



**UNIVERSITI PUTRA MALAYSIA**

**AN EXPERT SYSTEM FOR SELECTING AN APPROPRIATE SOLID  
WASTE TREATMENT TECHNOLOGY**

**MOHD ARMI BIN ABU SAMAH**

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**By**

**MOHD ARMI BIN ABU SAMAH**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in  
Fulfillment of the Requirement for the Degree of Master of Science**

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Abstract of thesis presented to Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science

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**APRIL 2009**

**Chairman : Associate Professor Latifah Binti Abd Manaf, PhD**

**Faculty : Environmental Studies**

The industrialisation, urban development and increasing population have brought about waste disposal problem that pose a tremendous challenge to the planners and managers of Malaysia. Therefore the advent of industrialisation, new environmental problems have also emerged, in the form of toxic and hazardous waste, demanding immediate attention and containment measures. Thus, it is not surprising that a primary concern in Malaysia is the management and disposal of an increasing amount of waste which contribute to environmental degradation in the all area especially in urban area. Solid Waste Treatment Technology (SWATT) expert system is a computer program for decision making in solid waste management. Solid Waste Treatment Technology (SWATT) expert system using application of Analytical Hierarchy Process (AHP) usually can be ranked according to solid waste management hierarchy as described in “EPA’s Agenda”



for Action. Following the integrated approach in solid waste management, Analytical Hierarchy Process (AHP) is being applied using a multi-level hierarchical structure of objectives, criteria, subcriteria, and alternatives. Based on knowledge acquisition from multiple sources, two forms of hierarchy structure has been developed and it was divided into two sections namely general hierarchy structure and specific hierarchy structure for selection of technologies; [1] for selection of general technology where political support, technical expertise, environmental impact, market potential, community involvement and technology cost become as a criteria while alternative consist of three distinct technologies (recycling, composting and incineration) and four combinations of the respective technologies [2] for selection of specific technology in more detail. Inputs data from the experts are used for the pairwise comparison matrix. Through the matrix of pairwise comparison, solid waste treatment technology will be ranked according to their height value of benefit technology. Based on consistency ratios a value of 10 percent or less will be accepted; otherwise the process must be re-evaluated. These comparisons will be used to obtain the weight of importance of the decision criteria, and the relative performance measures of the alternatives in terms of each individual decision criterion. If the comparisons are not perfectly consistent, then the AHP technique will provides a mechanism for improving consistency. To verify, the effectiveness of SWATT expert system has been evaluated for two case study; Kajang Municipal Council and Sepang Municipal Council. Through consultation session, expert system suggested that the best selection of technology is combination of recycling and incineration technology of which the weight is 0.17 for Kajang while combination of recycling and composting technology of which the weight is 0.13 for Sepang. The effectiveness of SWATT expert system was evaluated by selected experts and system engineer that demonstrated

satisfactory results as well as user will be able to have the benefits of informed decision making.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai  
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**Sistem Pintar Untuk Pemilihan Teknologi Sesuai Rawatan Sisa Pepejal**

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Penghasilan sisa pepejal yang banyak telah menyebabkan banyak negara menghadapi masalah dalam aktiviti pelupusan sisa pepejal di tempat mereka. Sistem pintar SWATT ialah program komputer yang berfungsi sebagai alat bagi membantu membuat keputusan dalam pengurusan sisa pepejal. Sistem pintar SWATT Sistem pintar biasanya boleh diatur berdasarkan kepada hierarki pengurusan sisa pepejal seperti digambarkan di dalam agenda pengawalan alam sekitar. Berdasarkan pendekatan pengurusan sisa pepejal bersepadu, Proses Analisis Hierarki (PAH) diaplikasi dengan menggunakan pelbagai paras struktur hierarki terhadap objektif, kriteria, subkriteria dan alternatif. Berdasarkan perolehan pengetahuan daripada pelbagai sumber, dua bentuk struktur hierarki telah dibangunkan; [1] pemilihan teknologi secara umum di mana sokongan politik, kepakaran teknikal, kesan alam sekitar, potensi pasaran, penglibatan komuniti dan kos teknologi menjadi sebagai kriteria manakala alternatif merangkumi tiga





