UNIVERSITI PUTRA MALAYSIA

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By

MOHD ARMI BIN ABU SAMAH

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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

AN EXPERT SYSTEM FOR SELECTING AN APPROPRIATE SOLID WASTE TREATMENT TECHNOLGY

By

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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 memenuhi keperluan untuk Ijazah Master Sains

Sistem Pintar Untuk Pemilihan Teknologi Sesuai Rawatan Sisa Pepejal

Oleh

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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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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master Science. The members of the Supervisory 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.

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Mohd Armi Bin Abu Samah

Date: 06 JUN 2009

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