UNIVERSITI PUTRA MALAYSIA

A MULTISTAGE DECISION-MAKING MODEL FOR GREEN REVERSE LOGISTICS

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A MULTISTAGE DECISION-MAKING MODEL FOR GREEN REVERSE LOGISTICS

By

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

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I DEDICATED THIS THESIS TO MY BELOVED MOTHER, FATHER, AND SISTERS WHO SUPPORTED ME EACH STEP OF THE WAY.

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia
in fulfillment of the requirement for the degree of Master of Science

A MULTISTAGE DECISION-MAKING MODEL FOR GREEN REVERSE LOGISTICS

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ALI HAJI VAHABZADEH

February 2013

Chair: Proffessor Rosnah bt. Mohd. Yusuff, PhD

Faculty: Engineering

Reverse Logistics (RL) has an increasing impact on corporate image. In order to increase the competitive advantage and recapture the value of returns in the RL, companies have to develop a holistic strategy and efficient techniques. Besides, legislative policies with respect to the environment and sustainability have enforced manufacturers to accept the responsibility of taking back their returns. Nonetheless, many companies are not capable of applying the current tools to satisfy their requirements. To address this issue, a multi stage decision-making model by combining the concept of Green and RL has been proposed in this research. This model consists of three stages: quality inspection, cost calculation and analysis, and green environmental factors. In the first stage, the model proposes the quality level of returns by using Analytical Hierarchy Process (AHP). In the second stage, the total cost of each possible decision option would be calculated based on the traditional costing system. And in the

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final stage, the environmental impacts of RL on the environment would be measured by employing the VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) technique. The output of the proposed model would be the best decision option in dealing with the returns in terms of quality, cost, and green areas. In order to verify and validate the proposed model, an expert opinion elicitation and a case study in the computer industry, which is called the ABC Company, (e.g. Hard Disk) have been conducted, respectively.

In the verification phase, the sixteen qualified experts from both academia and industry have approved the terms, contents, criteria and the methods which have been used in each stage of the model via interviews. Ultimately, in order to analyze and test the validity of the whole model in a real world, a case study in a computer industry and specifically the Hard Disk product as a return has been carried out. In this case study, the two quality problems including the pin contamination and the yoke height of the Hard Disk have been considered as the two main problems to study. The five qualified experts from the three departments (quality management, accounting, and logistics and HSE) have expressed their technical views in each stage of the model. The results in the first stage of the model have represented that, the quality level of returns according to the AHP model is low quality and is equal to 0.2843. The findings in the second stage of the model have shown that the recycling and disposal options with RM2359.4, and RM2354.75 for the understudy returned batch (48 PC of Hard Disk), have the two lowest costs, respectively. And, in the final stage of the model, the results based on the VIKOR method has demonstrated that the recycling with Q_{rec} = 0.3843 compare to the

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disposal recovery option with $Q_{dis} = 1$ has the minimum impact on the environment and therefore the recycling would be the best and final proposed recovery option for the returned Hard Disk.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

A Model Membuat Keputusan Berperingkat Untuk Logistik Hijau Berpatah

Oleh

ALI HAJI VAHABZADEH

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Logistik undur atau "Reverse Logistics (RL)" menunjukkan peningkatan impak ke atas imej korporat. Dalam usaha untuk meningkatkan kelebihan daya saing dan memperoleh semula nilai pulangan dalam nilai RL, syarikat perlu membangunkan strategi yang menyeluruh dan teknik yang cekap. Selain itu, dasar-dasar perundangan alam sekitar dan kemampanan telah menguatkuasakan tanggung jawa pengilang untuk mengambil semula barangan mereka. Walau bagaimanapun, banyak syarikat tidak mampu menggunakan peralatan terkini bagi memenuhi keperluan mereka. Bagi menangani isu ini, model membuat keputusan secara berperingkat diperkenalkan di dalam kajian ini dengan menggabungkan konsep Hijau dan RL. Model ini terdiri daripada tiga peringkat yang berbeza: kualiti pemeriksaan, pengiraan kos dan analisis, dan faktor-faktor persekitaran yang hijau. Di peringkat pertama, model mencadangkan tahap kualiti pulangan dengan menggunakan Analytical Hierarchy Process (AHP). Dalam peringkat kedua, jumlah kos bagi setiap kemungkinan keputusan akan dikira berdasarkan sistem pengiraan

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tradisional. Pada peringkat akhir, kesan RL terhadap alam sekitar akan diukur dengan menggunakan teknik VlseKriterijumska Optimizacija I Kompromisno Resenje(VIKOR). Hasil model yang dicadangkan akan menjadi pilihan keputusan yang terbaik dari segi kualiti, kos, dan kawasan hijau. Dalam usaha untuk mengesahkan model yang dicadangkan, pendapat pakar diperoleh dan satu kajian kes dalam industri computer (contohnya cakera keras) telah dijalankan.

Dalam fasa pengesahan, pakar berkelayakan dari kedua-dua ahli akademik dan industri telah meluluskan terma, kandungan, kriteria dan kaedah yang telah digunakan dalam setiap peringkat model melalui wawancara. Akhirnya, untuk menganalisis dan menguji kesahihan model keseluruhan di dunia sebenar, satu kajian kes dalam industri komputer dan khususnya produk cakera keras sebagai output telah dijalankan. Dalam kajian kes ini, kedua-dua masalah kualiti termasuk pencemaran pin dan ketinggian cakera keras telah dianggap sebagai dua masalah utama untuk kajian. Lima pakar berkelayakan dari tiga jabatan (kualiti pengurusan, perakaunan, dan logistik) telah menyatakan pandangan teknikal mereka dalam setiap peringkat model. Keputusan di peringkat pertama model telah menunjukkan bahawa tahap kualiti output mengikut kepada model AHP adalah berkualiti rendah dan adalah sama dengan 0,2843. Penemuan dalam peringkat kedua model telah menunjukkan bahawa kitar semula dan pilihan pelupusan dengan RM2359.4, dan RM2354.75 untuk pelaku kembali batch (48 PC cakera keras), mempunyai kos kedua terendah. Dan, di peringkat akhir model, keputusan berdasarkan kepada kaedah VIKOR telah menunjukkan bahawa kitar semula dengan Qrec = 0.3843 berbanding dengan pilihan pemulihan pelupusan dengan Qdis = 1 mempunyai impak

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yang minimum terhadap alam sekitar dan oleh itu kitar semula akan menjadi keputusan terbaik dan pilihan pemulihan terakhir yang dicadangkan untuk cakera keras yang dipulangkan.

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at University Putra Malaysia or at any other institution.

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ALI HAJI VAHABZADEH

Date: 7 February 2013

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