teknologi berlainan (kitar semula, pengkomposan dan pembakaran) dan empat kombinasi mewakili teknologi [2] pemilihan terhadap teknologi khusus dengan lebih terperinci. Data input daripada pakar digunakan untuk perbandingan matrik. Melalui proses perbandingan matrik, teknologi olahan sisa pepejal boleh disusun mengikut nilai. Berdasarkan nisbah konsistensi, nilai 10 peratus atau kurang boleh diterima, jika tidak proses perbandingan matrik tersebut perlu dinilai semula. Perbandingan ini akan digunakan untuk memperolehi kepentingan pemberat terhadap keputusan kriteria dan pengukuran pelaksanaan hubungan terhadap alternatif dalam bentuk kriteria setiap individu. Jika perbandingan tidak berterusan dengan tepat, maka teknik Proses Analisis Hierarki (PAH) akan menyediakan satu mekanisme untuk memperbaiki konsistensi. Walaubagaimanapun untuk melalui proses pengesahan, sistem pintar SWATT telah diuji keberkesanannya untuk dua kajian kes iaitu di Majlis Perbandaran Kajang (MPKJ) dan Majlis Perbandaran Sepang (MPS). Melalui sesi perundingan tersebut, sistem pintar telah mencadangkan pemilihan teknologi yang terbaik iaitu teknologi kitar semula dan pembakaran yang pemberatnya ialah 0.17 untuk MPKJ manakala teknologi kitar semula dan pengkomposan yang mana pemberatnya ialah 0.13 untuk kawasan MPS. Keberkesanan sistem pintar SWATT telah dinilai oleh pakar-pakar yang terpilih dan pemerhatian daripada jurutera sistem menunjukkan hasil yang memuaskan apabila menggunakan sistem ini bukan sahaja kepada pengguna sistem malahan kepada orang awam yang akan mendapat kelebihan daripada pembuat keputusan.

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I certify that an Examination Committee met on date of Viva Voce to conduct the final examination of Mohd Armi Bin Abu Samah on his degree thesis entitled “An Expert System for Selecting an Appropriate Solid Waste Treatment Technology” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulation 1981. The Committee recommends that the student be awarded the relevant degree. Member of the Examination Committee were as follows:

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## **DECLARATION**

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledge. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

---

**Mohd Armi Bin Abu Samah**

Date: 06 JUN 2009



## TABLES OF CONTENTS

	<b>Pages</b>
<b>ABSTRACT</b>	ii
<b>ABSTRAK</b>	v
<b>ACKNOWLEDGEMENTS</b>	vii
<b>APPROVAL</b>	ix
<b>DECLARATION</b>	xi
<b>LIST OF TABLES</b>	xvii
<b>LIST OF FIGURES</b>	xxiv
<b>LIST OF ABBREVIATIONS</b>	xxvi

### CHAPTER

<b>1</b>	<b>INTRODUCTION</b>	
	1.1 Solid Waste Generation	1
	1.2 Problem Statements	2
	1.3 Rapid Economy Growth in Malaysia	4
	1.4 Expert System as a Solution	5
	1.5 Objectives of Study	7
	1.6 Scope of the Study	8
	1.7 Thesis Organisation	9
<b>2</b>	<b>LITERATURE REVIEW</b>	
	Municipal Solid Waste (MSW)	11
	2.1.1 Solid Waste Generation in Malaysia	18
	Integrated Solid Waste Management in Sustainable Development and Waste Management Option	21







3.2.2	Step 2: Pairwise Comparison Matrix (PCM)	67
3.2.3	Step 3: Synthesis of Priority	68
3.2.4	Example Calculation of Pairwise Comparison Matrix (PCM)	69
3.2.5	Consistency Ratio Test	77
3.3	Development of Prototype Expert System	80
3.3.1	Task Analysis	81
3.3.2	Sources of Expertise	88
	3.3.2.1 Manual and Textbooks	88
	3.3.2.2 Research Publication	90
	3.3.2.3 Domain Expert	91
3.4	Knowledge Acquisition Process	93
3.4.1	Text Analysis	94
3.4.2	Interview with the Experts	95
3.4.3	Field Observation	95
3.5	Expert System Development Tools	96

#### **4. ARCHITECTURE OF EXPERT SYSTEM**

4.1	Introduction	103
4.2	Mechanism of SWATT Respond	104
4.3	Architecture of SWATT	106
4.4	Model in SWATT Expert System	108
	4.4.1 AHP module and Saaty Ratio Scale	111
4.5	Consultation Process	117



