer technical questions that are raised about the technology. In cases where the technology is inappropriate, the technical team makes known the things that have to be addressed to make the technology appropriate. Depending on where the technology will be used (rural or urban), District assemblies are contacted to give the necessary support for piloting these technologies which they willingly do.

The challenge that EHSD have had over the years is that, most of these technologies are introduced by businessmen. The attitude of most of these businessmen, who have come across a technology elsewhere, is to import the technology wholesale. When these businesspersons meet the technical team, they do not bring along the technical people who have researched into the technology and are therefore unable to answer technical questions. When the technologies need modification, the businesspersons are discouraged due to the cost.

7. WASH Technologies introduced in Ghana: processes and outcomes

Several water and sanitation technologies have been introduced in Ghana. This section catalogues technologies that have been introduced at the CWSA and EHSD, the approval processes and performance of the technologies. The experience of the private sector in introducing technologies is also presented. The section concludes with the key success factors for technologies as identified by stakeholders in the approval process.

7.1 Technologies introduced through the CWSA

This section catalogues various water and sanitation technologies introduced through the CWSA, the processes and the present state of such technologies. The CWSA has introduced several water and sanitation technologies through different processes and with varying degrees of success. Some of the technologies introduced by the CWSA include:

- Ferrocement tanks
- NIRA hand pumps
- Hand-drilled rigs
- Indian Mark II
- Afridev
- Vergnet
- Slow sand filters
- MWACAFE iron removal plant
- Solar pump
- Aluminium tanks.

The technologies that were introduced but did not get to the national level are Ferrocement tanks and Hand-drilled wells. The Ferrocement tanks and hand-drilled rigs were tested on some projects. Subsequently, CWSA trained artisans for them to use it in other areas. These technologies are promising but did not get to the national level. The reasons why technologies do not get to the national level are because of a combination of the following reasons:

- they are difficult to use,
    - For hand-drilled wells, communities found the manual operation difficult and this was a factor in they not going up to scale.
- they break down easily,
    - A technology like the rope pump was not taken up to the national level by CWSA after piloting because it broke down quickly (the rope).
- the absence of standard drawings, designs and training.
    - For a technology like the ferrocement tanks, no special efforts were made to replicate them. Capacity was not built, and their designs were not standardised as was done for the small town's water systems. This prevented it from getting to the national level although it was quite promising as a technology.

- they are not easy to replicate and
- not aesthetically pleasing,

Individuals and organisations have also tried introducing certain technologies which have failed to be implemented. Examples include a packaged treatment plant for the removal of fluoride by a Jewish company. This technology was rejected because it was too expensive and too complex.
Another technology was the rope pump, which was rejected because some communities didn't like it. And then it had certain technical weaknesses. It was tested in the field and after piloting and evaluation by CWSA, it was dropped by CWSA as a technology for use in service delivery.

7.2 Technologies introduced through EHSD

The EHSD has been promoting sanitation technologies in Ghana. There are well known technologies in the sector introduced through EHSD such as VIP, KVIP (Mozambique and Rectangular), Aqua Privy and Pit Latrines.
Some individuals and organisations have tried introducing certain technologies that have failed to be approved. For example, a team wanted to introduce a technology from Germany. The proposal was to dig underground throughout the city of Accra and place dustbins underground so that one would just have to pedal for the bin to come up and drop in refuse. The EHSD analysed it, looking at the socio-cultural behaviour and attitudes of Ghanaians and concluded it was inappropriate in our local context. The technical team on this technology pointed out the fact that most bins which were placed by the metropolitan authorities at vantage points were not being used just because most of the intended users found it difficult to take off the cover and drop their litter. They would rather drop the litter by the bin than take time to press a pedal to open the bins and drop their litter. Based on this, it was evident that most of the intended users will not have the patience to pedal and wait for a bin placed underground to appear on the ground before dropping their litter.
Another example was when a private person wanted to introduce urinals throughout the Central Business District (CBD) of Accra Metropolitan Area (AMA). The proposer of the technology was told by the EHSD that it was herculean task because there is not enough space within the CBD to implement the concept. Upon insistence, permission was granted by the EHSD to do piloting in the AMA but after a year not a single pilot has been set up. Even though no further contacts have been made with the proposer, it is the belief of the EHSD that nothing has happened because it is not feasible. According to the EHSD, the proposer of the technology was to bear the cost of the pilot, as has been the practice.

7.3 Technologies introduced by the Private Sector - sanitation

The Biofil Toilet System is a technology developed by the private sector which was launched in 2008 after 10 years of development. The Biofil Toilet System did not go through any approval process before the technology was used in Ghana. When the technology was developed it was launched with the Ghana Institution of Engineers (GHIE). It was quite a big launch which saw many sanitation engineers present. The engineers who were at the launch did not have to approve the technology. The launching gave people opportunity to look at the technology and ask questions. According to the developer of the technology, the Biofil Toilet System is constantly being developed and improved but not under the supervision or

approval of government agencies. The developer indicated that people have started using the technology. The key success drivers for the Biofil technology are:

- Space requirements – it takes very little space when compared with similar technologies.
- It is totally odour free.
- No need to de-sludge
- It is cheaper than all other toilet technologies

The developer of the Biofil Toilet System did not intend to circumvent the approval process. According to the developer, there was no knowledge of a laid down procedure for approving technologies in Ghana as at that time. The knowledge was to get the technology accepted by Ghana Institution of Engineers and once that is done, in Ghana, you are on your own and you have to market it. Thus the inventor was not aware of the procedure of assessing and approving technologies by the EHSD.

7.4 Technologies introduced by the Private Sector - water

Water Health was established in Ghana in 2003 after going through the usual process of registering at the Registrar-General and then followed up with the Ghana Investment Promotion Council (GIPC) registration.
Water Health interacted with the Ministry of Water Resources Works and Housing (MWRWH) and was referred to CWSA. From there, Water Health then went on to identify some communities close to Accra with World Vision's guidance to serve as a pilot scheme to assess the viability of the project in Ghana. Water health started a pilot scheme in Afuaman in the greater Accra region as their initial project. After that, Water Health then implemented their technology in five more areas as part of the initial pilot scheme in the Ga West District. The reason for selecting the Ga West District was because:

- Presence of Buruli Ulcer in the district.
- Access to safe potable water was about 30% in the area
- Proximity of the area to Accra was good for monitoring purposes.

After these schemes were put up, Water Health sent a letter to CWSA to inform them of their pilot projects. The CWSA sent a three member technical team to conduct an audit of the Water Health projects. The team conducted inspection of all the Water Health Centres in Ga West and invited Water Health for further enquiries on certain issues that were not clear to them. CWSA later sent the final report to Water Health indicating that, CWSA has:

- endorsed the facility
- accepted the technology
- listed the technology as one of the technologies in Ghana

According to Water health, CWSA mentioned that they will inform the regional CWSA offices of this technology as one of the accepted technologies in Ghana. The idea was for communities that have surface water and need access to potable water to make their requests through their district assemblies to the CWSA Head Office. CWSA would then forward the request to Water Health.

7.5 Key success factors for technologies

This section looks at the key factors that stakeholders have identified as necessary for the successful implementation and upscaling of a technology. The answers to this question are drawn from experience and observations made by the stakeholders.
There are about five factors common to all technologies that went from local to national level. The key success factors include:

- Acceptability to the community
- Involvement of the private sector
- The private sector has a source of livelihood
- Training on the technology
- Standard drawings , tender documents and guidelines
- Willingness (of donors)to fund a technology

Some of these five factors have to be at least present for a newly introduced technology to succeed. The stages for getting a technology accepted are to pilot the technology, train the users, get the private sector involved and train them, provide standards and guidelines and make it known.
One significant thing about the technologies that did not get to the national level is that there was something wrong with them. According to the CWSA the following are the main reasons for the technologies that failed to reach the national level:

- Difficult to use
- Not aesthetically pleasing
- Broke down easily
- Not easy to replicate
- There were no standard drawings, designs and training

8. Conclusion

The Community Water and Sanitation Agency (CWSA) and the Environmental Health and Sanitation Directorate (EHSD) have procedures in place for assessing and approving water and sanitation technologies in rural and peri-urban areas in Ghana. The approval procedures for water and sanitation are similar. However, these approval procedures are not widely known outside the organizations. Furthermore the approval procedures are also not documented but rather enforced when new technology proposals are received by the institutions. Outside the government institutions, the private sector found it a challenge to know the processes of getting technologies approved in Ghana.

