Strategy and Implementation Plan for Integrated Solid Waste Management in Tehran

A. Harati, M. R. Azimian

Organization of Waste Recycling & Composting, Tehran-Iran

Abstract

The Tehran Solid Waste Management Strategy is being developed with the current situation, the current organizational structure and the current operational practices. The waste management organization has done various projects in public awareness, composting etc. The management and operation of solid waste relate to lots of criteria more than the human mind can handle effectively. The reports show integrated view in the solid waste management is the best method for management under multi dimensional situation.

This study focuses on strategy and implementation plan in Tehran for gaining to the best result. With the aim of come to a long term cost effective, sustainable and social/political acceptable solid waste management system, the strategies were developed. The municipality has already defined some high level strategic goals like the 3-R approach. But With the use of SWOT analysis and QSPM, as a decision support system (DSS), it is possible to Process on quantitative methods for choice of strategies in solid waste management and ranks them under spatial criteria. This method has been checked for integrated Solid waste management in Tehran as a case study.

Keywords

Integrated solid waste management, Strategic management, SWOT analysis

1 Introduction

The daily production of solid wastes in Tehran is 7500 tons (min 4000 – Max 11000 t/d) which according to analyses almost %65 is organic materials which can be composted (wet wastes) %32.5 is solid wastes and %2.5 is special household waste and the healthcare waste as almost 40 tons daily. As the waste decays fast it is collected once in 24 hours from the production sources. This method is based on a three years plan. Presently the collection is mechanized by implementing this project the 2 millions point of waste reduced to 70.000 bins which has a good effect on reducing the air pollution. The city of Tehran is, as many multimillion cities, confronted with a steadily increasing population and a consequently increased production of waste. The study area is bounded by the Alborz Mountains (north) and province borders (East, West and south). The Solid Waste Management (SWM) system is challenged to cope with the developments and find a way to manage waste, urban planning, environment and social requirements in a sustainable manner. The proposed 7500 tons per day needs to have

strategic plan as part of well built decision support system (DSS). The documents show that the developments in decision support system begun with building mode- driven DSS in the late 1960s, theory development in 1970s the implementation of financial planning systems spread sheet DSS and group DSS in the early and mid 1980s. Executive information system and business intelligence was evolved in the late 1980s and mid early 1990s. Finally, the chronicle ended with knowledge-driven DSS and the implementation of web- based DSS in the mid 1990s. Also Little identified four criteria for designing models and systems to support management decision-making instead which included: robustness, ease of control, simplicity, and completeness of relevant detail. All four criteria remain relevant in evaluating modern Decision Support Systems. Scott Morton studied how computers and analytical models could help managers to make perfect in key business planning decision. He conducted an experiment in which managers actually used a Management Decision System (MDS). The solid waste management is by far one of the most concerns for governments and municipalities. The strategic management systems play important role in integrated solid waste management in Tehran. This Management is divided to 3 main sections:

- Waste generation
- Collection and transportation to disposal sites
- Disposal methods

The background of solid waste management refers to thousands years ago, human used fertilizer in agriculture. In 1906, engineering approach on solid waste management was presented and some methods to mechanize waste collection were shown. The studies and other experiences show the municipal solid waste management (MSWM) consists of many qualified parameters. Consequently, it's very difficult to choose the best strategy for MSWM under spatial scenarios with uncertainties.

Consequently, this study tries to develop methodological approach on how to perform the Decision Support system (DSS) and strategic management for integrated solid waste management. The next step discusses the DSS capability.

2 Materials & Methods

2.1 Development of strategic options

Many engineering efforts have developed mathematical methods, fuzzy logic, game theory etc. in DSS model, but there are not clear methods in strategies selection. In order to show quantitative methods of coping with flood hazards and their effects, different strategic alternatives should be defined and ranked. Therefore, the SWOT is appropriate tools to define strategic alternatives with evaluation of the strengths, weaknesses, opportunities and threats in systems. This technique is created by Stanford University in the 1960s and 1970s for business companies; nevertheless there are many similarities between case study systems and companies. In both of them, the strategies are established on strengths, weaknesses, opportunities and threats.

