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Defining and Delivering Appropriate Technology for Sustainable Access to Safe Drinking Water in Un- And Under-Serviced Rural South Africa

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Brief biography of presenting author (80 words): Bongi is Water, Sanitation and Hygiene practitioner with several years' experience in Southern Africa. She has a strong interest in research and the utilisation of outputs for support evidence based policy and practice in development of communities. Bongi holds an MSc in Public Health from Oxford Brookes University and has skills ranging from programme design, management through to information dissemination and advocacy.

Abstract text (320 words):

This paper presents the experiences and lessons from the Accelerating Sustainable Water Services Delivery (ASWSD) initiative that is currently being implemented in South Africa. The initiative is being spearheaded by the Department of Science and Technology in partnership with the Council for Scientific and Industrial Research (CSIR). Millions of South Africans still do not have access to safe drinking water and the rate of coverage has slowed down over the years despite sustained financial investment into the sector and development of water supply technologies. The majority of the unserved citizens are in the hard to reach rural and other second economy areas. Thus, the ASWSD initiative is seeking to harness available technologies to accelerate the sustainable access to water services by those presently without.

Over the last two years, the initiative has progressed from the conventional, to prescribed and to co-construction of technological solutions with the water service providers (municipalities) and end-user communities. This paper presents how appropriate has been jointly defined in the context of the respective stakeholders, progressively leading to safe drinking water technology interventions. This process has led to interventions that are set to foster sustainable development through

- Interventions based on a context analysis and consultation of end users as well as their service providers; as well as
- Water service providers that:
  - Take-over (from external project teams) technologies that they have the capacity to maintain with minimal external input;
  - Have knowledge about, access to and skills to exploit the national innovation system to harvest technological innovations;
  - Appreciate of the role that technological innovation can play in sustainable delivery of services.

The participatory comprehensive options assessment that has emerged and facilitated an all-stakeholder co-construction of technology packages could lead to sustainable access to safe drinking water. It is anticipated that the experiences and lessons will be utilised by the relevant line departments and service providers to facilitate sustainable social and economic development.

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Introduction and purpose

In South Africa, water is a human right and it is acknowledged that having access to clean water is one of the first steps towards reducing poverty and improving the standards of living, especially in poor communities. As a result, the South African government has developed the concept of free basic water (FBW) as a mechanism to extend water services to those who cannot always afford them. (Tissington et al, 2008). The FBW policy seeks to guarantee at least 25 litres per person per day, an amount presently accepted as the minimum to sustain healthy living. In addition to this institutional framework, there has been sustained financial investment into the sector. Despite this however, millions of South Africans still do not have access to safe drinking water and the rate of coverage has slowed down over the years. The majority of the unserved citizens are in the hard to reach rural and other second economy areas characterised by a difficult terrain, irregular settlement patterns and inaccessible roads among other issues. This scenario is in the backdrop of a wide array of water technologies that have been developed over the years. Thus, the ASWSD initiative is seeking to harness available alternative technologies to accelerate the access to water services by the presently un- and under serviced citizens. The Accelerating Sustainable Water Services Delivery Initiative (ASWSD) is spearheaded by the Department of Science and Technology in South Africa in partnership with the Council for Scientific and Industrial Research (CSIR).

A diverse group of actors are involved in water service provision in South Africa. However, there are two main actors. The first is the Department of Water Affairs (DWA). DWA serves as an overall policy maker and regulator. It provides oversight for all the activities of all water sector institutions and is responsible for national as well as international resource planning and allocation. The second actor are water service providers (WSPs, the local government institutions, mostly district and local municipality that are tasked with water provision. The institutions who have to service both urban and ruaral communities are often poorly resourced in terms of finances and human capital and, and due to their limited resources tend to focus on paying urban consumers for their financial stability (Smith, 2005). In rural water supply, at the planning stage what's often neglected is how to support mainly rural based systems after construction of new infrastructure and who should pay for the long-term costs of operation and maintenance are considered to be *'somebody else's problem'*, and of little concern to the organisations funding the new infrastructure (RWSN, 2009). This has resulted in a lot of communities being left with water infrastructure without a plan or budget for operation and maintenance. With the multi-stakeholder approach all these issues are addressed upfront with the institutions' limitations taken into account when deciding on appropriate technologies to be implemented. These decisions are shared among the major role players through constant stakeholder engagement at all stages.