APPENDIX A

Table 1: List of People Interviewed

Name of Interviewee	Organization	Role in Organization	Date
Mr. Kweku Quansah	EHSD	Director	7/06/2011
Mr. Kweku A. Anno	K. A. Anno Engineering	Managing Director	8/06/2011
Mrs Charlotte Engmann	CWSA	Head, Technical Division	8/06/2011
Mr. Owusu Konadu	CWSA	Ashanti Regional Engineer	9/06/2011
Mr. Stephen Opoku Tuffour	CWSA	Ashanti Regional Director	10/06/2011
Mr Charles Berkoh	Private sector (Bhekans Services Limited)	Managing Director	14/06/2011
Mrs Mawunyo Puplampu	Water Health Ghana	General Manager	30/06/2011

Baseline study on stakeholder knowledge attitude and practice

A report produced by Network for Water and Sanitation Uganda

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Water, Sanitation and Hygiene Technologies
WASHTech, 2012

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The **Water, Sanitation and Hygiene Technologies (WASHTech)** is a three-year action research initiative that aims to facilitate cost-effective investments in technologies for sustainable water, sanitation and hygiene services (WASH). Through action research and the development of a set of methodological tools and participatory approaches, WASHTech embeds the practice of multi-stakeholder learning, sharing and collaboration – instilling individual and collective ownership and responsibility for sustainable WASH services.

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Abbreviations

ADA	Austria Development Agency
ATC	Appropriate Technology Centre for Water and Sanitation
DWD	Directorate of Water Development
DWO	District Water Officer
EHD	Environmental Health Division
HTN	The Hand Pump Technology Network
JICA	Japan International Cooperation Agency
MOES	Ministry of Education and Sports
MOH	Ministry of Health
MUK	Makerere University, Kampala
MWE	Ministry of Water and Environment
NGO	Non Governmental Organization
RUWASA	Rural Water and Sanitation
RWH	Rain water Harvesting
SARAR	Self Esteem, Associative Strength, Resourcefulness, Action planning, Responsibility
UDDT	Urine Diversion Dry Toilet
UNBS	Uganda National Bureau of Standards
UNICEF	United Nations Children's Fund
URWA	Uganda Rainwater Association
US-	Uganda Standard
UWASNET	Uganda Water and Sanitation NGO Network
VAD	Voluntary Action for Development
VIP	Ventilated Improved Pit Latrine
VLOM	Village Level Operation and Maintenance
WASH	Water, Sanitation and Hygiene
WATSAN	Water and Sanitation

Executive Summary

Uganda's water sector is guided by the Water Policy (1997) and the Water Statute (1995). There are different service level criteria for rural and urban areas which have a bearing on technologies used in those areas. In rural areas an area is considered covered there is a source within 1.5km from which the population can obtain 20-25l per capita per day. In urban areas, there's a greater water requirement and the walking distance shouldn't exceed 0.2km.

The report investigates the circumstances and procedures around which certain water and sanitation technologies were introduced in Uganda. The more in-depth study is for the Indian Mark 2 pump/ U2 pump, the rope pump, the Ecosan urine diversion toilet, the ferrocement tank, the plastic tank and the tippy tap.

Firstly it is evident, that the introduction of the technologies preceded the water policy which is supposed to guide the introduction of technologies. Therefore technologies were introduced outside an established framework. Secondly, there are divided views on whom to approach when introducing a new technology, with some stakeholders thinking they should approach the line ministries, or donors, or some international NGO. The general agreement is that it is the line ministries that authorize the introduction of a particular technology, though so far it is only the U2 pump which has been standardized for bore holes. The policy places emphasis on appropriate low cost technologies that offer community participation in decision making, implementation, operation and maintenance. However, it falls just short of suggesting or stating how one would choose one technology above another. What is needed therefore is a mechanism that can determine the most appropriate between numbers of technologies which meet the said criteria.

Stakeholders have expressed that decision making tools would be a useful step in technology introduction and there is not much preference on whether the tool should be paper or computer based. The important considerations are that they should comply with policy guidelines, guide technology uptake and ease the decision making process. The establishment of the Appropriate Technology Centre by MWE in 2010 was part answer to the problem of examining and diffusing technologies. The possibility of using a decision making tool will certainly make the work of the ATC more objective, with regard to technology selection.

Although stakeholders do not see many technology options outside Uganda that could be adopted here, the changing demography may demand a whole new range of technology options or considerations. Point sources are likely to become less important over the years and the emphasis will be more on powered sources. Therefore there may be a lot of new decisions to be made on technology options and when the time comes, decision making tools may save time, money and resources.

1. Formal processes of technology approval

1.1 National standards for WASH Technologies

The framework within which the water sector ought to function consists of the National Water Policy (1997) and the Water Statute (1995). The provision of clean and safe water for her people is enshrined in the Constitution of the Republic of Uganda (1997). Under General Social and Economic Objectives (Objective XIV), it states; "The state shall endeavour to fulfill the fundamental rights of all Ugandans to social justice and economic development and shall in particular ensure that all Ugandans enjoy rights and opportunities and access to education, health services, clean and safe water, work, decent shelter, adequate clothing, food security, and pension and retirement benefits. Clean and safe water Objective (XXI) states that, "The state shall take all practical measures to promote a good water management system at all levels."

According to the policy, DWD maintains a national level role in monitoring, assessment and forecasting of water resources and water quality; managing surface water, ground water and water quality data banks; and disseminating data on water resources to relevant agencies and users.
Service level criteria in the policy that have a bearing on the technology stipulate a minimum of 20-25l per capita per day in rural areas within 1.5km of all households. In peri-urban areas the minimum is also 20-25l but with a walking distance not exceeding 0.2km. The public water point should not serve more than 300 persons. In urban areas design figures in excess of 80l per capita per day are not considered justified for house connections without waterborne sewerage. If users choose a service level above their basic level, they'll be required to meet the added costs of such services.

For technologies on water supply the key guidelines or regulations in the policy require that:

- Appropriate low cost technologies should be selected that offer community participation in decision making, implementation and operation and maintenance.
- Point sources are preferred for rural and sparsely populated per-urban areas
- Motor and engine driven pumps are normally a reserve for urban areas with regular power and trained operation and maintenance staff.
- Only well known and tested technologies preferably locally made/ available shall be used.
- Standardization of equipment will only be applied as a means of safe guarding the community based maintenance system. Types of pumps should be limited and technical specifications available in the 'public domain'.
- In accordance with the UNBS standards, the U2 is the standard equipment for deep boreholes (deeper than 20m). For shallow wells the U3 light handle pump, the TARA direct action pump and the NIRA AF85 will be tested to select at least 2 models to standardize. At present therefore there is no standardized pump for shallow wells.

On sanitation and hygiene technologies, the policy stipulates that:

- Community should be involved in selection and emphasis should be on acceptability (financially, culturally).
- Preference should be given to low cost on-site methods.

There are no registered usable and adaptable standards set for the use and installation of tippy taps, ferrocement tanks, Ecosan and rope pump although guidelines on the construction of a tippy tap are available from different projects that are implementing the technology.
Even though the National strategy to promote Ecosan stipulates that Ecosan in the Ugandan context commonly means the UDDT, it does not provide standards or limitations to material, structure or otherwise.
At present there are no standards or procedures on sanitation technologies beyond the above stated guidelines.

The government's expenditure in the sector in comparison to the other players (NGOs, private sector) meant that a decision by the government to promote a particular technology had the potential to largely change the landscape with regard to technology. In the case of the India Mark 2 pump/ U2 pump a local manufacturing company- Victoria pumps was created to answer the call and there was a massive campaign to remove installed Bush pumps and replace them with the U2 pump. Even so, individual NGOs continue to promote their own preferred pumps. Busoga Trust prefers and uses the Consallen pump rather than the U2 pump.

