Community Water Supply in East Timor

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Abstract

Most East Timorese communities do not have access to adequate improved drinking water and sanitation practices. Attempts to address these shortfalls are being made by community water supply (CWS) projects being carried out across East Timor. This project is investigating the factors that surround a successful CWS, and ways in which success can be improved. Particular focus is made to the selection of appropriate techniques and technologies to be employed in a CWS, and the method in which to choose them.

1.0 Introduction

Only 51% of the rural population of East Timor (2002) have access to improved water sources. This is in comparison to the average for the South-East Asia district of 70% of the rural population having access to improved water sources and the world average of 72% (WHO and UNICEF, 2005). As 77% of East Timorese households are in rural areas (Plan-Australia, 2005) and a lack of improved water supply has been directly linked to poor health (Cairncross et al., 2003, WHO, 2006) this is of a major concern to the country. To address these low standards many community water supply projects are being undertaken across East Timor.

Community water supply (CWS) in East Timor refers to water supplies to non-urban communities. That is, water supply to communities that may or may not be in remote locations but do not have access to a mains electricity grid, mains water supply or sewerage systems. These communities are in general small, usually with a population under 1000 (as most of the major centres such as Baucau, Maubisse and Suai had their water supplies rebuilt soon after independence). Since East Timor has gained independence, these communities are looking to develop to improve the standard of living for their citizens.

2.0 Objectives of CWS in East Timor

The National Development Plan of East Timor was developed by the Government of East Timor in conjunction with the United Nations and outlines objectives designed to address the issues facing the country. Some of these goals are summarised below (PlanningCommission, 2002):

- People will no longer be isolated, because there will be good roads, transport, electricity, and communications in the towns and villages, in all regions of the country;
- It will be a prosperous society with adequate food, shelter and clothing for all people;
- People will be literate, knowledgeable and skilled. They will be healthy, and live a long, productive life. They will actively participate in economic, social and political development, promoting social equality and national unity;
- Living standards and services will improve for all East Timorese, and income will be fairly distributed.

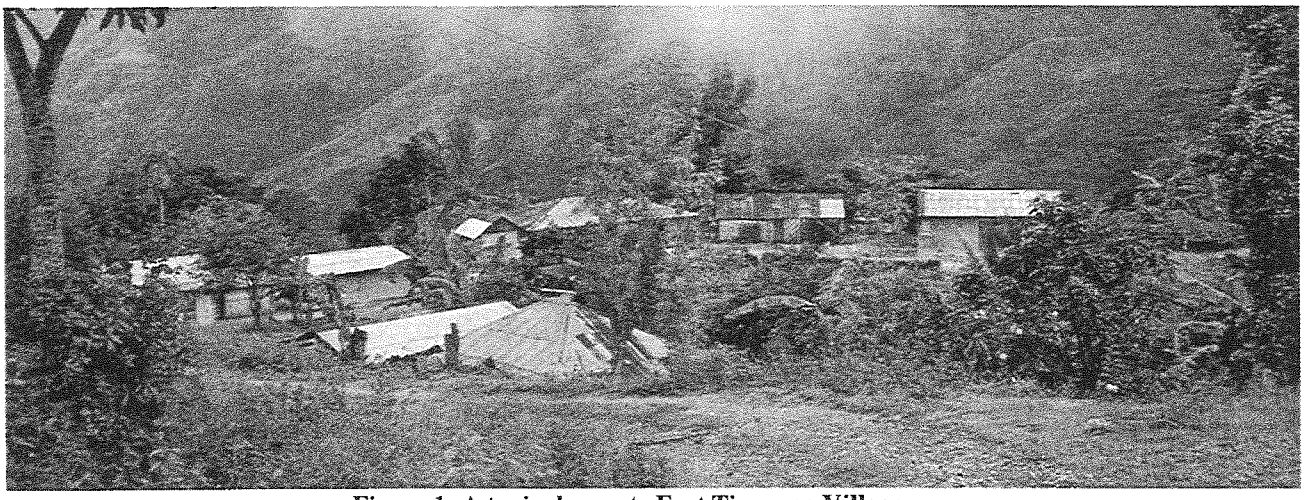

Figure 1: A typical remote East Timorese Village

The implementation of a CWS can achieve some of the East Timorese development objectives that are immediately relevant to the community. The emphasis of this project is upon how the supply of water can have outcomes that include improvements in health and increased agricultural activities, impacting on improving all facets of life. There are three levels of the supply of water, each supplying different quantities of water; water for drinking, water for sanitation and water for agriculture. Different levels of water supply bring different outcomes; however it is not just the provision of quantities of water in itself that creates benefits to the community.

