# UNIVERSITI TEKNOLOGI MARA

# FORECASTING UTILITY MANAGEMENT IN UiTMCTKKT USING PREDICTIVE ANALYTICS

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# ABSTRACT

Predictive analytics and Business Intelligence (BI) represent critical components in modern operational management, especially within institutions of higher learning. The improper handling of utility system at UiTM Cawangan Terengganu Kampus Kuala Terengganu (UiTMCTKKT) campus brings forth several issues, including excessive and inconsistent utility cost, irregularity and big gap in monthly bill charges and difficulty in decision-making and budget planning. In this project we will use the Cross Industry Standard Process for Data Mining (CRISP-DM) framework to mitigate these issues combining predictive analytics with iconic factors such as Holt-Winters and Autoregressive Integrated Moving Average (ARIMA) models. These techniques enable predicting utility costs and consumption and detecting trends and anomalies. Previous data was used to create a comprehensive dashboard which provides actionable insights for data-driven decisions. Using ARIMA and Holts-Winter this project shows the most optimum model found to gain insights is ARIMA(1,0,0), ARIMA (1,0,1) and Holts-Winter Multiplicative ($\alpha = 0.5$, $\beta = 0.2$, $\gamma = 0.1$). The model is validated with MAE values where lower MAE produced more accurate prediction. The Mean Absolute Error (MAE) values for the forecasting models are as follows: ARIMA (1,0,0) in Experiment 3 recorded an MAE of 14,135.026 ± 2,883.271. ARIMA (1,0,1) was used in Experiments 1 and 2, yielding MAE values of 2,915.241 ± 1,880.403 and 2,461.684 ± 1,550.353, respectively. Lastly, the Holt-Winters model ($\alpha = 0.5$, $\beta = 0.2$, $\gamma = 0.1$) applied in Experiment 1 resulted in an MAE of 9,225.052 ± 5,862.083.The dashboard provides key stakeholders with a mechanism to predict high-demand periods and reduce resource allocation through enabling data visualisation. Usability and efficacy were also tested using five experts and positive comments were received on its utility and relevance with a few suggestions on the enhancement of the dashboard. This project is an example of the need to combine predictive analytics and BI to better manage utilities proactively. The results show its potential to predict utility cost for better planning for the utility management. Future iterations could also improve the system using real-time monitoring and machine-learning based predictive algorithms.

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