Chapter 108
Logistics for the Garbage Collection through the use of Ant Colony Algorithms

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ABSTRACT

The contribution of this chapter is to present an approach to explain the Ant Colony System applied on the Waste Collection Problem, because waste management is moving up to the concern over health and environmental impacts. These algorithms are a framework for decision makers in order to analyze and simulate various spatial waste management problems. In the last decade, metaheuristics have become increasingly popular for effectively confronting difficult combinatorial optimization problems. In the present work, an individual metaheuristic Ant Colony System (ACS) algorithm is introduced, implemented and discussed for the identification of optimal routes in the case Solid Waste collection. This algorithm is applied to a waste collection and transport system, obtaining recollection routes with the less total distance with respect to the actual route utilized and to the solution obtained by a previously developed approach.

1. INTRODUCTION

Solid waste management is undoubtedly an increasingly important element in terms of efficiency and profitability for any municipality, particularly in industrialized nations. Its especially complex dimension is a result not only of the direct relationship with a number of factors that originate the living standard of a society, but also of our continuously rising consuming lifestyle which analogically enhances the existing operational difficulties.

Sustainable waste management is moving up to the concern over health and environmental impacts. Special emphasis, particularly in industrial-

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ized nations, is placed on concrete, comprehensive analysis of the waste management situation. To the extent possible, is necessary to highlight the areas in which an efficient improvement is feasible and how these goals derived from the objectives and principles of the waste management act can be achieved, while making available an appropriate basis of information (Figure 1 and Table 1).

Some critical areas for solid waste collection are:

- Solid Waste Collection Vehicle Routing
- Waste Characterization Studies
- Sustainable Development
- Expert Witness Services – environmental, solid waste management and transportation industry sectors
- Operational Performance Assessments (OPAs) for Collection Companies, Material Recovery Facilities (MRFs), and Transfer Stations
- Solid Waste Collection Rate Studies, Analysis and Recommendations
- Fleet Management – maintenance cost analysis and payload logistics
- Disposal Site Optimization Studies / Analysis
- Waste-by-Rail – track layout, intermodal facility layout, railroad negotiations, feasibility studies
- Transfer Trucking Operations – equipment optimization, payload maximization analysis, carrier contract management and negotiations

Figure 1. Life-cycle of waste generation

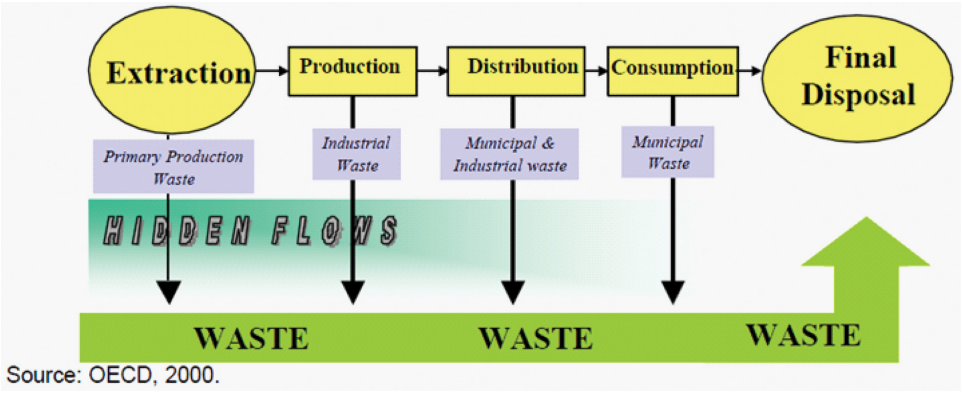

Table 1. Global dimensions of solid waste problem

Factor	Observation
Population	By 2050 the global population is projected to be 50% larger than today (i.e., 9 billion people), and 95% of that growth is expected to occur in developing countries.
Consumption	Consumers in certain rapidly expanding non-OECD economies are emulating the ecologically challenging consumption patterns of consumers in OECD countries.
Affluence	Some of the highest GDP growth rates in the world is taking place in countries outside the developed world, such as China, India, Brazil, and Indonesia.
Technology	The World Bank reports that "massive levels" of industrial investment will occur in developing countries (Hanrahan 1995). In principle, "leap-frogging" the dirty technologies of the past may be possible because many developing countries have fewer sunken costs in older "eco-unfriendly" technologies.
Impact	A five -fold increase in global waste generation is possible by 2025.

Source: OECD, 2000.