The process of introduction of various technologies always involved some partner organizations. These included district local governments, NGOs, research institutions, donors, the private sector and local or international experts. In some cases exposure visits to the technology outside the country were undertaken. In one instance two people from Water Aid on a learning tour to Ghana visited workshops and villages in which the rope pumps were being fabricated and used. In another, a team from MWE and MOH visited Zimbabwe to inform their decision before promoting the tippy tap for hand washing. There were generally some barriers encountered in introducing the technologies. These varied from one technology to another but the most frequent ones were operation and maintenance, the need for spares, opposition from locals and experts and cultural barriers. These were overcome through skills transfer, manufacturing of spares locally and the introduction of community based maintenance.

In the case of the Indian Mark 2 pump, the barriers faced included the need for retraining of technicians, opposition from locals, where its predecessor, the bush pump was still working well; all spares were to be procured from India and all aspects i.e. hydro geological surveying, drilling, pump testing, installation, minor and major repairs were managed centrally by UNICEF and DWD. In overcoming these barriers, there was some arm twisting where locals were informed that there were no more spares for the bush pump and hence the need to change to the Indian Mark 2 pump. The management of the hand pumps was later decentralized to the local governments, mechanics were retrained and later in 1995, DWD embarked on a standardization policy that was completed in 1999. The policy was

designed to ensure that only a small number of types of hand pumps were used in the country, for which spare parts and repair skills would be widely available. Victoria pumps Ltd started manufacturing the pumps in Uganda, although some components are still imported.

The barriers encountered in the introduction of the ecosan urine dry diversion toilet were an onset of failures early on due to ignorance, resistance from medical practitioners who preferred sewer systems, and negative cultural attitudes towards it. There were also negative sentiments from those who were promoting traditional and VIP latrines, especially the local masons. The composting toilet which was introduced first was abandoned due to odour problems and instead the urine diversion type was promoted.

The turning point was that in Kabale and Kisoro where the toilet was first piloted, the mountainous landscape was beset by various challenges, such as rocky soils, collapsing formations and water logged areas. These did not favour the excavation for traditional pit latrines. The bonus for the ecosan toilet was its longevity since it was not abandoned when full. In Kisoro, the negative aspects of the traditional pit latrines were exacerbated by the fact that the town sits on a porous rock through which water would infiltrate into the town's water source. These factors worked together to favour the reception of the ecosan toilets in this region. Cultural sentiments, countrywide about pouring ash over faeces still remain undermining its wider spread though sensitization has helped to bridge the gap. According to Mr. Suresh, the managing director of Crestanks Ltd, one of the barriers is taking the ecosan to places where there is no need.

Tests and studies were carried out to validate some of the technologies. In the case of the Indian Mark 2 pump, there was a smaller one year pilot in Luwero with quick monitoring and results. There was also some experimentation done with different hand tools for fixing the pump. However, the larger number of respondents did not think, or where not aware of whether tests were carried out, and what they were. The DWO Mukono and a Hydrogeologist from MWE said they did not know if tests were done. Mr. Rwamanja Ronnie, a consultant with the Global Sanitation forum says no tests were done, while Mr. Tajjuba Patrick, a Public Health specialist with MWE is not sure if any tests were done but supposes so. Therefore only 2 out of 6 respondents were aware that tests were done and this were limited to break down period and experimenting with different hand pumps. With regard to the location of the tests, Eng. Gava cited tests from India and Bangladesh as well. Some of the studies involved piloting a technology in a localized area over a limited period before scaling up to the national level. Others revolved around quality and safety issues.

1.2 Process of Introduction of new WASH Technologies

The process of introduction of WASH technologies in the past does not conform to a clearly defined process. According to various officials drawn from the Ministry of Water and Environment, Ministry of Health, District Water Officials, a senior university lecturer, NGOs in the water and sanitation sector and independent consultants, the Ministry of Water, Lands and Environment was approached in seeking to establish a new technology. However the role of the Uganda National Bureau of Standards, Uganda's standards body did not feature prominently in the thinking or past actions of UNICEF, HTN, Water Aid, MOH, MWE and ACORD who have been credited with introducing some technologies, such as the India Mark

2 pump, the rope pump and the ferrocement tank. The proper sequence of events followed is also not the same. Although at some point the sector government ministries were co-opted, into the process they were not always approached first. In fact Mr. Rwamanja Ronnie, a consultant with Global Sanitation Forum, MOH who was involved in the introduction of the VIP toilet, revealed that he would approach UNICEF and not government. Mr. Mulabya Fred, a senior environmental officer with MOH shares the same view Another differing view was from Mr. Kalule James, the DWO for Mukono district who said he would approach JICA, as he noted that they showed interest in innovations.

The government and in particular the MWE and its predecessors have introduced a number of technologies in the past. Other players that have been credited with the introduction of technologies include international NGOs, local NGOs, and individuals, development partners, such as the UNICEF and World Bank, and private companies.

Invariably, the introducers of a technology, typically the MWE, MOH, international or local NGOs approached a particular organization or group to scale up use of the technology. In many cases it was a line ministry of the government such as the MWE and the MOH. In some cases, one NGO approached or partnered with another without necessarily approaching government ministries. Where, a government ministry introduced a technology, they approached a development partner, as was the case when ADA was approached for the introduction of the UDDT Ecosan toilet. The district local governments were also approached for scaling up or piloting of specific technologies.

The Government of Uganda through line ministries has authorized the scaling up of different technologies. The existing environment before decentralization meant that decisions were made at the centre and then pushed down to the local governments. The decentralization program was launched in October 1992 by President Yoweri Museveni. In 1997, a local government Act was enacted. All line ministries now operationalize their activities through local government staff based at district and sub-county levels. For water and sanitation, these include relevant departments of water, health services and education in collaboration with NGOs, private sector organizations, cultural and religious leaders. The districts are also expected to form water and sanitation committees to plan, implement and monitor activities. District water and sanitation conditional grants form the bulk of funding in the sector for districts. Predominantly, still, the government is credited for authorizing the existing technologies although generally free market rules determined whether a technology would thrive or not. Government authorization was more a recognition that a particular technology had certain advantages and then decided to invest in to it. Given the significantly large size of the government's expenditure, its actions hold sway on the events within the sector.