4.5.1	Criteria to Goal Process	117
4.5.2	Subcriteria to Criteria	118
4.5.3	Alternative to All Subcriteria	119
4.5.4	Priority Model	122
4.6	User Interface	123
4.7	Targeted End User	123
<b>5.</b>	<b>RESULT AND DISCUSSION</b>	
5.1	Introduction	124
5.1.1	Consultation Process in SWATT Expert System	125
5.2	Case Study 1 – Kajang Municipal Council (MPKJ)	126
5.2.1	AHP Analysis for General Hierarchy Structure	127
5.2.2	AHP Analysis for Specific Hierarchy Structure	140
5.2.2.1	Analytical Hierarchy Process (AHP) for Recycling Hierarchy Structure model	140
5.2.2.2	Analytical Hierarchy Process (AHP) for Incineration Hierarchy Structure	144
5.3	Case Study 2 – Sepang Municipal Council (MPS)	148
5.3.1	AHP Analysis for General Hierarchy Structure	151
5.3.2	AHP Analysis for Specific Technology	163
5.3.2.1	AHP for Recycling Hierarchy Structure Model	164
5.3.2.2	AHP for Composting Hierarchy Structure Model	167
5.4	Comparison Analysis Between Kajang Municipal Council and Sepang Municipal Council	171



5.5	User Friendly of the Interface	172
5.6	Overall Effectiveness of the Prototype	173
<b>6.</b>	<b>CONCLUSION AND RECOMMENDATION</b>	
6.1	Conclusion	175
	6.11 Expert System Technology	175
	6.12 Knowledge Acquisition	176
	6.13 Expert System Development	176
	6.14 Analytical Hierarchy Process (AHP)	177
	6.15 Prototype Development Tool	179
	6.16 Internet Application	180
6.2	Recommendation	181
	<b>REFERENCES</b>	183
	<b>APPENDICES</b>	
A:	Survey Questionnaire for Treatment Technology Selection to Manage Solid Waste in Malaysia	195
B:	Example Codes for the Pairwise Comparison Matrix in SWATT Expert System	202
C:	Example of Database An Expert System for selecting An Appropriate Solid Waste Treatment Technology	206
	<b>BIODATA OF THE STUDENT</b>	209



## LIST OF TABLES

<b>Tables</b>	<b>Page</b>
2.1 Sources and types of Municipal Solid Waste	14
2.2 Data of MSW at Kuala Lumpur	17
2.3 Waste Generation in Peninsular Malaysia	19
2.4 Municipal Solid Waste Generation in ASEAN (1995-2025)	20
2.5 Criteria for Assessment of Appropriate Technologies for Solid Waste Treatment and Disposal	27
2.6 Comparison of a Human Expert and an Expert System	45
3.1 Data Analysis for Selection of Criteria in Solid Waste Management	59
3.2 Value for Pairwise Comparison Matrix: Criteria to Goal	69
3.3 Criteria Column for Normalizing Process	70
3.4 Pairwise Comparison Matrix Subcriteria for Political Support	71
3.5 Normalize Process Result from Subcriteria for Political Support	71
3.6 Total Weight for Subcriteria	71
3.7 Pairwise Comparison Matrix Alternative for Location	73
3.8 Normalize Process Result from All Alternative for Location	73
3.9 Total Weight for Alternative to Subcriteria	74
3.10 Calculation for Consistency Ratio Test	77
3.11 Random Index Value	79



3.12	List of Task for general Hierarchy Model	83
3.13	List of task for Recycling Model	85
3.14	List of Task for Composting Model	86
3.15	List of Task for Incineration Model	87
3.16	List of Expertise from Textual and Sources	89
3.17	List of Human Expert	92
4.1	Example Rule for Composting	105
5.1	First Level Pairwise Comparison Matrix - Criteria to Goal	127
5.2	Second level Pairwise Comparison Matrix: Subcriteria to Criteria - Political Support	128
5.3	Second Level Pairwise Comparison Matrix : Subcriteria to Criteria - Technical Expertice	128
5.4	Second Level Pairwise Comparison Matrix : Subcriteria to Criteria - Environmental Impact	129
5.5	Second Level Pairwise Comparison Matrix: Subcriteria to Criteria - Market Potential	129
5.6	Second Level Pairwise Comparison Matrix: Subcriteria to Criteria - Community Involve	130
5.7	Second Level Pairwise Comparison Matrix: Subcriteria to Criteria - Cost	130
5.8	Third Level Pairwise Comparison Matrix : Alternative to Subcriteria - Location (L)	131
5.9	Third Level Pairwise Comparison Matrix : Alternative - Subcriteria: Public Acceptance (P.A)	132