Accordingly, for flood management, SWOT analysis is applied to define strategic alternatives in case study area. Next, the SWOT analysis identifies internal and external factors. The strengths and weaknesses are presented by internal factors. The opportunities and threats are shown as external factors to the case study area. The related strategic options have been summarized in table (1). All strategies have been divided in four main sections. Section 1 belongs to strategies to use maximum opportunities with strength positive potential of case study areas (SO). Section 2, divides some strategies to apply strengths against the threats (ST). Section 3, is for strategies that use opportunities to cover weaknesses (WO). Section 4, minimizes weaknesses and threats (WT). Table (1) shows S, W, O and T in case study area.

Table1 SWOT analysis for Tehran Solid waste managementDateiformat

External Factors / Internal Factor	Threats						Opportunities						
	Problem in Market because of low quality	Illegal Market	Health and Safety	Lack of professional Workers	Problem in product because of bad separation	Lack of source separation	Support by Local Government	Employment	Development of Recycle Industries	Decrease Waste Management Costs	Public Participant	Development of Agriculture and Soil Quality	Natural Resource Separation
Strengths													
Decrease Landfill Operation Cost							*	*		*		*	*
Income	*				*		*	*	*				
Waste Volume Minimization							*			*			*
Save Resource & Material							*	*	*				*
Energy Production			*	*			*	*		*		*	*
Soil Protection			*		*		*	*				*	*
Pollution Emission Control							*			*		*	*
Marketing for recyclable Material	*	*	*	*	*	*	*	*	*	*	*		
Weaknesses													
Low Quality of Material	*	*	*	*	*	*			*				
Low level of Health Care	*	*	*	*							*		
Air & water Pollution													
High Capital Cost				*	*								

There are 7 strategies, gain from SWOT analysis for complete analysis and achieving better results.

Table 2 SWOT analysis for Tehran Solid waste management

Process / Strategy		Preparation	Primary Processing	Secondary Processing	Final Disposal
S1	Waste Acceptance	Shredder & Screening	Compost production	Manual Sorting & Screening	RDF
S2		Shredder & Screening	Compost production	Manual Sorting & Screening & Compress	Landfill
S3		Shredder	Stabilize organic material	Compress	Landfill or bio filter
S4		Screening	Compost production	Manual Sorting & Screening & Compress	Landfill
S5		Bag opener & Screening	Compost production	Manual Sorting & Screening	RDF
S6	Landfill for all kind of waste				
S7	Waste Incineration				

In the next steps, the best scenarios are defined and compared with Quantitative Strategic Planning Matrix (QSPM), in this method the best alternatives are chosen based on Strengths, weaknesses, opportunities and threats. The analytical hierarchy process (AHP) is applied to quantify QSPM method.

2.2 Quantitative Strategic Planning Matrix (QSPM), to select best scenarios

The integration of management in Tehran is the most important target and DSS methods should be applied with quantitative parameters. This study shows all part of DSS with quantitative methods to achieve this target. Meanwhile the application of strategic management in DSS is assessed. In this section, the scenarios of solid waste management are score and sorted based on QSPM method. The strategic alternatives in Tehran solid waste management are ranked by Strengthens, Weaknesses, Opportunities and Threats. The numerical models are applied upon Analytical Hierarchy Presses. Alternatives are weighted and scored under S, W, O and T criteria by Delphi analysis.

The result has been shown in table (4) and the S5 scenario is the best one with this methods.

Table 3 QSPM method to select best strategic option in Tehran Solid waste management

