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Water is fundamental for life in terms of quantity and quality. Most available water sources are surface water or groundwater. Surface water considered an essential source for water supply in many improving countries [11].

The water supply system of the Addis Ababa city is characterized by a low output capacity, inadequate networks and high system losses, high water use or high water demand, urbanization, and high population [12]. The city water demand met is not more than 60% [13] and it is expected to address the estimated 36.5% leakage of water supply in the system as a way of ensuring that more potable water is made obtainable for the population [14].

Water demand management is any socially beneficial measure which reduces the consumptive use from surface or groundwater [20]. It is the development and implementation of strategies aimed at influencing demand, so as to achieve efficient and sustainable use of a scarce resource and widely considered as a promising path towards the sustainable development of water [16, 17].

In urban areas, relying on water distribution networks for water supply having large leakage losses constitutes a significant portion of water demand, and thereby leakage control is one the important measures to reduce water loss [26]. Adopting the low-flow appliances (e.g., toilets, showerheads, and washing machines) can save water usage [27]. Water demand management strategies include efficient fixtures, water efficiency labelling, and conservation awareness programs [21].

The UN has recognized that African cities urgently need to develop and implement effective water conservation and water demand management strategies. The toilet account 30% of all indoor uses and is one of the most water uses, averaging 5 flushes per capita per day. An inefficient showerhead can use more than 20 liters per minute but a water efficient showerhead only uses about 8 liters per minute which can save significant amount of water without reducing the quality of service to the user [29]. Replacing an inefficient toilet with a low flow model will conserve water [28].

Addis Ababa city is a grid-connected electric energy system, which is accompanied by high energy demand and limited energy supply. To ensure reliable power supply security in the city, the government has a grid expansion plan [30]. Also, to enhance energy supply, the city has to increase the alternative sources of energy and concentrating more on energy efficiency which is the ultimate for achieving supply and demand balance [31].

This paper aims to predict the future water-energy demand (2016-2050) using the regression model and assesses sustainable water-energy supply to improve the future city demand through considering ECDM and

WCDM based on predicted demand.

Addis Ababa city is located at 38?44"E and 9?1"N, as well as it is home to 25% of the city population in Ethiopia and one of the rapidly growing in Africa [36]. Addis Ababa"s GDP is growing by 14% per year and has 50% of national GDP contribution [37]. The city water scarcity is become significant due to the high growth of urbanization and individual water demand. The total water sourced from groundwater and surface water is about 0.45 million m3/day and 36.5% of the water is lost due to leakage [37].

The WE demand prediction is based on developing a mathematical relationship between the predictor socio-economic variables with the dependent variable WE consumption based on regression model using the WEKA tool. Flow diagram in predicting WE demand is indicated in Fig 1.

The regression equations were providing a fundamental explanation for an actual trend and high goodness of fit [38]. The multivariate linear regressions are commonly used in the water-energy demand prediction. The linear regression model can extend to a multivariate linear relationship as expressed in Eq (1).

Where v1,..., vn and vo are coefficients of regression and constant respectively and x1,..., xn are explanatory variables (population, GDP and PCI) and whereas y (water-energy consumption) is the dependent variable.

This tool is developed at the University of Waikato in New Zealand. It is a collection of machine learning algorithms for solving real-world data mining problems. A number of data mining methods were implemented and experimented in the WEKA tool. Some of them were based on probability and regression was implemented. WEKA is the most data mining software over the others as it is open source and deployed on any problem [40].