Supplying enough clean water for drinking and cooking can create immediate health benefits by breaking a cycle of water borne illnesses and diseases. The World Heatlh Organisation (WHO) state 20 litres of water per person per day as the most basic supply of water (WHO, 2006), which is is sufficient for a days drinking and cooking (Howard et al., 2002). This quantity of water can address the problems associated with suffering dehydration during the dry season (Democratic Republic of East Timor and United Nations, 2004). But futher benefits from a CWS can be made with the supply of greater quantities of water.

Supplying quantities of water greater than those required for drinking and cooking, results in excess water that can be used to introduce a sanitation program. Just 19% of East Timorese communities have access to adequate sanitation facilities (PlanningCommission, 2002) and this is a serious cause of illness (Cairncross et al., 2003). The implementation of a sanitation program, including latrines and basic personal hygiene education and training, can substantially reduce sickness. To achieve this the CWS needs not only to concentrate upon supplying water, but removing water once it has been used. Additional educational campaigns and sanitation infrastructure is required to achieve this, and is discussed in more detail in the project undertaken by Phoebe Mack entitled "Sanitation and Waste Disposal in Aldeia Tangkae, Timor-Leste."

The benefits from improved quantities and quality of water can be further enhanced by supplying quantities of water great enough to support agriculture. Improved agriculture has the ability to decrease or even eliminate malnutrition. Malnutrition is a large problem in East Timor due to low crops yields and because the majority of the country cannot grow a crop during the dry season without irrigation (Nesbitt, 2006). Thus a great improvement can be made in health through the supply of water for irrigation. The improvements can be further increased through an agriculture program focused upon improved farming techniques, increasing crop yeilds.

There are futher benefits that come from a CWS that are not directly related to the supply of water. Improved agricultural yeilds from addition time spent farming and improved agricultural practices not only result in improved nutrition but it also increases the ability of the community to trade. This can greatly improve wealth, in turn improving health by increasing access to medicine and materials needed to avoid disease and illness.

Supply of water can significantly reduce the time required for the daily collection of water and the exploitation of these time savings bring significant benefits. Education programs can allow the community to participate in new activities, or improve their techniques for existing activities as better techniques and skills (eg farming techniques) improve the ability of the community to undertake more productive activities. The time savings can also be used to ensure that children can attend school contributing to the development objectives, and improving the choices available to them in the future.

Previous approaches to CWS have not always taken this hollistic view and had objectives only focused upon the implementation of infrastructure. It can be argued that this view is too simplistic (Cairncross et al., 2003) and does not allow the CWS achieve all the potential outcomes that are possible by the implementation of the additional programs discussed in this paper. The achievement of these objectives however is not straight forward, as the failure of many CWS projects is testiment to and there are many factors influencing the success of the project.

3.0 Factors influencing success in CWS

There are many factors that influence the success of a CWS in achieving its objectives. There are generic factors such as levels of community participation that apply to all projects and other factors more specific to each individual CWS project such as the physcal characteristics surrounding the community. Contraints don't allow the discussion of the majority of these factors; however four of the more critical factors have been examined in more detail below.

The overriding factor for a successful CWS is that it must satisfy the community's needs and wants (Deverill et al., 2002). The argument underpinning this is that if the community is to undertake all the actions required to ensure the ongoing operation of the CWS, then they must feel that the CWS provides useful service to them. Furthermore, the process with which the CWS is undertaken should promote community ownership of the project, to promote its acceptance, sustainability and longevity. This will not only help create the view that the CWS is a valuable tool, but a responsibilty and desire to undertake the requirements in order for the supply to remain operational.