1.3 Institution Roles and Responsibilities

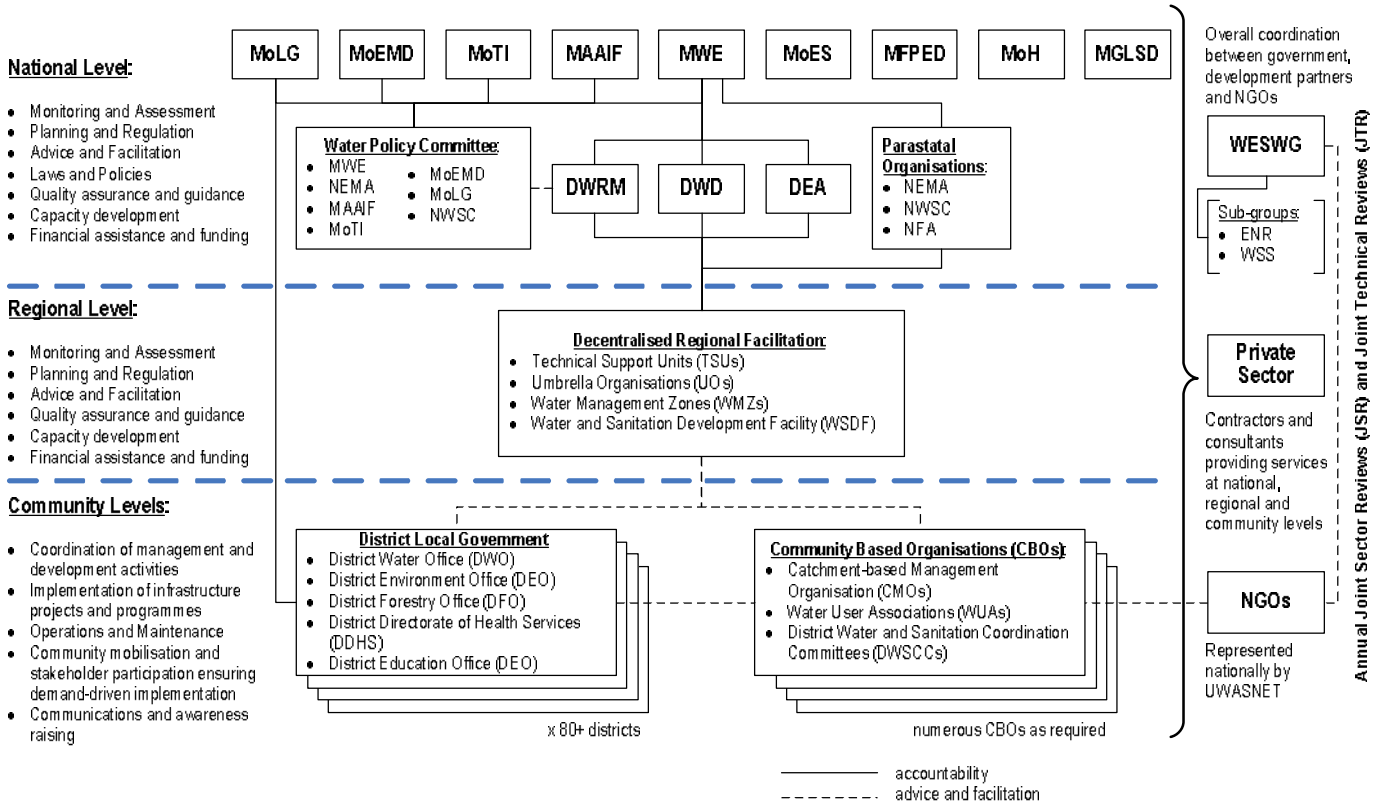

Figure 1: Institutional framework of Ministry of Water and environment from (MoWE, (2009) Strategic Investment Plan for the Water and Sanitation Sub-Sector

1.3.1 Community level

Community based structures: Communities are responsible for identifying needs, demanding for services, planning, contributing cash towards capital cost, and operating and maintaining rural water supply and water for production facilities. A water user committee (WUC)/Water and Sanitation Committee (WSC) elected by the users is established at each water facility, for small towns and RGCs Water User Associations and Water Boards have been formed.

In *sanitation and hygiene*, households are responsible for identifying needs, demanding, financing, operating and maintaining household sanitation and hand washing facilities.

NGOs / CBOs: These are active in the provision of water and sanitation services (construction of facilities, community mobilisation, providing operational and maintenance services, training of communities and local Governments, hygiene promotion as well as advocacy and lobbying. There are over 150 NGOs and CBOs currently undertaking water and sanitation activities in Uganda. Most of the NGOs are represented in an umbrella organization known as Uganda Water and Sanitation NGO Network (UWASNET) which coordinates NGO activities and is represented at the highest decision levels in the sector (sector working groups).

Private Sector: The private sector provides services to communities, district local governments and central government on demand. It is composed of construction firms,

artisans, hand pumps and scheme attendants who provide essential building and maintenance services in rural and peri-urban areas.

Local Government: Districts and Sub-Counties are empowered by the Local Governments Act (2000) for the provision of water and sanitation services. They receive funding from the centre in the form of a conditional grant and can also mobilize additional local resources for water and sanitation programmes.

1.3.2 At the National level

Ministry of Water and Environment: MWE has overall responsibility for initiating national policies and for setting national standards and priorities for W&S development and management. It is responsible for integrated planning with other relevant line ministries in the water sector (e.g. via the MoU on Sanitation and the MoU on WfP). Under the Ministry are the following directorates and agencies:

- ***Directorate of Water Development:*** DWD is responsible for providing overall technical oversight for the planning, implementation and supervision of the delivery of rural and urban water services across the country as well as ensuring water for production. It is responsible for regulation of provision of water supply and sanitation services and the provision of capacity development and other support services to Local Governments, Private Operators and other service providers.

- ***National Water and Sewerage Cooperation:*** NWSC is an autonomous parastatal entity established in 1972, responsible for the delivery of water supply and sewerage services in 19 large urban centres with a total population of over 2.1 million.
- ***Directorate of Water Resources Management:*** DWRM is responsible for management of the nation's water resources and undertakes the following key functions: i)monitoring and assessing the quality and quantity of water resources ii) storing, processing and disseminating water resources data and information to users; iii) providing advice and guidance to water development programmes iv) providing advice on management of trans-boundary water resources v) regulating water use through issuing of water permits and providing water quality analytical services.
- ***Directorate of environment affairs (DEA)*** is responsible for environment policy, regulation, coordination, inspection, supervision and monitoring of the environment and natural resources as well as the restoration of degraded ecosystems, mitigation and adaptation to climate change. DEA has four departments, wetlands Management Division (WMD); department of meteorology, Department of Environmental Support services (DESS) and Forestry sector support Department.
- ***National Environment Management Authority*** responsible for regulatory functions and activities that focus on compliance and enforcement of the existing legal and institutional frameworks on environmental management in Uganda.
- ***National Forestry Authority (NFA):*** is responsible for sustainable management of central forest reserves, supply of seed and seedlings, provision of technical support to stakeholders in the forestry sub sector on contract. NFA is a semi autonomous business entity and generates most of its own revenues and finances its activities

- ***Other temporary and emerging institutions:*** in response to capacity challenges at the LG and community levels, the Ministry has established temporary structures to provide specialized and targeted support to enable the local agencies fulfill their mandates. These include

    - *Technical Support Units*: Support the capacity building of district based structures including NGOs and private sector organisations. They also liaise with other capacity building organizations and partners in the area.

    - *Umbrella Organisations:* Regional organisations constituted as associations of the local Water Supply and Sanitation Boards (WSSBs) with the principal objective of providing Operation and Maintenance (O&M) back-up support to their member boards (training, technical, legal and organisational support, supervision of rehabilitation and extension works and water quality monitoring. Established in 3 regions so far.

    - *Water Service Development Facility (WSDF):* Mechanism for supporting water supply and sanitation facilities for RGCs, small towns and large gravity flow schemes intended to promote a demand responsive approach where Water Authorities/ Town Councils or Town Boards apply for funding. The successful applicant Water Authorities is assisted by the WSDF to develop piped water supply systems**.**

    - Water Management organizations; coordinate activities for community awareness, information management and dissemination at regional and local government level.

Other line Ministries include:

- ***Ministry of Finance, Planning and Economic Development:*** Mobilizes funds, allocates them to sectors and coordinates donor inputs.
- ***Ministry of Health:*** MoH is responsible for hygiene promotion and household sanitation i.e., the development / initiation of sanitation and hygiene promotion strategies and approaches and for the provision of support to the decentralized structures.
- ***Ministry of Local Government:*** Regulating and ensuring a transparent and effective governance environment for local government. It is also responsible for supporting the districts and sub-district units to build up their capacity and it offers support in the form of training courses and on-site coaching.
- ***Ministry of Education and Sports:*** MoES is responsible for hygiene promotion and sanitation in primary schools, to ensure that schools have the required sanitation facilities and provide hygiene education to the pupils
- ***Ministry of Agriculture, Animal Industry and Fisheries:*** MAAIF spearheads agricultural development and holds the responsibility for water use management in relation to Water for Production including the on-farm use and management of water for production (irrigation, animal production and aquaculture). The MoU between the MWE and MAAIF defines the shared and separated responsibilities in the field of WfP.

- ***Ministry of Gender, Labour and Social Development:*** MoGLSD is responsible for gender responsiveness and community development/mobilisation. It assists the sector in gender responsive policy development, and supports Districts to build staff capacity to implement sector programmes.

1.3.3 Institutions of Learning

These provide skilled personnel to the sector through offering professional courses in water and sanitation engineering, public health, community and social development and other tailored courses. They also conduct and disseminate results of applied research – sometimes in partnerships with development and implementing organizations. These institutions include the Universities, institutes and vocational and technical colleges e.g. Makerere University specifically the Institute of Public Health and Faculty of Engineering, Kyambogo Department of Civil Engineering and Technology and faculty of science, Nsamizi Institute of Social Sciences, etc.

