UNIVERSITAS
GADJAH MADA
Optimasi Jaringan Distribusi Program Makan Bergizi Gratis Berbasis Capacitated Location Routing Problem with Time Windows
Rafi Aulia Ihsan, Ir. Agus Darmawan, S.T., M.S., Ph.D., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

INTISARI

Program Makan Bergizi Gratis (MBG) merupakan program distribusi pangan publik yang membutuhkan sistem layanan yang terstruktur, tepat waktu, dan efisien. Pada implementasi di Kota Yogyakarta, distribusi MBG masih menghadapi tantangan terkait alokasi sekolah ke SPPG, keterbatasan kapasitas fasilitas, serta pembentukan rute distribusi yang harus memenuhi batas waktu pelayanan. Penelitian ini bertujuan untuk merancang jaringan distribusi MBG di Kota Yogyakarta dengan mempertimbangkan pemanfaatan SPPG, alokasi sekolah, penggunaan kendaraan, kapasitas fasilitas, kapasitas kendaraan, dan rute distribusi. Permasalahan tersebut dimodelkan sebagai *capacitated location routing problem with time windows* agar keputusan lokasi, alokasi, dan *routing* dapat dianalisis secara terintegrasi.

Data penelitian mencakup 739 sekolah fisik yang diproses menjadi 902 titik permintaan, 44 SPPG eksisting, 521 kandidat SPPG, tiga kelompok *time window*, serta total kebutuhan sebesar 113.605 porsi per hari. Model diselesaikan menggunakan pendekatan *simulated annealing* untuk instance skala besar, sedangkan *mixed integer linear programming* digunakan sebagai pembanding pada instance kecil. Hasil optimasi menunjukkan bahwa jaringan distribusi dapat melayani 902 titik permintaan dengan total permintaan sebesar 113.605 porsi per hari menggunakan 46 SPPG, yang terdiri atas 44 SPPG eksisting dan 2 SPPG kandidat. Perbandingan indikatif dengan kondisi eksisting menunjukkan bahwa routing cost per porsi hasil optimasi sebesar Rp6,30, lebih rendah daripada kondisi eksisting sebesar Rp8,35. Namun, hasil tersebut perlu diinterpretasikan dengan mempertimbangkan perbedaan cakupan layanan antara kondisi eksisting dan simulasi. Hasil sensitivitas juga menunjukkan bahwa peningkatan kapasitas SPPG memberikan pengaruh besar terhadap penurunan total biaya sistem, sedangkan perubahan *routing cost* memberikan pengaruh searah tetapi lebih terbatas. Hasil penelitian ini dapat menjadi dasar kuantitatif bagi Koordinator SPPG dalam menyusun alokasi sekolah dan rute distribusi MBG yang lebih terstruktur, layak, dan efisien berdasarkan kapasitas, jangkauan layanan, kendaraan, dan *time window.*

Kata kunci: Program Makan Bergizi Gratis, Satuan Pelayanan Pemenuhan Gizi, *Capacitated Location Routing Problem with Time Windows,* Alokasi Sekolah, *Simulated Annealing.*

UNIVERSITAS
GADJAH MADA
Optimasi Jaringan Distribusi Program Makan Bergizi Gratis Berbasis Capacitated Location Routing Problem with Time Windows
Rafi Aulia Ihsan, Ir. Agus Darmawan, S.T., M.S., Ph.D., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

ABSTRACT

Program Makan Bergizi Gratis (MBG) is a public food distribution program that requires a structured, timely, and efficient service system. In its implementation in Yogyakarta City, MBG distribution still faces challenges related to school allocation to SPPG, limited facility capacity, and route formation that must satisfy service time constraints. This study aims to design the MBG distribution network in Kota Yogyakarta by considering SPPG utilization, school allocation, vehicle use, facility capacity, vehicle capacity, and distribution routes. The problem is modeled as a capacitated location routing problem with time windows so that location, allocation, and routing decisions can be analyzed in an integrated manner.

The research data include 739 physical schools that are transformed into 902 demand nodes, 44 existing SPPG, 521 candidate SPPG, three time window groups, and a total daily demand of 113,605 portions. The model is solved using a simulated annealing approach for large-scale instances, while mixed integer linear programming is used as a benchmark for small-scale instances. The simulation results show that the distribution network can serve 902 demand nodes with a total demand of 113,605 portions per day using 46 SPPG, consisting of 44 existing SPPG and 2 selected candidate SPPG. An indicative comparison shows that the simulation produces a routing cost per portion of Rp6.30, which is lower than the existing value of Rp8.35. However, this result should be interpreted by considering the difference in service coverage between the existing condition and the simulation. The sensitivity analysis also shows that increasing SPPG capacity has a substantial effect on reducing the total system cost, while changes in transportation cost have a direct but more limited effect. The results of this study can serve as a quantitative basis for SPPG coordinators in planning school allocation and MBG distribution routes in a more structured, feasible, and efficient manner based on facility capacity, service coverage, vehicle capacity, and time window constraints.

Keywords: Program Makan Bergizi Gratis, Satuan Pelayanan Pemenuhan Gizi, *Capacitated Location Routing Problem with Time Windows, School Allocation, Simulated Annealing.*