The key to sustainable water service provision is that all stakeholders involved in consumption /use, maintenance, cost recovery and continuing support, perceive it in their best interests to deliver high quality service. Experiences in the country have demonstrated the need for a balanced approach by all the major stakeholders to achieve social, environmental, economic and engineering sustainability. The large-scale projects of based on the convectional approach of assistance and predetermining solutions by the funders or project are typically more economically sustainable, but often lack engineering and environmental sustainability. The small-scale projects of empowerment and training of locals to operate and maintain services are typically more engineering and environmentally sustainable but often lack economic sustainability. The multifaceted approach though highly desirable, it's main challenge is reaching consensus among the stakeholders on achieving common objectives, as each stakeholder group is always focussed at their own interests, (Thabrew et al. 2009). Integrated planning involving relevant stakeholders, including the community, is necessary to integrate the sectors and plan and implement sustainable interventions that are suitable and feasible to the communities (Thabrew and Ries, 2009). Communities are therefore an integral stakeholder in the water supply value chain as they need to be convinced of the desirability of new facilities, financial implications of the chosen technology as recurrent expenses may be unacceptable, unaffordable, **o**r impracticable and they ultimately need to understand the benefits of the new technology to foster a sense of ownership. Although, nowadays, community participation is an essential foundation stone of water and sanitation projects in developing countries, this alone is no automatic guarantee of success. Community participation at all stages from planning through to the implementation phase, in as many aspects as possible, will improve chances of success. Throughout all these stages of stakeholder's engagement communities have to be motivated to utilise the facilities, even though they might be aware of the immediate benefit of an improved water source, the associated health benefits may not be so obvious. Mobilising communities through health education and involvement of the community, to the extent of vesting ownership in them, has been shown to a way of bringing such motivation.

Stakeholder are diverse, and the involvement of the field specialists in project planning and implementation is equally critical as they have the ability provide a clear picture of all the activities behind the proposed

improvements, in terms of both the nature of the activities and the short-term and long-term resource commitments that are required to implement them. The field specialists have potential to assist in determining the appropriate level of improvement, including identifying the operation and maintenance costs that would have to be borne by the community and the water service provider in the long term yet these are often not identified, communicated, or discussed at the planning stage. The commonly overlooked aspect is the ability to combine these appropriate concepts from institutions, experts and communities into a working process model that fosters active participation, knowledge sharing, structured discussion aimed at reaching consensus focused on sustainable and implementable solutions that fit local contexts while recognizing the political nature of multistakeholder environments. The flexibility to generate and unify the knowledge of stakeholders and experts (e.g., transdisciplinary knowledge) in a structured, logical, and transparent manner is also a key requirement (Stauffacher et al. 2006). Thus, the processes in the ASWSD II initiative are seeking to address some of the participation challenges in an action research methodology.

Design and Methods

The ASWSD initiative is being implemented through a series of projects. The first of these, Phase 1, was implemented in 6 villages, across the Amathole District Municipality (ADM) and O R Tambo District Municipality (ORTDM) in the Eastern Cape Province. Building on the first phase, Phase II is being implemented in 11 villages across 4 district municipalities (Ehlanzeni, Vhembe, Mopani and Sekhukhune) in Limpopo and Mpumalanga Provinces.

The project in the Eastern Cape villages sought to improve access to safe drinking water in the selected villages in ADM and the ORT through the provision of Communal Water Stations (CWS) as part of a technology package to provide effective uninterrupted access to unserved and undeserved rural communities. The project thus envisaged a three-pronged package comprising:

- A communal water station to abstract and treat water from a river. These would be constructed at or as close as possible to the traditional water collection points at rivers.
- A borehole management plan to ensure that all borehole water would be safe and to minimise breakdowns. Boreholes and springs are an important source of drinking water in rural South Africa and in recognition of this, the plan was included in the suite of technologies;
- A household-based water treatment technology for the purification of water in the home. This was planned to be a ceramic filtration technology. The filters were to treat water that the households would collect from the springs and the river in case they did not walk to the CWS. In addition, they were to act as a back-up intervention in case of breakdown of the communal water stations. The ceramic filter technology was selected based on desktop assessments of its cost effectiveness, project budget, potential acceptability and the sustainability of the intervention in a rural South African setting.

