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A context based planning approach for comparative analysis of centralised and decentralised wastewater systems sustainability

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2012-01-31
http://hdl.handle.net/10539/11207

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ABSTRACT

Wastewater management is traditionally viewed primarily as a technical and economic issue. However, it is now recognised that these are some of the criteria in an array of other factors that affect sustainability. Municipal authorities have traditionally used indicators in monitoring performance and reporting the state of the environment. However, they have neglected other critical aspects of the use of these indicators such as their input into the planning and decision making process. The overall objective of this study is to make use of Multi Criteria Decision Aid (MCDA) in a Decision Support System (DSS) for the comparative evaluation of wastewater systems technology with respect to technical, environmental and social criteria in one step and then carryout a detailed economic analysis on the finite solution set as a second step. The methodology consisted of comprehensive literature review, case study analysis and the development of the DSS for Gauteng Province in South Africa. One hundred and eighty three settlements and twenty wastewater treatment plants were visited. Sixteen wastewater technologies (land treatment, package plants, ecological systems, mechanical and pond systems) were incorporated into the DSS and evaluated on the basis of eleven indicators in order to measure their sustainability index. The normalised main criteria weights for the case study were technical (0.4), social (0.3) and environmental (0.3). The overall result shows that land treatment systems, ponds and ecological treatment systems pose the least economic and environmental impact with an average score above 85% of the sustainability index measure. These systems have low energy requirements and are more likely to create more employment per plant capacity than mechanical systems. The lessons learnt are that wastewater management is not a preserve for engineers and scientists but requires a multi-disciplinary approach. This MCDA tool will be used as a context-oriented planning tool and is useful in demystifying and communicating the decisions to a wider stakeholder base including users of the systems. The overall recommendation for the case study is that a differential wastewater management approach should be employed with tailor made solutions for each municipality and a proposal to set up a Capacity Building Centre as an indispensable prerequisite to empower the stakeholders.