Wastewater Management in the Kingdom of Bahrain: A Case Study using Analytic Network Process in SWOT Analysis for a Textile Facility

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Abstract

The volume of wastewater generated by domestic, industrial and commercial facilities in the Kingdom of Bahrain has increased with population, urbanization, and industrial development. Centralized and de-centralized approaches to wastewater management are evaluated and contrasted through SWOT analysis and analytic network process (ANP). Data were collected from different sources including governmental reports, relevant environmental regulations, wastewater treatment facilities and were evaluated through structured questionnaire with responses of 25/38 and 9 personal interviews with experts conducted to both systems practiced in Kingdom and the enforcement of the national wastewater management regulations. The research found that wastewater legislations need to be reviewed and updated. SWOT tool was used to evaluate strengths, weaknesses, opportunities and threats factors for both decentralized and centralized wastewater management systems represented by a textile facility and Tubli STP. The SWOT sub-factors were identified and the alternative strategies (SO-WO-SW-WT) were developed in which SO uses strengths to maximize opportunities, WO minimizes weaknesses by taking advantage of opportunities. ST uses strengths to minimize threats and WT minimizes weaknesses and avoid threats. Since SWOT possesses deficiencies in the measurement and evaluation steps, the Analytical Network Process (ANP) approach was used to measure the dependency among strategic factors and sub-factors that will reflect both the weight and change of the strategic priorities. The ANP analysis for the local textile facility indicated that reusing 100% of the treated wastewater on the production process is the best strategy (ST) to reduce the water consumption with highest priority value of 0.804. For centralized wastewater management system Tubli STP, the ANP indicated that the (ST) is the best strategy with priority value of 0.680. Therefore, Tubli needs to upgrade its wastewater treatment plants in order to improve the wastewater effluents and fulfill legislation limits for the disposal in Tubli bay. Both management systems were found effective and appropriate and the best alternative strategy is ST that will enhance and improve their management to ensure a better reuse of the treated wastewater.