1.4 Technologies introduced in the last 30 years

24% of Uganda's population of 31,783,300 receives water from piped water supplies including public outlets and private, as well as institutional connections. 76% receive their water from point water sources, such as deep boreholes, shallow wells, protected springs and rainwater harvesting tanks. There are an estimated 80,790 point water sources supplying domestic water in Uganda. The most widespread water supply technology in Uganda in terms of population served is the borehole (38%), followed by protected springs (26%) and shallow wells (25%). (Uganda water Supply Atlas 2010).

A number of water technologies have been introduced over the years. The approximate dates or number of years the technologies have been in use in Uganda is given below.

Table 1 A table showing the date of Water technology introduction

Water technology	Application	Year introduced	Comment
Canzee pump	Shallow wells and rainwater tanks	2008	
Rope pump	Shallow wells, smaller communities or families	2002	Earliest known isolated one before Water Aid's re-introduction was in the 1980's
U2 pump/ India Mark 2 pump	Deep boreholes (up to 45 m)	1980s	Designed in India in the 1970s.
U 3 pump	Deep boreholes (up to 45 m)	1980s	Improved version of U2 but more

			expensive
Niira pump	Shallow wells (1-15m)		
Ferrocement tanks	Rainwater harvesting	1970s	There's evidence that they pre-date this period due to their existence at colonial times local government offices
Plastic rainwater tanks	Rainwater harvesting	1990s	

Sanitation coverage for urban areas stands at 77%. Sewerage coverage stands at just 6.4% because most people already have onsite sanitation facilities. The national sanitation coverage stands at 69.7%. One of the challenges faced is the lack of sustainability with typical facilities lasting 2 to 3 years and therefore a costly venture. (Water and Environment Sector Performance Report 2010)

There is a range of innovations that have been developed though traditional pit latrines, followed by VIP latrines still predominate. Emerging technologies include various forms of the ecosan toilets and use of unconventional materials like plastics.

Table 2 showing the dates of sanitation technology introduction

Sanitation technology	Application	Year introduced	Comments
Ecosan UDDT	Disposal of human waste, nutrient reuse	1998	
VIP toilet	Cleaner pit latrine for human waste disposal	1983	Different accounts but 1983 is earliest reported from Zimbabwe
Pour flush toilets	Disposal of human waste	1980s	
Mobilet		Late 1990s	Plastic mobile toilet with standard key-hole design
Mobi-Loo	Toilet with urine diversion	2000s	Pre-fabricated plastic version of UDDT
Tippy tap	Hand washing device	1990s	Initial concept was from Zimbabwe

1.5 Level of compliance with the Standards

Generally, there are no set standards that must be strictly adhered to in terms of technology approval. Technologies that have succeeded were first tried out on a smaller scale in Uganda before becoming more widespread. In fact sometimes adjustments had to be made as lessons were learned from the pilots. This was the case with the U2 pump where adjustments were made to the length of the handle to match the performance of the Bush pump which the U2 pump replaced.

In some cases, international publicity media guided on designs and lessons learned from other countries were incorporated in decision making. Performance of a technology in terms of meeting the community's needs and lending itself to village level operation and maintenance was a major measure of suitability. For instance, the bush pump which was directly replaced by the U2 pump required a truck to extract while the U2 pump can be managed at village level. At the time, about 50% of hand pumps were non-functional.

Decisions therefore reflected national policy inasmuch as they contributed to the increase of coverage and they highlighted the lack of known standards to guide those who would wish to introduce a technology.

The UNBS catalogue lists some standards that affect the water technologies without much specific details except specifications for pipes and fittings made from unplasticized poly vinyl chloride (US 264-2: 2000 EAS 182-1) and (US 272:2000) for steel pipes, joints and water for sewage. Even these few standards were not in place at the time of introduction of the technologies examined.

2. Informal processes for WASH Technology approval

2.1 Existing Informal Processes for approval of WASH Technologies

There is quite a thin line between what can be termed formal processes and informal processes of introduction of technologies in Uganda. There is no written step by step procedure that is followed.

The common step is that either a line ministry was usually approached or identified the merits of the technology early on and implemented it on a smaller scale before scaling up.

One of the variants is the way in which the tippy tap was introduced. The MWE and MOH enabled some of their staff to go for training in Zimbabwe to learn about the SARAR approach which included the hand washing concept, while they were grappling with which technology to use in promoting hand washing, they came across a health assistant in Butagaya sub-county in Jinja district, Mr. Masaba Henry who had locally developed the design and had his own set up. At this point, the MWE was impressed with the technology and piloted it through the RUWASA programme. It was then scaled up through a number of NGOs.

The main deviation from the norm is that this technology started at a more or less grass roots level and generated the interest of MWE. After that, it followed the usual steps involving district local governments and NGOs. It has also been the beneficiary of a serious media campaign on hand washing in recent times.

Other deviations may be when an NGO directly introduces a new technology under a program. International organizations like UNICEF also have a strong influence and they impacted significantly on the introduction of the U2 pump, which was an international effort affecting other developing countries as well.

3. Attitudes of stakeholders towards specific technologies

3.1 Experience and attitude towards specific technologies

There is some consensus on the criteria used to rank technologies, although there were quite a broad number of factors for consideration. These include; cost, ease of operation and maintenance, accessibility, reliability, running costs, sustainability, acceptability and susceptibility to vandalism.

3.1.1 India Mark 2/ U2 pump

The Ugandan variant of the India Mark 2 pump, the U2 pump was considered favourably. It was said to be ideal for Africa, and Uganda in particular having been adapted to local conditions. A Ugandan company Victoria pumps Limited was formed to manufacture the pumps and spares. However, ***"en.wikipedia.org/wiki/Mark_II_hand_pump"*** says that major criticism of the India Mark II is that its design makes it difficult to repair at the village level and hence, without government support, NGO intervention, or community savings systems in place, the pump is more susceptible to extended periods of non-function or permanent failure. Lower upfront hardware costs and widespread adoption of the Mark II pump makes replacement parts more accessible. The U3 had some improvements in design over the U2 but was more expensive due to the bigger rising mains.

Under UNICEF influence, the Directorate of Water Development (DWD) under the Ministry of Water, Lands and Environment (MWLE) introduced a hand pump standardization policy in 1995 which was eventually adopted in 1999. This policy was designed to enhance sustainability by ensuring that only a small range of hand pump models were used in the country for which spare parts and repair skills were widely available. The hand pumps selected were the Uganda manufactured India Mark II (U2) and India Mark III (U3). The modified 'corrosion-resistant' version of the U3 (U3M) has not been formally standardized but is manufactured in country and is now used widely. ***(P.A. Harvey).***

Although Victoria Pumps Limited is the only company in Uganda which is able to supply all components of the Ugandan standardized versions, there are several other companies which import the India Mark II pump from India, which are available at lower prices than the U2 from Victoria. Due to the Government's policy of economic liberalisation there are no attempts to limit importation of such pumps which threaten the long-term security and sustainability of local manufacturing. Some local artisans also manufacture the U2 pump-head, pedestal and handle, which are generally of poor quality. Although this is not authorised there appears to be no attempt by Government to control this.

It was generally a big step up in lending itself (U2 pump) to VLOM, compared to the Bush pumps it replaced across the country, which required a truck to extract for maintenance. It was boosted by the introduction of community based maintenance where hand mechanics were provided with tools and bicycles.

Its success was further boosted by international effort involving HTN, UNICEF and shared experiences from other countries such as India and Bangladesh.
A one year pilot in Luwero district provided quick monitoring and results. The break down period was studied and some experimentation was done on different hand tools that could be used for fixing the pump.

