ABSTRACT

The present water usage in Kolkata Metropolitan area (KMA) cannot be considered sustainable because too much water of high quality is taken from the eco-systems and replaced back with polluted water instead leading to increased cost of treatment of water supply. This situation raises a vital question. Is conventional Urban Water System feasible in the long-term? This highlights the need to adopt alternative approach to ensure that the rain falling over a region is tapped as fully as possible through appropriate water harvesting techniques for direct storage and use of rain water as a supplementary source.

The goal of the thesis is to measure the factors and indicators responsible for the implementation of Rooftop Rain Water Harvesting (RRWH) for non potable uses in a humid urban catchment. There are several decentralized harvesting solutions which do not consider *socio cultural* and *socio economic* behavior of the stakeholders towards acceptance of RRWH, feasibility of RRWH for different building uses in metropolitan catchments and its relationship with the end use of harvested rain water, regional and local policies and other institutional mechanism to support RRWH, to assess impediments for acceptance of RRWH in humid catchment.

In this study, an user response survey was conducted in December, 2010 – March, 2011, with 390 sample size, in five types of building uses; *Residential, Educational*, *Medical, Institutional* and *mixed use Commercial*, with variable roof sizes and situated in four different zones of KMA, having wide variation in piped water supply. A database of 32 years of daily rainfall data has been analyzed , in order to find out demand for different end uses for various building, supply from roof runoff, demand supply ratio, priority of different socio-economic factors for each type of building using AHP analysis, user's opinion on choice of end-use using regression analysis and finally developed a DSS model.

The results from the analysis interpreted that there is a huge potential of using large building's rooftop for harvesting rain water as a supplement for utilizing it for all non potable uses in KMA at plot level. Analysis also revealed that the highest acceptance of RRWH are in favor of the *Medical uses* building, the lowest being *mix-Commercial building*. Further factors like *toilet flushing* is found to be most potential end use options, followed by *landscaping* and *cleaning*. The regression model clearly show that the variables like ground condition, scale of development, degree of contact, storey's of building and water scarcity are key to decision making. Model – driven DSS emphasizes access to and manipulation of a statistical, financial, optimization, or simulation model. Model-driven DSS use data and parameters provided by users to assist decision makers in analyzing a situation; they are not necessarily data-intensive. In other words this thesis attempted to find out what makes up an improved process for acceptance of RRWH in different buildings in KMA. This could be very well utilized for implementation of RRWH in the decision making, at plot level, under the jurisdiction of Urban Local Bodies (ULB).

This thesis developed a model to implement Rooftop Rain Water Harvesting at plot level addressing social, economical, technical and institutional issues. This model can give water engineers and planners information regarding the importance of certain social, environmental, behavioral characteristics and their influence on acceptance of Rain Water Harvesting. They can accommodate these variables in their estimation process to develop better model for RRWH acceptance for different uses of buildings. For example from the model it is understood that Policy framework and legislation have implication on all the building uses except medical use building. So by looking at the AHP Analysis model for separate building in a particular area one can estimate the potential impact of *Judgment Strategies, Cost, Co Existence, Adaptability, Performance, Policy framework* and *Legislation* separately in acceptance of RWH for that Particular building.

The model is also suitable for water authorities to identify the potential end-use for a specific type of building which tend to supplement maximum rain water. The ULB authorities can use this information to target such groups by creating new regulations to implementation of RWH, introduce RWH campaigns specifically targeted towards certain groups and improve existing water supply and storm water drainage.

Key words: Roof top Rain Water Harvesting (RRWH), non potable use, Decision support system (DSS), Analytical Hierarchy Process (AHP), End-use potential, Urban Local Bodies (ULB).