

Assessing and forecasting groundwater development costs in Sub-Saharan Africa

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ABSTRACT

Greater use of groundwater in Sub-Saharan Africa is a pre-requisite for improved human welfare; however, the costs associated with groundwater development are prohibitively high and poorly defined. This study identifies and disaggregates the costs of groundwater development in 11 Sub-Saharan African countries, while the cost factors that most strongly affect drilling expenditures are traced. Further, the institutional and technical constraints impeding groundwater development are also explored while a time-series analysis forecasts future drilling expenditures. The results indicate that mobilisation and demobilisation costs, together with well development costs, factors that are difficult to change, are most significantly affecting the total costs of drilling. Further, the nature of the hydrogeological formation (which is largely a site characteristic), along with the often-aged machinery (which can be controlled), are also major impediments to lowering the cost of drilling. All countries are forecasted to have a slight to considerable drilling cost decrease for the next decade which offers encouragement for future groundwater development. Greater attention to the individual cost factors and to forecasting analysis could help to design more coherent and consistent groundwater development policies in Sub-Saharan Africa.

Keywords: cost factors, groundwater drilling, forecasting analysis, Sub-Saharan Africa

INTRODUCTION

In recent years, driven by the need to improve water services and to ensure food security in Sub-Saharan Africa (SSA), there have been major efforts to enhance the level of access to groundwater through increased development (Adams et al., 2012). Although about 40 % of drilling projects appear to become dysfunctional after some years (Adekile, 2012a), a remarkable number of new wells are still developed annually (Schneider, 2012). Provision of drilling technologies that are technically, economically and socially suitable is the foundation to enable such development to occur.

The economics associated with groundwater development have been investigated through various theoretical and experimental studies that focus on the various costs of drilling and equipping shallow wells and deeper boreholes (Ball 2004; Danert, 2009; Danert et al., 2010a, Fonseca et al., 2011a). The groundwater expenditures have been interpreted through different well-detailed cost factors which aim to provide an integrated economic approach to groundwater development in SSA countries (Fonseca et al., 2011a,b). However, these studies often lack a solid theoretical economic background and sufficient data, and are applied across a limited geographical coverage.

Rarely have the total costs of drilling been systematically disaggregated component-wise and compared at a cross-country level on a wide scale across SSA.

Also, the institutional and technical constraints impacting groundwater drilling efforts tend to be evaluated on a

regional or national level. Rarely is there any consideration given towards the overall impediments that inhibit reducing the cost of drillings in SSA, although significant initiatives are currently underway (Danert and Furey, 2013). Another aspect hardly addressed in the literature is the estimation of the future groundwater expenditures in SSA given the current technological and societal conditions. The absence of systematic cost-related data and the low importance given to groundwater management in SSA have discouraged forecasting analyses of groundwater expenditures (Foster et al., 2011).

This study initially attempts to categorise in a systematic manner all the relevant fixed and variable costs pertaining to groundwater development in selected countries of SSA. Further, a cross-country correlation analysis is used to reveal the potentially significant effects of individual cost factors on the total groundwater costs. In turn, the most important institutional and technical factors that restrain lower-cost drillings in SSA are overviewed. Lastly, a time-series analysis is applied on a country-wise basis for forecasting the groundwater costs over the next decade.

This study focuses on 11 specific Sub-Saharan African countries which were selected within the context of a groundwater research project led by the International Water Management Institute, i.e., Burkina Faso, Mali, Ghana, Kenya, Ethiopia, Mozambique, Niger, Nigeria, Tanzania, Uganda, and Zambia. The data collection was conducted through published reports and grey literature related to the selected countries.

It should be noted that the study focuses only on machine drilling conducted in the selected countries. It is acknowledged that manual and shallow drilling occurs to varying degrees in many of the aforementioned countries, and strong encouragement of such practices is currently underway (Van der Wal et al., 2005; Van Herwijnen, 2005a,b; Strand, 2010; Sutton et al.,

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