5.10	Third Level Pairwise Comparison Matrix : Alternative to Subcriteria - Feasibility (F)	132
5.11	Third Level Pairwise Comparison Matrix : Alternative to Subcriteria – Experience (E)	133
5.12	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria Group – Water Pollution (W.P)	134
5.13	Third Level Pairwise Comparison Matrix : Alternative to Subcriteria Group – Public Health (P.H)	134
5.14	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria – Estimates Cost (E.C)	135
5.15	Third Level Pairwise Comparison Matrix : Alternative to Subcriteria - Financial Management (F.M)	136
5.16	Third Level Pairwise Comparison Matrix Alternative to Subcriteria - Cooperation (Co)	136
5.17	Third level Pairwise Comparison Matrix : Alternative to Subcriteria – Interest Message (I.M)	137
5.18	Third Level Pairwise Comparison Matrix : Alternative to Subcriteria – Operation Cost (O.C)	138
5.19	Third Level Pairwise Comparison Matrix : Alternative to Subcriteria – Capital Cost (C.C)	138
5.20	Rangking of Solid Waste Treatment technology	139
5.21	First level pairwise Comparison Matrix : Criteria to Goal	141
5.22	Second Level Pairwise Comparison Matrix: Alternative to Criteria – Location	141



5.23	Second Level Pairwise Comparison : Matrix Alternative to Criteria – Collection Effective	142
5.24	Second Level Pairwise Comparison Matrix : Alternative to Criteria – Participation	142
5.25	Second Level Pairwise Comparison Matrix Alternative to Criteria - Value of Material	143
5.26	The Overall results for the Specific Selecting of Recycling Technology	143
5.27	First Level Pairwise Comparison Matrix: Criteria to Goal	144
5.28	Second Level Pairwise Comparison Matrix : Alternative to Criteria – Man Power	145
5.29	Second Level Pairwise Comparison Matrix: Alternative to Criteria – Cost	145
5.30	Second Level Pairwise Comparison Matrix: Alternative to Criteria – Availability	146
5.31	Second Level Pairwise Comparison Matrix Alternative to Criteria – Air Emission	146
5.32	Second Level Pairwise Comparison Matrix: Alternative to Criteria – Energy	147
5.33	The Overall Results for the Specific Selecting of Incineration Technology	148
5.34	Sepang Municipal Council of District and Area	149
5.35	Solid Waste Generated in Sepang District	149



5.36	First Level Pairwise Comparison Matrix: Criteria to Goal	151
5.37	Second Level Pairwise Comparison Matrix: Subcriteria to Criteria – Political Support	152
5.38	Second Level Pairwise Comparison Matrix: Subcriteria to Criteria – Technical Expertise	152
5.39	Second Level Pairwise Comparison Matrix: Subcriteria to Criteria – Environmental Impact	153
5.40	Second Level Pairwise Comparison Matrix: Subcriteria to Criteria - Market Potential	153
5.41	Second level Pairwise Comparison Matrix: Subcriteria to Criteria - Community Involvement	154
5.42	Second level Pairwise Comparison Matrix: Subcriteria to Criteria - Cost	154
5.43	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria Group – Location (L)	155
5.44	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria Group – Public Acceptance (P.A)	156
5.45	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria - Feasibility (F)	156
5.46	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria - Experience (E)	157
5.47	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria -Water Pollution (W.P)	157
5.48	Third Level Pairwise Comparison Matrix: Alternative	158





	to Subcriteria - Public Health (P.H)	
5.49	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria - Estimates Cost (E.C)	159
5.50	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria – Financial Management (F.M)	159
5.51	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria - Cooperation (Co)	160
5.52	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria - Interest Message (I.M)	161
5.53	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria - Capital Cost (C.C)	161
5.54	Third Level Pairwise Comparison Matrix: Alternative to Subcriteria - Operation Cost (O.C)	162
5.55	The Ranking of Solid Waste Treatment Technology	163
5.56	First Level Pairwise Comparison Matrix: Criteria to Goal	164
5.57	Second Level Pairwise Comparison Matrix: Alternative to Criteria - Location	165
5.58	Second Level Pairwise Comparison Matrix: Alternative to Criteria - Collection Effective	165
5.59	Second Level Pairwise Comparison Matrix: Alternative to Criteria - Participation	166
5.60	Second Level Pairwise Comparison Matrix: Alternative to Criteria - Value of Material.	166