

ABSTRAK

Pemilihan *Supplier* yang tepat merupakan elemen krusial dalam mendukung keberhasilan proyek, seperti industri konstruksi pengolahan air limbah yaitu *Sewage Treatment Plant* (STP). Penelitian ini bertujuan untuk mengintegrasikan metode *Analytical Hierarchy Process* (AHP) dan *Mixed Integer Linear Programming* (MILP) untuk mengoptimalkan pemilihan dan alokasi pemesanan pipa proyek STP di PT Enerba Teknologi. Masalah utama adalah pemilihan *Supplier* dan alokasi pemesanan pipa belum optimal karena hanya berdasarkan harga satuan terendah tanpa mempertimbangkan biaya tetap, MOQ, kapasitas, dan biaya pengiriman. Pertama dilakukan dengan pendekatan AHP untuk menentukan bobot kriteria dan memprioritaskan *Supplier* berdasarkan empat kriteria utama: harga, kualitas, waktu pengiriman, dan pembayaran. Hasil perhitungan AHP menunjukkan bahwa kriteria harga memiliki pengaruh tertinggi dengan bobot 0,284. Selain itu, diperoleh nilai *Consistency Ratio* (CR) di bawah 0,10 menandakan konsistensi penilaian yang baik. Berdasarkan hasil AHP, *Supplier* B dipilih sebagai alternatif terbaik dengan nilai prioritas tertinggi sebesar 34,2%. Selanjutnya, pendekatan MILP dirancang untuk mengoptimalkan alokasi pemesanan pipa kepada *Supplier* B. Model mempertimbangkan kebutuhan total pipa sebanyak 70 unit, kapasitas maksimum pemasok, MOQ, serta komponen biaya seperti harga per unit, biaya pengiriman, dan biaya tetap. Fungsi tujuan dari model MILP adalah meminimalkan total biaya pengadaan. Hasil optimasi menunjukkan bahwa alokasi paling efisien adalah memesan 40 unit PVC 2 Rucika dan 30 unit PVC 2 Alderon dari *Supplier* B dengan biaya minimum sebesar Rp3.205.000, menghasilkan penghematan sebesar Rp1.795.000 dari anggaran maksimum Rp5.000.000. Integrasi metode AHP dan MILP ini terbukti efektif dalam memberikan dasar pengambilan keputusan yang objektif, efisien, dan berbasis data untuk pemilihan serta pengalokasian *Supplier* secara optimal.

Kata Kunci: *Analytical Hierarchy Process* (AHP), *Mixed Integer Linear Programming* (MILP), Optimasi Biaya, Pemilihan *Supplier*, Proyek *Sewage Treatment Plant* (STP).

ABSTRACT

The selection of the right Supplier is a crucial element in supporting the success of a project, such as the wastewater treatment industry, namely the Sewage Treatment Plant (STP). This study aims to integrate the Analytical Hierarchy Process (AHP) and Mixed Integer Linear Programming (MILP) methods to optimize the selection and allocation of pipe orders for the STP project at PT Enerba Teknologi. The main problem is that the selection of Suppliers and the allocation of pipe orders are not optimal because they are only based on the lowest unit price without considering fixed costs, MOQ, capacity, and shipping costs. First, the AHP approach is used to determine the criteria weights and prioritize Suppliers based on four main criteria: price, quality, delivery time, and payment. The results of the AHP calculation show that the price criterion has the highest influence with a weight of 0.284. In addition, the Consistency Ratio (CR) value is below 0.10 indicating good assessment consistency. Based on the AHP results, Supplier B is selected as the best alternative with the highest priority value of 34.2%. Furthermore, the MILP approach is designed to optimize the allocation of pipe orders to Supplier B. The model considers the total pipe requirement of 70 units, the Supplier's maximum capacity, the MOQ, as well as cost components such as price per unit, shipping costs, and fixed costs. The objective function of the MILP model is to minimize the total procurement cost. The optimization results show that the most efficient allocation is to order 40 units of 2 PVC Pipe Rucika and 30 units of 2 PVC Pipe Alderon from Supplier B with a minimum cost of Rp1,000, resulting in savings of Rp1.795,000 from a maximum budget of Rp5,000,000. The integration of the AHP and MILP methods has proven effective in providing an objective, efficient, and data-driven decision-making basis for optimal Supplier selection and allocation.

Keywords: Analytical Hierarchy Process (AHP), Mixed Integer Linear Programming (MILP), Cost Optimization, Supplier Selection, Sewage Treatment Plant (STP) Project.