Communal water stations were constructed as planned save for the introduction of solar powered plants in two villages. Cognisant that one of the major barriers to implementation of water systems in rural areas is the complex sociological dimension of introducing new and unfamiliar technologies to communities who are not aware of the benefits that such technologies could provide, the use of solar power was selected for one village in each DM as solar power was used by a school, a clinic and/or some individual households in these villages and the people were familiar with the concept of solar energy. These two communities were mobilised and made aware of the maintenance and the advantages of a solar system to optimise the chances of sustainability in these two areas. The borehole management plan was however changed to a groundwater management plan after initial assessment in the project villages revealed that there were virtually no boreholes. Rather, the communities relied on unprotected springs for their drinking water. Ceramic filters were distributed as originally planned although they appeared to clog in a short space of time.

To ensure sustainability, the project also sought to establish innovative arrangements for operation and maintenance (O&M) in terms of both hardware as well as the preservation of water quality. Thus, the municipality, as the mandated service provider was engaged as far as possible in the technology design processes. The implementing agencies worked closely with the municipalities and provided the technical specifications for the water stations. They also introduced the ceramic filters to the municipalities. The appointment of consulting engineers and contactors for the communal water stations then followed the normal municipal tendering procedures as this was what would be expected to happen should the intervention be scaled up. However, the ceramic filters selected, groundwater plan and water quality monitoring proposals were all as far as possible, aligned to the requirements, existing activities and systems as well as capacity of the respective municipalities. Suggestions were made at technology handover workshops by the implementing agencies.

These were discussed and modified as necessary before adoption by municipal officials who committed to ensuriing proper operation and maintenance technologies in the villages.

Based on the experiences and lessons from the first phase in the Eastern Cape, the second phase in Limpopo and Mpumalanga has been formulated to be more participatory and responsive to context. A key aspect of this ongoing phase is the adoption of an action research methodology. Within a wider consultation and sustainability framework, the projects in Limpopo and Mpumalanga are highly context specific with subsequent sections relying significantly on the outcomes of the preceding sections for engagement processes, assessment procedures as well as intervention packages formulation and delivery. The project framework has three major components:

- An **inception phase** that defined the project scope and plan in greater detail based on preliminary desktop assessment of potential project areas, available resources and initial engagement. Based on the outcomes from this phase, plans were drawn up for the subsequent phases of the project.
- A **situational assessment and mobilisation** phase with a strong stakeholder engagement component that encompassed the strengthening of liaison with the municipality, setting up of community participation structures and a baseline survey and community health risk assessment. Lastly, comprehensive technical assessments of available water resources were carried out.
- An **intervention development and implementation** phase. This is the phase in which technology packages are being proposed by the CSIR to service providers and user communities.

Results

At the end of the first phase in the Eastern Cape six water stations had been completed and ceramic water filters distributed to nearly 2000 (1998) households. In ORTDM, the municipality mobilized additional resources to build on the proposed CWS and reach more people. Groundwater management plans were also prepared for each village. The plans contained recommendations to the municipalities for groundwater protection at the community level. As far as possible, the technology package was implemented to respond to the context of the area as well as the capacity of the service providers to operate and maintain. At a project review workshop, the municipalities expressed satisfaction with the interventions they had received, indicating that through these they had been able to reach communities they otherwise had no immediate plans for. In addition, the officials indicated that they were now aware of the possibilities that they could tap into through the national innovation system although they would need more support in this regard.

Another key outcome from the first stage projects was the design of the second phase of the project which was heavily influenced by the experiences, lessons and outcomes of the first phase. The phase began with an open preliminary inception phase to define the project plan with greater clarity based on an assessment of potential sites, resources and other context features. Municipalities were also engaged at this initial stage and the collaboration has continued since then. Limpopo and Mpumalanga Provinces were selected because of the relatively low coverage of safe water and sanitation compared to the rest of the country. Within the Limpopo and Mpumalanga, the actual project sites were selected using a set of criteria responding to the ASWSD initiative objectives to explore solutions for the hard to reach areas and accelerate delivery of water services. The criteria were set so that sites would allow maximum learning from the project, in line with the broader objectives of the ASWSD II initiative. The criteria were applied to all districts and 4 were selected for inclusion in the project. The criteria were further applied to the local municipalities in the 4 DMs and again to potential villages. From the local municipality assessments, the application of the criteria was combined with consultation of the service providers to identify the areas presenting challenges for service delivery.