3.1.2 Rope pump

The Rope pump is a simple, cheap and easy to handle technology with capacity to pump huge volumes of ground water. The pump can easily be manufactured out of locally available materials like scrap, polythene materials, used plastic materials and old tyres ***(Water Aid 2003)***

The principal elements of the rope pump are a pulley wheel, a rope with pistons attached, a pipe that enters the well, and at the base of this pipe, a guidance device for the rope. As the crankshaft is turned the rope drags the pistons up the pipe, trapping the water above them and ejecting it at the surface. The pump functions well at groundwater depths of up to 50 meters. Due to the simple and sturdy design of the pump, maintenance needs are very limited and can easily be handled by the community or local artisan. The rope itself is the most likely part to break down, and can either be easily and cheaply replaced locally or patched up without difficulty. Makeshift repairs do not significantly detract from pump performance. (***WSP 2001)***

It is reported in available reports that only three rope pumps have been implemented in the Busoga region by DWD in collaboration with Busoga Trust, a local NGO and Water Aid Uganda in Sempya village Namayumba Parish, Wakiso District.

(***Ahmed & Kerstin 2007)*** report that the original plan of installing the rope pumps on hand dug wells to be constructed by the private sector could not be undertaken as it was not approved by the contracts committee of DWD. Thus, discussions were held with Busoga Trust, an NGO based in Jinja with experience of shallow well drilling, hand digging, and hand pump installation. Memorandum of Understanding (MoU) between DWD and Busoga Trust was signed in June 2004.

The promoters of the Rope pump in Uganda, Water Aid, considered it to be appropriate and worth promoting due to its low-cost and locally available materials. However, it is perceived negatively in Wakiso district by both the the acting DWO and a County water officer in the district. One reason given is that because parts of it are exposed, it is susceptible to contamination. Another is that bits of the rope contaminate the water as the rope wears. In fact others go as far as to say that the technology failed.
Water Aid piloted the technology in Wakiso district, Busoga Trust piloted it in Iganga, Mbale and Mpigi districts. In Mbale another NGO, Little Big Africa was involved.

There are no current reports available of activities and evaluations after 2007 however; experiences for the promotion of the rope pump were drawn from success stories in Nicaragua, Honduras, Lao, Ecuador, Madagascar, Mozambique and Ghana.

However it has not been written off altogether as one of the reasons given is that it doesn't fit well into the usual Ugandan community sizes of 100-300 people and therefore has likely been overstretched in practice. The government expects boreholes and shallow wells to serve 300 people each, but the rope pump being a very basic design was not designed for this kind of workload. Inevitably, therefore there were frequent rope breakages when it was used in an ordinary community setting. It may have some future as a self-supply technology evident by 'pockets' of farmers especially those with cattle still using it.

An organization, WATCOM was formed that manufactures the rope pumps. Mr. Wasswa Edson, a technical advisor with Busoga Trust and Eng. Ahmed Ssentumbwe who has been with the MWE attribute its introduction to the MWE. Four out of seven attribute its introduction to Water Aid, while two said that Busoga Trust was also involved in the introduction. Its drivers are low costs, readily available spares, user friendliness, unsophisticated supply chain and VLOM. It wasn't considered a new technology, so the challenge was expected to be in adoption. Strictly speaking, since it wouldn't readily serve a population of 300, it is not a point source that the government would fund, but it rather expected that people would adopt it for self supply. It is fair to say that it is not widely used. Neither Busoga Trust, the ministry, Wakiso district nor Water Aid who were all involved in its introduction are enthusiastic about its success.

3.1.3 Ferro cement Tanks

Ferro cement tanks consist of an armature (framework) of steel reinforcing, which is then covered with a sand-cement plaster. They offer complete flexibility in shape. They have a long life, are cost-competitive when contractor-built, and are owner-buildable in both industrialized and non-industrialized countries. ***(Art Ludwig: How to Make Ferro cement Water Tanks)***

Ferrocement consists of cement rich mortar reinforced with layers of wire mesh. Tanks made from ferrocement are used for collection and storage of water. They are usually cheaper than other types of tanks due to their thin body that requires less material and the technique of moulding the tank using formwork can be easily learned. The tanks vary in capacity, size and shape, though cylindrical shapes are more common in Uganda.

There is evidence that these tanks existed in pre-colonial times, Rainwater Harvesting was used in institutions, police posts and isolated large houses in Colonial times; such systems are now in decay. Private, middle-class Domestic Roof Water Harvesting (DRWH) exists in Kampala and some other towns; it is based mainly on corrugated Galvanized Iron drums. However, credit is sometimes given to ACORD for their introduction in the 1970s. The tests carried out were on the suitability of different sands. Local artisans who were trained by the NGOs were later taken on by local governments when they started to promote the technology. Private companies also joined the fray as business opportunities were realized.

Several organizations are now promoting ferrocement water tanks in Uganda and reasons for selection include water stress and dry areas, hilly terrain and no available alternative sources of water. They are promoted majorly by Diocese of Kigezi in Kabale, ACCORD in Mbarara, Mukono Women's Aids Task Force in Mukono and Rakai and also Bwindi

Mugahinga Conservation Trust in Kanungu Districts. Literature available indicates that in the Districts of implementation, masons have been trained and a task force of trainers have been created hence making it available on the market as a viable alternative.

The technology is rated highly when it is owned and managed at a domestic level. The government largely left the building of this technology to NGOs as it envisioned a problem with the ownership in a communal setting. The conventional logic would be that whoever owned the roof, would own the water or at least demand more say in its use. Different sizes can be built therefore the advantages are low costs, good accessibility, low operation and maintenance costs, durability and low skills required. The rising costs of cement are eroding its cost advantages and therefore scores who would need them cannot afford them. They also require hard roofs and so leave out those in grass thatched houses.

The government involvement has been limited to grants to districts to promote the technology, but MWE's stance is that they are not a hassle free option to promote at the institutional level, as the owner of the roof would expect to own the water. However when the MWE set up the ATC, it had originally envisaged it to be a rainwater harvesting centre. The centre, which is running independent from the MWE though currently being funded by MWE was expected to take up challenges on technologies and research around rainwater harvesting, which was expanded to include other appropriate water and sanitation technologies.

3.1.4 Plastic tanks

The plastic tanks for rainwater harvesting were introduced by Crestanks Uganda Limited, after successful introduction in India and Kenya. They approached the ministry of Water and Environment, as well as the District local governments, notably Soroti District Locsl Government where pilot were carried out. Tests were carried out on impact strength, tensile strength and carbon black content to protect against U.V. light.

Plastic tanks have a high visibility in many institutions such as schools and health centres. They are credited with a long life span (30 years). There are also a range of sizes which offers some choice options to would be beneficiaries. The tanks are also easy to install. They are beset by issues such as vandalism and high costs. Their success has been fast-tracked by favourable consideration from large organizations that are also credited with being involved in the technology introduction. These include MWE, UNICEF, WFP and local governments.

3.1.5 Ecosan Urine Diversion Dry Toilet (UDDT)

Ecological Sanitation (Ecosan) is a holistic approach to sanitation and water management based on the systematic closure of local material flow-cycles; it introduces the concept of sustainability to sanitation by its basic principle of closing the (nutrient) loop between sanitation and agriculture. In the Ugandan context the abbreviation EcoSan is commonly applied for Urine Diversion Dry Toilet (UDDT) systems, although other technologies for ecological sanitation are also known***. (Ten Year National Strategy on Ecological Sanitation 2008 – 2018)***

A Urine Diversion Dry Toilet (UDDT) is a toilet in which urine is separated from faecal matter; it consists of two processing chambers each with a volume of about 0.3 cubic meters. It is built entirely above ground with the processing chambers placed on a solid floor of concrete, bricks or clay. The floor is built up to at least 10cm above ground so that heavy rains do not flood it. The processing chambers are covered with a squatting slab that has two drop holes, foot rests and a groove for urine. At the back are two openings 30cmx 30cm for the removal of the dehydrated material.

Excreta use in Uganda is not absolutely a new practice as urine was traditionally used as a pesticide and fertilizer on many crops especially bananas and fruit trees planted on a filled latrine pit. However, the ecosan concept as it is known today and the use of technologies like urine diversion systems only started in Uganda after the mid 1990s with the South-Western Towns Water and Sanitation project ***(Jackson 2004).***

The introduction of Ecosan was spearheaded by the Ministry of Water and Environment, and particularly Engineer Tushabe Aus Ali (Assistant Commissioner Planning & Development, Rural Water Department), with support from the Austrian government and particularly Mr. Hans Schattauer who played a major role in introducing the concept to Uganda. The introductory process involved consultations with various stakeholders from government, private sector and academic institutions in Uganda, Kenya and Tanzania. The UDDT went through a process of design modification to attain one that was safe and user friendly.