Close consultation with the community can be used to achieve both these objectives. The theory of this concept, is that working with the community allows easy and accurate identification of their needs and wants while building community ownership over the project (Deverill et al., 2002). The advantages of this process come from the experience and knowledge that the community has of their own circumstances. Not only will the needs and wants be easily identified, but the process also helps identify social and physical characteristics within which the CWS has to perform that might otherwise be overlooked by an outsider.

The social characteristics of the community and the physical characteristics surrounding them define what techniques and technologies can be used. The physical attributes include the type, capacity and location of any water sources and need to be identified to ascertain which techniques can be employed to deliver water. The social characteristics are also used to determine what technique is chosen but play a far greater role in the choice of technology to use

within the technique. The concept of appropriate technology (AT) explains; "AT is the selection of a technology that best suits the community by satisfaction of the community's requirements while making the most of their time, capabilities, resources and envirnoment." Thus the technology most likely to succeed is going to be the technology that is most appropriate to the community.

For a technology to be appropriate, conducting the ongoing operation and maintenance (O&M) requirements must be uncomplicated; including the repair of break downs. This aims to ensure that the CWS is sustainable, that is, the community has the capacity to ensure that the requirements for the ongoing operation of the system are met. However it may be found that the skills required to conduct the O&M requirements may be lacking. Education and training will need to be undertaken during the project to ensure that the community has the skills to undertake the O&M of the system.

It must be mentioned that finance stands as a large hurdle to implementing infrastructure and program requirements. East Timor is one of the world's poorest countries with 41% of the population living on under US$0.55c per day (Planning Commission, 2002). Most CWS will thus require outside donors to secure the funds required for implementation, but it is important to note that the funds required for ongoing O&M are likely to have to be supplied by the community. Affordability of the O&M requirements is thus likely to be a large factor when determining the most approprate options for the community.

4.0 Technique and Technology Selection for Water Supply

The technique used in water supply is described as the process that is to be used, while technologies are used within this process for the technique to occur. It is the physical situation surrounding the community that mainly governs the choice of technique to be used in the CWS with the location of water sources, their type and the quantity of water they can deliver influencing the choice. For example if a spring at a lower elevation of the community is to be used, then it will be required to pump the water. Within each technique there will be a number of different options of solutions using different technologies.

The technology to use within the technique must be chosen to best suit the community's social and physical characterstics. There will be choices of different technologies to use within each technoque as each technology has its own advantages and disadvantages and circumstances in which they will be most appropriate. How appropriate a technology is to the community, should be used as a base for the technology selection.

The decision as to which technique and technology to employ should be made by the community and be based upon selecting the overall system that is most appropriate to them. There are many techniqes and technologies that can be employed in East Timor, each with their own advantages and disadvantages. The major techniques that can be employed are pumping, gravity fed systems and rainwater collection while there are many technologies that can be used within each of these techniques.

Pumping

If the water source is below the elevation of the community, then a pump will have to be employed to lift the water. The water source may be a bore hole, a spring, well or stream, and will need to be enclosed at the catchment point to ensure good water quality (water quality is discussed in more detail by Heidi Michael's Paper entitled "Water Quality Assessment in a

Developing Community: Tangkae, East Timor.") There are many options of pumps to use and they are discussed briefly below:

Technology	Description	Advantages	Disadvantages
Solar Pumps	Uses photovoltaic cells to produce electricity to run an electric pump.	Non-polluting in operation No fuel required Almost entirely self contained systems	Complex machinery Technology likely not to have been encountered before High Cost Requires high levels of sunshine
Wind Pump	Relatively simple machinery that relies upon the wind to drive what is usually a piston pump. E.g. The farm windmills used throughout rural Australia.	No fuel is required Relative simple technology Non-polluting in operation Almost entirely self-contained Inexpensive	Require constant wind speeds (not available in most of East Timor) Require regular maintenance
Internal Combustion Pumps	Includes both petrol and diesel powered pumps running on a fossil fuel to pump water	Relatively low upfront capital cost Not dependant upon environmental conditions to run	High ongoing costs (fuel) High maintenance requirements Complex machinery Pollution of the local environment Noisy Parts are difficult to obtain in East Timor
Hydraulic Pumps	Harness the flow of water down a slope to pump. Many forms available ranging from hydraulic ram pumps to hydro-electic systems	Can also be used for electricity generation Non polluting Large range – flexible No fuel expenses	Require a large flowing body of water all year round

