

ABSTRAK

Distribusi air minum merupakan salah satu kegiatan operasional krusial yang memengaruhi efisiensi biaya dan layanan pada PDAM Tirta Binangun Kulon Progo. Penjadwalan rute distribusi saat ini masih bergantung pada pengalaman sopir, sehingga berpotensi menimbulkan jarak tempuh yang tidak optimal dan ketidakefisienan pemanfaatan armada. Permasalahan ini semakin kompleks karena jumlah pelanggan harian, volume permintaan, dan lokasi pengiriman bersifat dinamis, serta kapasitas armada terbatas.

Penelitian ini bertujuan merancang sistem informasi rute distribusi berbasis kombinasi metode *K-Means Clustering* dan *Saving Matrix* untuk meningkatkan efisiensi operasional dan menekan biaya distribusi. Data distribusi harian selama enam hari dianalisis, dengan rute aktual mencatat total jarak 896,5 km dan biaya Rp 913.117, sedangkan rute usulan menghasilkan total jarak 892,7 km dan biaya Rp 792.889. Variasi harian terlihat signifikan, misalnya pada 11 September, jarak rute usulan meningkat menjadi 222,9 km dibanding rute aktual 168,9 km, sedangkan pada 10 dan 13 September, rute usulan lebih pendek, menunjukkan efisiensi sebesar 6–27%.

Hasil penelitian menunjukkan bahwa metode *K-Means Clustering* membagi pelanggan ke dalam klaster harian, sedangkan *Saving Matrix* menentukan urutan kunjungan optimal di tiap klaster, sehingga rute usulan adaptif terhadap perubahan permintaan dan kapasitas armada. Meskipun pada beberapa hari jarak usulan lebih panjang, penggunaan armada L300 yang lebih efisien menurunkan total biaya distribusi. Penelitian ini menegaskan bahwa kombinasi optimasi matematis dan pertimbangan kondisi operasional nyata mampu meningkatkan efisiensi distribusi air minum secara keseluruhan, serta dapat dijadikan dasar perancangan sistem informasi rute distribusi berbasis web.

Kata kunci: sistem informasi, rute distribusi, *K-Means Clustering*, *Saving Matrix*, kapasitas armada, *User Acceptance Test* (UAT)

DESIGN OF A WEB-BASED DRINKING WATER DISTRIBUTION ROUTE INFORMATION SYSTEM USING K-MEANS CLUSTERING AND SAVING MATRIX METHODS TO SUPPORT OPERATIONAL EFFICIENCY

ABSTRACT

Water distribution is a critical operational activity affecting cost efficiency and service quality at PDAM Tirta Binangun Kulon Progo. Current route scheduling relies heavily on driver experience, potentially leading to non-optimal travel distances and inefficient fleet utilization. The problem is further complicated by daily fluctuations in customer numbers, delivery volumes, and locations, as well as limited vehicle capacity.

This study aims to design a web-based distribution route information system using a combination of K-Means Clustering and Saving Matrix to improve operational efficiency and reduce distribution costs. Analysis of six days of daily distribution data shows that the actual routes had a total distance of 896.5 km with a total cost of IDR 913,117, while the proposed routes recorded a total distance of 892.7 km and cost of IDR 792,889. Daily variations were observed; for instance, on September 11, the proposed route distance increased to 222.9 km compared to 168.9 km for the actual route, while on September 10 and 13, the proposed routes were shorter, resulting in efficiency gains of 6–27%.

The results indicate that K-Means Clustering groups customers into daily clusters, and the Saving Matrix determines the optimal visit sequence within each cluster, making the proposed routes adaptive to changes in demand and fleet capacity. Although some days showed longer travel distances, the use of more efficient L300 vehicles reduced overall distribution costs. This study confirms that combining mathematical optimization with operational considerations can enhance overall water distribution efficiency and serve as a foundation for a web-based distribution route information system.

Keywords: *information system, distribution route, K-Means Clustering, Saving Matrix, vehicle capacity, User Acceptance Test (UAT)*