

THE GREEN SUPPLIER SELECTION AND ORDER ALLOCATION IN THE
SUPPLY CHAIN UNDER STOCHASTIC CONDITIONS

POORIA HASHEMZAHI

A project report submitted in partial fulfilment of the
requirements for the award of the degree of
Master of Engineering (Industrial Engineering)

Faculty of Mechanical Engineering
Universiti Teknologi Malaysia

JUNE 2014

Dedicated to...

My beloved parents; Hassan and Manijeh whose show me the path and support me

in every momonet of my life

My cherished brother and sister

You are in my heart forever

ACKNOWLEDGEMENT

Foremost, I would like to express my sincere thanks to Dr Syed Ahmad Helmi bin Syed Hassan for the continuous support, patience, motivation, enthusiasm, and immense knowledge all the time during this research. I would like to thank Faculty of Mechanical Engineering's staff, Universiti Teknologi Malaysia for their kind cooperation.

I would like to extend my gratitude to Amir Hossein Azadnia who always guide and support me in this research.

I would like to acknowledge my family who always support and encourage me in every stage of my life. My thanks and appreciations also go to all of my friends who help me with their abilities and encourage me.

ABSTRACT

The complexity of the competitive marketing in recent decades has forced the firms, industrial groups and researchers to have more attention towards the supply chain. The supply chain is a network that changes the raw materials to the finished products by passing them through the linked entities. This network consists of suppliers, industrial groups, warehouses, distribution centers, and retailers. Suppliers as a part of a supply chain play a functional role in this network. Since preserving the environment has been a paramount criterion for researchers in recent years, considering the green environment factors in the supply chain could be more favorable. This study was conducted to select the best suppliers among the existing suppliers, and allocate an appropriate order quantity to each of them. The input data have an uncertainty and fuzziness in the real problem, and this study considered this fact in the different levels of supplier selection. Firstly, this study defined the cost, lead time and green environment factors as the qualitative factors, and used fuzzy analytic hierarchy process (FAHP) to weigh each of the existed supplier regarding these criteria. Secondly, a mathematical multi-objective nonlinear model formed with three different objective functions under the stochastic conditions including the demand quantity and the demand timing. Total cost of purchasing, total value of purchasing, and supplier flexibility were considered in this mathematical model as the objective functions, simultaneously. The genetic algorithm was utilized to solve this mathematical method using MATLAB software. Finally, the best suppliers and their optimum order quantity ratio was obtained, and the optimum purchasing fitness function was calculated.

ABSTRAK

Selari dengan perkembangan bidang pemasaran yang begitu kompetitif semenjak beberapa dekad muttakhir ini, ia telah menarik minat dunia industri dan para penyelidik untuk menjuruskan fokus kearah bidang ventaian bekalan dengan lebih serius. Ventaian bekalan adalah rangkaian proses yang bermula dari bekalan bahan mentah hingga sesuatu produk siap sepenuhnya. Rantaian ini melalui beberapa bahagian dan proses yang saling berkaitan antara satu sama lain. Secara asasnya rantain ini terdiri daripada pembekal-pembekal, kumpulan industri, gudang-gudang, pusat pengagihan dan para peruncit. Dalam rantaian ventaian bekalan ini, pembekal memainkan peranan fungsi yang terbesar. Pada masa yang sama, beberapa tahun kebelakangan ini isu kelestarian alam sekitar telah menjadi parameter yang penting dalam kalangan penyelidik, selaras dengan itu mengabungkan idea kelestarian alam sekitar sebagai salah satu kriteria Supply chain adalah releven. Kajian ini dengan itu dijalankan untuk menentukan pembekal yang terbaik antara kumpulan pembekal pembekal yang ada. Hal ini membolehkan kuantiti pesanan dapat diagihkan antara para pembekal secara tepat. Pada dasarnya, input mengandungi unsur ketidakpastian dan kekaburan, dengan itu, kajian ini turut mengambil kira kriteria tersebut dalam menentukan pemilihan pembekal pada tahap/ peringkat yang berbeza-beza. Pada peringkat pertama, kos, masa menunggu dan kelestarian alam sekitar didefinisikan sebagai element kualitatif dan dianalisis menggunakan (FAHP) bagi menilai kecederungan setiap pembekal terhadap kriteria-kriteria tersebut. Seterusnya, model matematik multi-objektif tidak linear dibentuk. Model ini dibina berdasarkan tiga fungsi objektif stokastik termasuk kuantiti permintaan dan peruntukan masa. Dalam pada masa yang sama nilai kos keseluruhan pembelian, nilai pembelian keseluruhan dan tolak ansur atau kefleksibelan pembekal yang terlibat turut diambil kira sebagai fungsi objektif model ini. Algorithma genetik menggunakan perisian MATLAB diguna pakai untuk menganalisis model yang telah dibina. Hasil dari analisis model ini, pembekal pembekal yang terbaik dapat dikenalpasti dan kuantiti optimum pesanan bagi setiap pembekal seterusnya fungsi bagi kesesuaian nilai optimum pembelian (dari pembekal terbabit) dapat dikira.