Gravity Fed Supplies

Gravity fed supply systems can be used to move quantities of water from the water source to the community utilising the flow of water downhill. This technique requires the water source to be at a higher altitude to the final distribution point and is in general much simpler than pumping water. The machinery of a pump is not required and so for a supply over a similar distance it is almost always a cheaper alternative to pumping. Thus gravity fed supplies are the recommended option in most circumstances due to the lower costs and complexity, particularly with O&M requirements.

Rainwater collection

Rainwater collection involves the collection of rainwater, usually from rooftops, and the storage of the water in tanks for later usage. The major drawback of this technique is that inconsistant rainfall or a long dry season requires the storage tanks to be very large to accommadate the large volumes of water required to be stored. However in some areas it may be the most appropriate

technique possible to implement and it has been used successfully in the village of Hera, East Timor.

Alternative techniques

All of the techniques discussed above involve moving water to the community; however it may be just as effective to improve access to the water source. If the landscape is the barrier to water collection, then the construction of good quality paths to the water source may be as beneficial to the community as any other technique. There are many other alternate techniques that have not been discussed that can be just as appropriate to a community's circumstances.

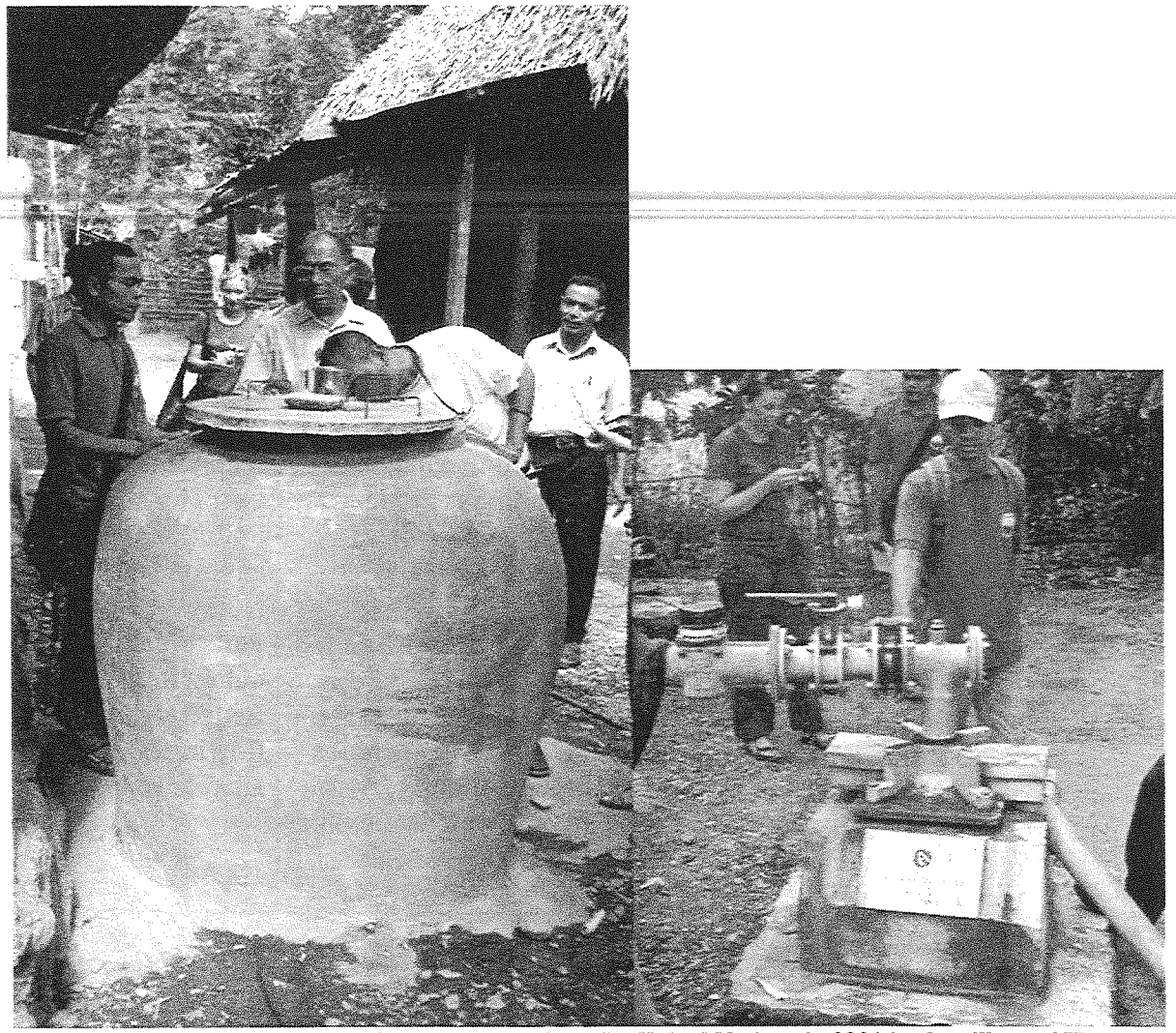

Figure 2: A rainwater storage tank as constructed by the United Nations in 2001 in the village of Hera
Figure 3: A bore that now services the village of Hera only works on the days the electric generator is working

5.0 Methodology for water supply

To implement a CWS that successfully achieves its objectives, a methodology to conduct CWS implementation has been developed. This metholodogy is aimed at improving the method with which a CWS is conducted by ensuring that the important factors influencing success are addressed. A recommended process in order to achieve a successful CWS is briefly outlined below, designed to address all the issues already discussed.

1. **Meet with the East Timorese Water Authority (DNAS) and Initial Community Visit.** The initial step is designed to allow the East Timorese Government body in charge of water and sanitation to keep track of the projects being undertaken in the country, and

