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An Urban Water Consumption Model for Gampaha District, Sri Lanka

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Water is a limited and an essential resource for living and its importance is understood by all. Climate change along with increase in population and economic growth exert stress on existing water resources. Sri Lanka experiences drought very frequently. Therefore, careful consumption of water is of high importance and there is a need to develop new methods to use water wisely. This study discusses an approach to understand and estimate the socio-demographic and climatic relationship with water consumption using Multivariate Analysis Techniques and comprises the formulation of an urban water consumption model using Multiple Regression Analysis.

Water consumption data of the Gampaha district during the period 2000-2009 were examined to develop a model of urban water consumption. The analysis was done with water consumption as a dependent variable, and selected socio-demographic and meteorological data such as number of water connections, average annual temperature, total annual rainfall, GDP at current market price, population and ratio of population to university students as independent variables.

The factor analysis revealed the variables of high influence on water consumption. The various factors and factor scores gave an understanding of the influence of each of the socio-demographic variables and the meteorological observations and helped to classify them into groups based on their inter-relationships. The results indicated that urban water consumption is quite strongly affected by the number of water connections, average annual temperature and GDP at current market price.

Regression models in seven different functional forms were investigated using independent variables. It was noted that six of these models showed higher adjusted R^2 value approximately equal to 0.99. Among all the functional forms used, three of the models were the best with high R^2 values and low standard errors. Various plots of residuals, the assumption of normality and the constant variance and independence of the error terms were also valid for the three models. The selected three models were used to simulate the behaviour of the forecast water consumption in relation to the actual water consumption. Data during the year 2010 was used for verification of the model's validity. The obtained results were then used to recommend an appropriate model for water consumption in the Gampaha district.