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Making Knowledge Useful

Determinants of Key Drivers for Potable Water Treatment Costing in Umgeni Basin

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Background

- In the past many water monitoring programs have been characterised as “data-rich but information poor”, because of the existent of data which was not used effective and efficient (Adriaanse et al., 1997; Timmerman et al., 2010)

- However, in recent years there has been an increase concern of deriving information from such data

- Derived information helps for alert, action and decision-making.

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- The study thus seeks to treat this shortcoming of the past as the challenge for the future by utilising historical data to determine;
  - key parameters that are influencing treatment cost
  - expand current water quality index by incorporating derived significant parameters
  - To formulate regression equations which shows correlation between quality variability and treatment cost

Peer Review

- Water treatment costs are expenses incurred by water treatment plants in complying with compulsory national standards (SANS 241:2006) for the production of quality potable water (Pretty et al., 2002)

- According to Dearmont, Mccarl et al. (1998) and Pretty et al. (2002) cost of drinking water treatment depends primarily on the raw water quality.

- As quality of raw water deteriorates, cost of treatment increases.

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- Studies in Vaal Basin have already cited raw water quality variability as a significant factor affecting treatment cost
  (Dzwairo, 2011)

- Wyk (2001) have revealed that cost of raw water contributed 50% of the total potable water treatment cost .

- Graham (2004) study on man-made lakes in Umgeni catchment established a correlation between algal variability and treatment cost.

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- Although that study was performed in the **same Basin** as the intended research, it only determined the impact of **algal variability** on portable water treatment cost.

- This left room for further studies on the impact of **other parameters** on potable water treatment cost in Umgeni Basin

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- Dennison and Lyne (1997) conducted a study to find factors causing high treatment cost at DV Harris Water Treatment Plant using monthly data for 1990 – 1995.

- They cited raw water quality as a significant factor contributing to high treatment cost on the plant.

- However water quality is not static there is still need again to analyse water quality for determining current parameters of significance to treatment cost in the basin.

Research Aim

- To make an in-depth statistical analysis of surface raw water data for determination of key parameters impacting portable water treatment cost in the Umgeni Basin.

Specific objectives

1. To analyse Umgeni Water Monitoring data set for detection of spatial and temporal quality trends.

2. To correlate variability of raw water parameter to treatment cost and formulate regression formulas for prediction of treatment cost

3. To calculate Weight factors for determining significant parameters that can be incorporated into the current Umgeni Water Quality Index.

Methodology

- The research is Quantitative.
- Shall involve in-depth statistical analysis of historical data

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Procedure

1. Acquisition of raw data for specific parameters as agreed and beneficial to the Water Boards.

2. Pre-processing of six year (2006 to 2011) raw water data

3. Application of the Explorative Data Analysis approach on pre-processed data

4. Statistical testing of correlation among parameters (spatial and temporal trends).

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1. Acquisition of raw data for specific parameters as agreed and beneficial to the Waters Boards.

- Six year (2006 to 2012) historical Umgeni water monitoring data shall be subjected to statistical analysis
- Spatial and temporal trending of thirty-one parameters monitored by Umgeni in the study period shall be done
- pH, otho-phosphate, sulphur, suspended solids, temperature, total silicon, raw water turbidity, treated (potable) water turbidity, ammonium, ammonia, chlorophyll – *a,* chemical oxygen demand, dissolved organic carbon, total organic carbon, molybdenum, silicon, total phosphorus, iron, rainfall

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2. Pre-processing of six year raw water data

- Instruments: Microsoft Excel and Matlab
- Missing values and outliers

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3. Explorative Data Analysis approach

- Allows full scrutiny of data by visual, spatial, dynamic and interactive way.
- Scatter plots ,graphs, time series plots, box and whisker plots
- Factor Analysis will be performed for data reduction and grouping of parameter according to significant.
- Weight factors (WF) shall be calculated on parameters, to determine significant parameters which can be incorporation into the current WQI for upgrading.
- N.B- WF shall be based on human health, environment and economic,
- Instruments: Matlab and SPSS

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4. Statistical test

- Correlation analysis test (e.g. Pearson) shall be performed to test the relationship between raw water parameters
- Kendal (regional and seasonal) test shall be performed for testing significant spatial and temporal trends of the parameters.

Limitation

- Real costing prediction equations and models requires input of all variables including electricity and wages.
  - However the study will only express treatment cost as a function of raw surface water quality.

- Because of time constraints and availability of data, the study shall only consider water monitoring data from Umgeni Basin although they is also to need to compare the data with other stakeholder which also preform water monitoring in the basin.

Deliveries

- Upgraded (expanded) Water Quality Index
- Regression formulas showing correlation between parameter variability and treatment cost
- Research Papers
- Thesis
- Conference paper

Importance's of the study

- WBs will benefit in terms of numerical (statistically) understanding of the correlations of water parameters among the various factors that may be driving the cost of treatment
- An update Water Quality Index will help reclassifying Water Monitoring Points according to emerging pollutants
- Regression formulas will help WBs forecast portable water treatment cost thus increasing budget forecast
- For all end users the benefit is high quality water at a reasonable tariff.

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THANK YOU