The technology was piloted in Kabale district under the South Western Town project. (***Nalubega 2003)*** states that by 2003, a total of 506 Ecosan toilet facilities had been constructed in the largest Ecosan project area of south western Uganda. She adds that of these 437 were household, 36 institutional and 33 public. The urine diversion dry toilet continued to be promoted nationally as it doesn't affect ground water, can be built above the ground and enables re-use of urine without many health fears. By 2004, more than 11 development partners were involved in the promotion of Ecosan at different extents. This was mainly due to their desire to sponsor sustainable sanitation solutions, protection of water resources, supporting agriculture production and sustaining biodiversity and improving health and quality of life.

The Ecosan systems piloted in south western Uganda faced a number of barriers and limitations which included: Costs: Typical costs for a UDDT ranged from 60USD for a toilet built with local materials (earth walls) to 400USD in brick masonry ***(Jackson 2004).*** Costs were very high then and are still high hindering uptake by the wider community***.*** Many communities are poor. The Ministry of Water and Environment therefore subsidized these costs to over 50%.

Many people in positions of influence did not want to give it much thought, while locals were against it because of social taboos prohibiting the use of ash on faeces. Others could not conceive of the idea of handling faeces and rejected the technology on these grounds. Its merits were longevity (It did not have to be abandoned when full), new innovations (plastic, seat and squat types), advocacy by government and international support agencies. What really gave the technology a needed lift was that it found fertile ground in Kabale and Kisoro. Kisoro town seats on a porous rock and waste from conventional toilets found its way to the water supply which lies below the town. Furthermore it was difficult to excavate through the

rock to set up pit latrines. A similar rocky situation prevailed in some parts of Kabale as well as water logged areas and collapsing formations. These conditions favoured the UDDT ecosan toilet and it was able to build on this success. The demonstrated successes were well documented and basic designs and standards were documented for dissemination. Still it is considered to require social marketing to become a mainstream sanitation technology.

3.1.6 The Tippy Tap

A tippy tap is a hand washing facility much used in rural setting. It consists of a small (3 or 5 liter) jerry can filled with water and suspended from a wooden frame. A string attached to the neck of the jerry can is tied to a piece of wood at ground level. Pressing on the wood with the foot tips the jerry can, releasing a stream of water through a small hole. Soap is suspended from the frame beside the jerry can. A tippy-tap located close to a latrine provides a cheap and potentially convenient means of washing hands after latrine use.

Other available literature describes the tippy tap as a simple device for hand washing with running water. A container of 5 liter with a small hole near the cap is filled with water and tipped with a stick and rope tied trough a hole in the cap. As only the soap is touched with the hands, the device is very hygienic. A gravel bed is used to soak away the water and prevent mosquitoes.

The first version of the Tippy Tap was designed by Dr. Jim Watt of the Salvation Army in Chiweshe, Zimbabwe, and was called the Mukombe. The Mukombe is a type of gourd or calabash, which can be used as the can. But many vessels can be used in the same way, such as those used for cooking oil or milk. "*http://www.akvo.org/wiki/index.php/Tippy_Tap*"

In Uganda, a team of officials from the MWE and MoH had training in Zimbabwe on the SARAR approach which promoted hand washing as a practice and the tippy tap technology alongside sanitation technologies, however, a local Ugandan model of tippy tap was invented by a health Assistant from Butagaya sub-county in Jinja district, Mr. Musada Henry who had a local design and had his own set up of the technology. Mr. Musada was implementing his own version of the tippy tap and the MOH opted to adopt it to promote hand washing. In addition to MWE and MOH, Mpigi ,Mukono districts as well as all districts under RUWASA were involved in the scaling up process with donor support from DANIDA and UNICEF.

The simplicity of the technology, as well as the basic materials used (jerry can, stick) endeared it to users in rural areas. It was gauged on ease of usability, water saving and ease of operation.
In the case of hand washing, the tippy-tap is perhaps the best-known enabling technology. It is a low-cost, do-it yourself technology that has been widely promoted for over a decade, notably in Uganda and Madagascar. ***(Adam Biran 2011)***

The main challenge faced by new adopters is in setting it up. None the less it is recognized as a technology that saves water and is made from locally available materials. Its up scaling was helped by the involvement of a number of organizations and local governments. These included Mpigi, Mukono, and all districts under RUWASA, UWASNET, UNICEF, DANIDA,

Water Aid, ACORD and Busoga Trust. It became the face of the hand washing campaign in Uganda and the subject of media campaigns.

3.2 Important Considerations for the TAF

The gaps in the technologies for water and sanitation are in limited knowledge among beneficiaries on technology options, use, handling and cost, and limited in-country research and documentation. There is also a need to explore renewable sources of energy such as wind and solar to power water facilities.

There isn't a strong indication that stakeholders are looking at any specific technologies abroad for introduction. Mr. Ssemugera, the acting DWO singled out rainwater harvesting using rovk catchments as a desirable technology. Eng. Gava of MWE pointed out motorized water sources replacing the hand pumps, as one option and the use of renewable sources of energy to pump water. He noted that some solar projects have taken off in the country, though the threat of theft of solar panels is still a challenge to wider adoption. Although, just a small number identified desirable technologies outside Uganda, we expect that with more urbanization, the focus will be more on appropriate methods of serving these populations and perhaps in the future, the capacity of point sources to meet demand will diminish. Powered sources may become more important and at present there are no elaborate guidelines.

The water policy should go on to formulate guidelines affecting powered sources, protected springs, gravity flow schemes, valley dams and rainwater harvesting. A number of NGOs and private companies have introduced new technologies such as the play pumps, different approaches to tank construction, a range of solar pumps. There's need to clearly the role of research institutions, government, districts with regard to aspects like testing, documenting performance and product improvement.

4. Attitude of Stakeholders towards the Technology approval process

4.1 Knowledge and experience of the approval processes

The Water Policy (1997) is a guideline that goes a long way to detail guidelines with regard to in particular borehole and shallow wells which together account for 64% of all users in Uganda. On technology and service provision, the policy states; "In rural areas, the basic service level for water supply means provision of 20 to 25 litres per capita per day from a public water point (protected spring, hand pump equipped shallow well or borehole, or tap stand on gravity fed scheme.) It goes on to state that each public water point should not serve more than 300 persons. It stipulates that the Uganda Version of the India Mark 2 and 3 pumps is to be used in deep ground water settings (deeper than 20m). For shallow ground water settings the U3 light-handle pump, the TARA direct-action pump, and the NIRA AF 85 ae to be field tested and monitored in order to select at most 2 models to be the standard equipment. It also refers to UNBS codes that apply. Clearly many of the technologies investigated came into force before the policy was formulated. While the policy spells out guiding principles on other technologies, it doesn't call for their standardization although the policy itself is not static.

The final decision on technologies is attributed by most stakeholders to the ministry, while at times it is considered part of an international effort. A good number do not know if the decision to promote a particular water and sanitation technology is derived from some policy and therefore may not be guided by it. Most thought that there were no particular standards. It is fair to say though that many of the events of technology choices preceded the policy, but there is evidence that the guiding principles which the policy spells out such as testing, low cost principles, maintenance at village level were generally upheld.

The issue of applying a decision making tool was well received. Although some people did not voice their opinion on whether they would use a decision making tool, everyone who answered the question intimated that they would use such a tool. There was no preference one way or the other on using a paper based or computer tool, though one thought that the paper based tool should come first and the computer one after a few years.
The function of the tool would be to guide technology uptake, ensure compliance with government procedures and guidelines and ease the decision making process.