direct organisations to work with the communities most in need. An initial visit to the community with a government official will legitamise any work and can also be used to determine amount of demand for a CWS.

2. **Collection of community data**. Initial investigations of the social and physical attributes of the community are conducted either during the intial visit or on a second visit to the community. Enough information needs to be collected to allow preliminary design work to begin.
3. **Preliminary Design**. Preliminary designs are developed to identify possible solutions to implement and to give comparisons between the different techniques and technologies available.
4. **Returning to the Community**. Return to the community to present and discuss the preliminary design options with the community. Working with the community, technique and technology choices are to be made identifying strenghs and weaknesses of each option. Once a decision has been made detailed design work on the final design can begin with the communities input.
5. **System design**. This stage includes all facets of the design including the design of social programs to be implemented in the project. Working closely with the community in this stage helps ensure a design satisfying the identified needs and wants.
6. **Implementation**. Implementation of the design and programs.
7. **Post Implementation**. Post Implementation is an ongoing stage that includes preparing the community in all the aspects needed to ensure the ongoing operation of the CWS. This includes training for the O&M programs and construction of management for the CWS finances.

6.0 Conclusion

Communtiy Water Supply projects can provide large benefits to the communities of East Timor, particularly when a hollistic approach is taken. However there are a number of factors that need to be considered if a CWS is to successfully achieve its desired objectives, the most important of these relating to ensuring community participation in the project. A successful CWS must take into account during design all facets of the community, making note of the social and physical circumstances in order to design an appropriate system. To identify these characteristics and assist the design of an appropriate system, a methodology was developed to guide the development of CWS projects. The methodolgy can be used as a tool for the selection of appropriate techniques and technologies, and designing a system that fulfills the community's needs and wants, giving the CWS the best chance of operating successfully over a long period of time.

7.0 Reference

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