The technologies to be employed in the project were not decided on upfront. The decisions are being made as the context assessments in study areas are being completed. This was based on the learning from Phase 1 that interventions should not be based on assumptions. The selection of technology packages should be based on assessments that are context specific. Furthermore, the events in phase I showed that the selection of a technology is a complex, multi stakeholder process. In phase II, the assessments to inform technological interventions are investigating the available water resources, previous projects implemented in the area, the community water, sanitation and hygiene practices, a health risk assessment and last but not least the service provider municipalities capacities (financial and skills).

The stakeholder engagement process is now more intensive and built into the entire project process in an effort to encourage a more active participation by the stakeholders. An example is the consultation of municipalities in identifying the villages to be included. Furthermore, the technical assessments of water resources, baseline community surveys are being done with the active involvement of the municipality and community. The community was also engaged early in the process. As soon as project villages were identified, local and

traditional leadership was engaged. Communities were informed about the project and mobilised to participate actively. The technology workshops that were held at the end of phase I have now been replaced with a technology consultation process. In this process, the CSIR after analysis of the technical assessment outcomes proposes a suite of interventions to the technical staff in the municipality. This is currently on-going and the intention is to then consult the community with a proposed package or suite of packages and then final decisions on the intervention to be implemented will be taken. In Limpopo and Mpumalanga, the community is taking a more prominent role in the selection of the technology intervention as it emerged in phase I that an increased focus on the beneficiaries' knowledge and understanding of technologies are vital for the sustained use of the technologies.

Another facet of stakeholder engagement that is being more actively pursued in phase II is the participation of the partner government departments. Regular meetings with these stakeholders are required for the success of the initiative. Particular care is being taken in the second phase to engage the relevant and appropriate structures in these departments to ensure ownership of the project outcomes as well as relevance, practicality and sustainability of the project process and the outcomes. This engagement is also seen as vital for the uptake and scale up of the outputs and outcomes from the initiative.

Beyond the selection of technologies is the transfer to the service providers and the users. In phase I single user training sessions proved to be inadequate to adequately transfer knowledge for effective use of the technology. Furthermore, it emerged that the municipalities or service providers need to take a more active role in the roll out of the technology so that not only would they are able to provide back up support to users but technology packages would be better constructed to respond to the challenges and opportunities the service provider encounters . The municipalities as the legislated service providers are key to the process yet they face capacity and financial constraints. During the first and now in the second phase of the initiative, levels of support and participation by the municipal officials are at times unpredictable due to the high levels of work load. There is also sometimes staff turn-over that affects continuity in the implementation of projects.

Conclusions

The processes in the ASWSD initiative have provided valuable lessons towards sustainable service provision. Phase I projects were based on desktop impressions of what might work in the target area. It emerged during the implementation that this approach had serious shortcomings. Furthermore, although changes were made to accommodate the realities on the ground, the project still faced limitations on its sustainability such as the problems that were experienced with filters. There were however significant success recorded as well. The municipal officials are happy with the interventions that they have. In ORTDM, the municipality built onto the proposed scheme and covered more people with their own resources.

Another significant outcome in the process has been the formulation of Phase II. In phase II appropriate is being defined in the context of the respective stakeholders progressively leading to safe drinking water technology interventions that are set to foster sustainable development through:

- Technology interventions based on a context analysis and consultation of end users as well as their service providers;
- Water service providers taking over (from external project teams) technologies that they have the human resource and technical capacity to maintain with minimal external input;
- Water service providers with knowledge about, access to and skills to exploit the national innovation system from which they can harvest technological innovations;
- Water service providers appreciative of the role that technological innovation can play in sustainable delivery of services in their areas of jurisdiction.

From the work done on the initiative to date, it is concluded that the participatory comprehensive options assessment that has emerged and facilitated an all-stakeholder co-construction of technology packages may well bear the anticipated sustainable access to safe drinking water for all South Africans. Ultimately, it is anticipated that the experiences and lessons learnt will be taken up by the relevant line departments for rural development and water supply to facilitate sustainable social and economic development. The lessons emerging encompass not only how the various technologies can be applied in different settings but also ways in which the various stakeholders, particular the end user facing municipalities can effectively exploit technological innovation.

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