4.2 Experience of Stakeholders in Approval Process

The MWE is involved in the approval process of technologies. It has also been involved in introducing new technologies and standardization of particular technologies. The district local governments are involved in piloting selected technologies. The district local governments who are key stakeholders in technology uptake indicated that they have an available human resource, and therefore capacity to introduce and disseminate new technologies should the need arise. In the past they have been involved in the introduction of new technologies. One such as example is the DWO of Mukono district who was involved in the introduction of the Ugandan versions of the Indian Mark 2 and Mark 3 pumps. He underwent specialized training ahead of the pilot in Mukono. This has involved testing, receiving training and participating in capacity building. There are annual budget lines so ad hoc funds for introducing new technologies are not available. The number of responses on which organization to approach when introducing a technology was almost as diverse as the number of individuals asked. Individuals from WATCOM who have been involved in the introduction of the rope pump, Canzee and UGA pump as fabricators did not answer the question on whom they'd approach to introduce a technology. Eng. Gava from MWE said people should approach in the MWE when introducing a new water supply technology. Mr. Rwamanja Ronnie, a consultant with Global Sanitation Forum, MOH says it would be best to approach UWASNET the umbrella body for NGOs in the water and sanitation sector and NGOs, but not the government. The DWO of Mukono said that he would approach JICA, as they have interest in innovations.

NGOs such as Water Aid have been involved in technology introduction in the past. They have partnered with other NGOs, district local governments and communities. No particular tests were carried out as the technologies were not new developments, but pilots were carried out. ACORD was heavily involved in scaling up the ferrocement tank technology. There was a multi-NGO involvement and the local governments were involved at project level.

The private sector has been involved as suppliers of spares, as mechanics and as caretakers of water facilities. The birth of Victoria pumps, the suppliers of the U2 and U3 pumps was due to the policy to standardize technologies. Crestanks have come up with a range of appropriate water and sanitation technologies that answer the needs of people and that are in line with the general principles of the water policy. They had to overcome fears related to safety of plastics and embarked on country wide professional sensitization to overcome this fear. They had to meet with UNBS standards and exploited successes in other countries like Kenya and Rwanda to build their case.

4.3 Attitude towards informal approval processes

When informal processes of technology introduction have happened, there hasn't been a rejection of the process. Where business entities have identified a need, they have made developments or improvements to the technologies and as long as they were acceptable to the public and met a certain need there was no interference. As demonstrated with the tippy tap, and several water and sanitation innovations from Crestanks, the government has displayed willingness and participated actively in promoting and piloting technologies with promise. The government is behind the technologies that have been standardized for boreholes i.e. the U2 and U3 pumps, it built on the work of a sub-county health inspector who was promoting the tippy tap to build a national hand washing campaign around it. Through district local governments and the MOES, the government has been a major buyer of plastic tanks for schools, health centres and other institutions thus promoting rainwater harvesting.

The setting up of an Appropriate Technology Centre for Water and Sanitation also underpins the government's commitment to ensure that her people will get the best water and sanitation services using the best technologies that they can afford.

Moreover, the formal process of technology approval is not firmly entrenched in the thinking of stakeholders and it still lacks a well defined step-by-step procedure.

5. Conclusions and recommendations

5.1 Conclusions

There is no detailed framework for technology introduction, appraisal or review of existing technologies. There are some general guidelines which consider public acceptability, cost, durability, ease and operation of maintenance, but there is no tool that is employed to ensure a harmonized decision making process. The Water Policy provides some guidelines and a few standards but it cannot be said to guide the technology selection process. While the U2 pump has been standardized as the pump of choice for deep boreholes in Uganda, the policy is quiet on the issue of review when circumstances dictate.

Stakeholders have embraced openness to the idea and willingness to use decision making tools. Whilst they largely did not recognize opportunities for new technologies other than renewable powered sources, there remain issues with existing technologies. For example, while several boreholes in various districts are beset by the problem of high iron content, iron removal plant technology that was piloted in the past has not been brought to scale.

The Ministry of Water and Environment set up an Appropriate Technology Centre in the year 2010 and it is expected that it will help on guiding thinking, selection and development of appropriate technologies. This indicates that the gap in the technology development and selection process had already been identified.

There is both room and need for a technology assessment framework that will also take into account the changing demographic situations. Evidently, there is also need for training and capacity building in technology assessment methodologies.

5.2 Recommendations

The world is a global village so any developed assessment should incorporate findings from other countries. A regional or multi-national outlook will save on the country's resources. Comparative assessments should be made of available options. The question should not be whether a particular technology is low-cost or sustainable but it must be measured against other technologies designed for a similar purpose to determine which is more sustainable, has more positive impacts, is more durable acceptable and safe to use. Different perspectives should be taken into account in the final analysis and communities should debate key options or issues.

The recommendations are:

- There is need to develop a formal process for technology selection that involves multi-sector and end user input
- Data and statistics of performance and costs of technologies should inform the decision process where available.
- Development of renewable powered sources should be investigated and subjected to an informed decision process.
- The role of different organizations and government should be clearly defined
- Emerging technologies and technology development and innovations should have a place in procedure documents
- There is a need to improve documentation at all levels and bridge the knowledge gap with regard to existing procedures.

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Annexes

ANNEX 1: List of Interviewees

Name	Designation	Date Interviewed
Dr. Charles Niwagaba	Senior Lecturer, Ag. Head Civil & Environmental Engineering Dept, MUK	14/06/2011
Eng. Tushabe Aus-Ali	Assistant Commissioner, planning and Development, Rural Water Department, Ministry of Water and Environment	14/06/2011
Mr. Edward Bwengye-Kahororo	WASH Specialist (Partnerships) UNICEF	**14/06/2011**
Mr. Tajjuba Patrick	Public Health Specialist, MWE	16/06/2011
Mr. Paito Obote	Water & Sanitation practitioner	16/06/2011
Mr. Waiswa Edson	Technical Supervisor, Busoga Trust	16/06/2011
James, James Mark & Aloysius	Workers at WATCOM	17/06/2011
Mr. Philip Tibenderana	Kigezi Diocese Deputy Coordinator	17/06/2011
Mr. Kyeyune Erisa	Hydrogeologist, MWE	17/06/2011
Mr. Suresh	MD, Crestanks Ltd.	17/06/2011
Mr. Johnnie Wasswa	Technical Officer, WATSAN, VAD	17/06/2011
Mr. Okatch Denis Arthurs	Senior Engineer, Nagongera District Local Government	17/06/2011
Mr. Ssemugera Thomas	Ag. DWO, Wakiso district	18/06/2011
Mr. Galabuzi	County water officer	18/06/2011
Eng. Gava Moses	Senior Engineer, MWE	20/06/2011
Ms. Lillian Muhebwa	Independent consultant PM Urban, Water Aid (2004-2007)	20/06/2011
Eng. Ahmed Ssentumbwe	Engineer, Rural Water, MWE	20/6/2011
Ms. Irene Nambi Muyindike	Sales Manager, Victoria pumps	21/06/2011
Julian Kyomuhangi	Ag. Commissioner Environmental Health Division	22/06/2011
Mr. Kalule James	DWO, Mukono	22/06/2011
Mr. Rwamanja Ronnie	Consultant, Global Sanitation Forum, MOH	22/06/2011
Mr. Mulabya Fred	MOH, Senior Environment Officer	22/06/2011
Mr. David Mukama	Sanitation Specialist, MWE	24/06/2011

Who is involved in WASHTech?

WASHTech is a consortium research project comprising national and international NGOs, academic institutes and training centres in Africa and Europe.

WASHTech in Africa is spearheaded by the following institutions:
In Burkina Faso:

- Water and Sanitation for Africa (WSA) (formerly known as CREPA), Burkina Faso
- WaterAid Burkina Faso

In Ghana:

- Training, Research and Networking for Development (TREND), Ghana
- Kwame Nkrumah University of Science and Technology (KNUST), Ghana
- WaterAid Ghana

In Uganda:

- Network for Water and Sanitation (NETWAS), Uganda
- WaterAid Uganda

European partners include:

- IRC International Water and Sanitation Centre (The Netherlands)
- Cranfield University (United Kingdom)
- Skat Foundation (Switzerland)
- WaterAid (United Kingdom)

WASHTech is coordinated by IRC International Water and Sanitation Centre in The Hague.

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