QSPM		S_1		S_2		S_3		S_4		S_5		S_6		S_7	
		V	S	V	S	V	S	V	S	V	S	V	S	V	S
Strengths	**weight**														
Decrease Landfill Operation Cost	0.04	3	0.12	4	0.16	2	0.08	4	0.16	4	0.16	2	0.08	4	0.16
Income	0.083	4	0.332	3	0.249	2	0.166	3	0.249	4	0.332	3	0.249	2	0.166
Waste Volume Minimization	0.01	4	0.04	1	0.01	2	0.02	3	0.03	4	0.04	1	0.01	3	0.03
Save Resource & Material	0.01	2	0.02	1	0.01	1	0.01	1	0.01	2	0.02	1	0.01	1	0.01
Energy Production	0.06	1	0.06	2	0.12	1	0.06	4	0.24	3	0.18	1	0.06	4	0.24
Soil Protection	0.06	3	0.18	4	0.24	2	0.12	4	0.24	4	0.24	3	0.18	3	0.18
Pollution Emission Control	0.3	3	0.9	4	1.2	3	0.9	3	0.9	4	1.2	2	0.6	2	0.6
Marketing for recyclable Material	0.047	4	0.188	1	0.047	3	0.141	1	0.047	4	0.188	1	0.047	1	0.047
Weaknesses															
Low Quality of Material	0.125	1	0.125	1	0.125	1	0.125	1	0.125	1	0.125	1	0.125	1	0.125
Low level of Health Care	0.125	1	0.125	1	0.125	1	0.125	1	0.125	2	0.25	1	0.125	1	0.125
Air & water Pollution	0.06	1	0.06	1	0.06	1	0.06	1	0.06	2	0.12	1	0.06	2	0.12
High Capital Cost	0.08	1	0.08	2	0.16	1	0.08	2	0.16	1	0.08	1	0.08	2	0.16
Opportunities															
Support by Local Government	0.05	4	0.2	3	0.15	2	0.1	3	0.15	4	0.2	4	0.2	1	0.05
Employment	0.05	4	0.2	4	0.2	2	0.1	3	0.15	4	0.2	3	0.15	1	0.05
Development of Recycle Industries	0.125	4	0.5	1	0.125	1	0.125	1	0.125	2	0.25	1	0.125	1	0.125
Decrease Waste Management Costs	0.0625	4	0.25	3	0.1875	2	0.125	3	0.1875	3	0.1875	2	0.125	2	0.125
Public Participant	0.03	3	0.09	1	0.03	1	0.03	1	0.03	2	0.06	1	0.03	1	0.03
Development of Agriculture and Soil Quality	0.2	3	0.6	2	0.4	3	0.6	3	0.6	4	0.8	1	0.2	2	0.4
Lack of source separation	0.2	4	0.8	4	0.8	3	0.6	4	0.8	4	0.8	2	0.4	3	0.6
Threats															
Problem in Market because of low quality	0.03	1	0.03	1	0.03	1	0.03	1	0.03	2	0.06	1	0.03	1	0.03
Illegal Market	0.02	1	0.02	1	0.02	1	0.02	1	0.02	1	0.02	1	0.02	1	0.02
Health and Safety	0.1	2	0.2	2	0.2	1	0.1	2	0.2	2	0.2	1	0.1	1	0.1
Lack of professional Workers	0.0625	1	0.0625	2	0.125	1	0.0625	1	0.0625	2	0.125	1	0.0625	1	0.0625
Problem in product because of bad separation	0.03	1	0.03	1	0.03	2	0.06	1	0.03	2	0.06	1	0.03	1	0.03
Lack of Tourists Participant	0.04	2	0.08	1	0.04	1	0.04	1	0.04	2	0.08	1	0.04	1	0.04
Final Scores			5.2925		4.8435		3.8795		4.771		5.9775		3.1385		3.6255
Ranking			2		3		5		4		1		7		6

3 Discussion and result

The results emphasize on integrated solid waste management. Meanwhile the SWOT analysis and numerical methods are useful in solid waste management. SWOT helps managers to choose the best strategic options. Basically, the DSS contain state of objectives, define the criteria and pick the alternatives. The methodology follows hierarchy process and tries to dedicate quantitative approach in all parts of decision support system (DSS). This method shows good adaptation with numerical models. To achieve above mentioned targets, strategic management and DSS tools have been combined together. This method decreases uncertainties with usage of strategic management to define strategic alternatives in case study zone. In this paper, management methods and engineering tools are linked, each phase is quantified and errors in decision making are shown to decreasing. The above mentioned alternatives are scored and ranked by Analytical Hierarchy Process (AHP) based on Quantitative Strategic Planning Matrix (QSPM) according to strategic management methods.

Consequently, S_5 (applying Bag opener and drum Screen to produce compost with manual sorting, secondary screen and production of RDF) is the best strategy for Tehran Solid Waste Management.

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Author's address(es):

Amir N. Harati
R&D Manager
Organization of Waste Recycling & Composting Tehran-Iran
Tel +98 912 17 57 319
Email: Haratia@alborz.kntu.ac.ir

Mohammad Reza Azimian
Deputy of Managing Director
Organization of Waste Recycling & Composting Tehran-Iran
Tel +98 912 12 67 675