



UNIVERSITI PUTRA MALAYSIA

**SUSTAINABILITY PERFORMANCE OF ESFAHAN STEEL COMPANY
USING ANALYTICAL HIERARCHY PROCESS**

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USING ANALYTICAL HIERARCHY PROCESS**

By

SHADI FEKRI YAZDI

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

June 2014

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Specially dedicated to

**My beloved partner, parents, and siblings
for their endless love, support and encouragement**



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Abstract of thesis presented to the Senate of University Putra Malaysia in fulfillment of the requirements for the degree of Master of Science

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Faculty: Environmental Studies

Sustainable development has become an important matter for the steel industry globally, due to the negative impacts of this industrial section on the environment. The main challenge for developing sustainability in steel companies appears to be in implementing sustainability concepts at a company level. Such implementation requires a comprehensive understanding of the company's current sustainability state, precise specification of sustainability targets, and the determination of the rate and direction of necessary improvement.

Esfahan Steel Company (ESCO), one of the biggest Iranian steel makers, faces similar challenge for its transition towards sustainability. Evaluation of its current sustainability performance is the first step to overcome the challenge. Considering a similar sustainable company as a benchmark and comparison of sustainability of both companies is essential for determining the sustainability targets and their specification. The objective of this study is therefore to develop a framework for sustainability assessment of steel industry with the ESCO as the case study including measurement and evaluation of its sustainability performance in comparison with a benchmark.

Assessment of sustainability performance using relevant indicators and benchmarking is established as a proper method to monitor companies' sustainability status. In this thesis, we have presented our approach to measure sustainability performance of the case study company (ESCO) and compared it to a benchmark company which is ranked as one of the highest sustainable steel company in the world.

Having defined the benchmark, proper quantifiable sustainability indicators are identified in three categories; economic, environmental and social. The relative preference of the indicators and criteria are determined via a basic AHP approach with pair-wise comparison considering the opinion of the target company's experts. Consistent comparison matrices are further applied for aggregating individual

judgments and calculating sustainability performance sub-indices. Finally these sub-indices are combined to produce composite sustainable performance index for either of the companies to compare.

Comparing the target company and the benchmark, in all the sustainability sub-indices -economic, environmental and social- the performance of the benchmark is higher than the case study; the overall sustainability performance of the benchmark is 1.6 times higher.

In addition, comparing the priority weight of the three criteria, the economic criterion plays the most significant role in the sustainability performance of the company, while social plays the lesser significant role after the environmental criterion.

The analysis on the relationship between criteria preference and experts' demographics shows that environment is the most important criterion for sustainability development according to the opinion of experts with Metallurgical background.

Regarding the consistency of the experts' opinion and their demographics, the least percentage of inconsistency in all comparison matrices belongs to the experts aged above 50 and those with more than 30 years work experience.

Based on the results, it is concluded that the proposed method can provide a framework for assessing sustainability performance of a steel company. It can pinpoint the area in which the company has deficiency in comparison with a benchmark to be focused on for more improvement. This will facilitate decision making process in prioritizing the resources of the company toward sustainability development. In our study case, investment in environmental facilities and injury cases are the two indicators with the highest priority to invest in to increase the sustainability performance.

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

**PRESTASI SYARIKAT BESI DAN KELULI ESFAHAN YANG MAPAN
DENGAN PENGGUNAAN PROSES ANALISA HIERARKI**

Oleh

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Pembangunan mapan telah menjadi suatu perkara yang penting dalam industri besi dan keluli secara global disebabkan oleh kesan negative sektor industri kepada alam sekitar. Cabaran utama dalam pembangunan mampan dalam syarikat besi dan keluli adalah pengaplikasian konsep kemampanan di peringkat syarikat. Pengaplikasian ini memerlukan pemahaman yang mendalam terhadap keadaan kemampanan syarikat semasa, matlamat kemampanan secara khusus dan penentuan kadar serta halatuju ke arah pembaharuan.

Syarikat Besi dan Keluli Esfahan (ESCO), adalah salah satu daripada pengeluar besi dan keluli yang terbesar di Iran yang turut menghadapi cabaran yang sama dalam perubahan ke arah keadaan yang mampan. Penaksiran keadaan prestasi kemampanan semasa merupakan langkah pertama dalam membendung cabaran mendatang. Penimbangan terhadap syarikat lain yang mampan sebagai penanda aras dan perbandingan taraf kemampanan kedua-dua syarikat adalah penting dalam penentuan hala tuju dan pencirian kemampanan. Maka, objektif kajian ini adalah untuk membangunkan rangka kerja penilaian kemampanan syarikat besi dan keluli di mana ESCO sebagai kes kajian serta perbandingan dengan penanda aras yang terdiri daripada pengukuran dan penilaian prestasi kemampanan.

Penilaian prestasi kemampanan dengan penggunaan penunjuk dan penanda aras yang sesuai telah dibuktikan sebagai kaedah yang sesuai dalam pemantauan status kemampanan syarikat. Dalam tesis ini, kaedah pengukuran prestasi kemampanan ESCO telah dipersembah dan dibandingkan dengan penanda aras yakni telah dikelaskan sebagai salah satu syarikat besi dan keluli yang termampan di dunia.

Melalui penakrifan penanda aras yang dijalankan, sejumlah penunjuk kemampanan yang bersesuaian telah dikenalpasti dalam tiga kategori; ekonomi, alam sekitar dan juga sosial. Perbandingan kecenderungan penunjuk dan ciri-cirinya ditentukan

melalui kaedah AHP asas dengan perbandingan gabungan yang menimbangkan pendapat daripada syarikat pakar yang terpilih. Matrik perbandingan yang konsisten seterusnya diaplikasi untuk mengumpul kesimpulan individu dan pengiraan petunjuk prestasi kemampuan. Akhirnya, petunjuk-petunjuk ini digabungkan untuk penghasilan indeks prestasi kemampuan komposit yang boleh digunapakai oleh syarikat-syarikat dalam membuat perbandingan.

Perbandingan dijalankan antara syarikat yang terpilih dengan penanda aras, kesemua penunjuk kemampuan; ekonomi, alam sekitar dan sosial di mana prestasi penanda aras didapati 1.6 kali lebih tinggi daripada kes kajian dalam erti kata keseluruhan prestasi kemampuan.

Tambahan pula, perbandingan antara pengaruh keutamaan bagi tiga kriteria, menunjukkan aspek ekonomi memainkan peranan yang paling penting dalam prestasi kemampuan sesebuah syarikat, manakala aspek sosial memainkan kurang peranannya selepas aspek alam sekitar.

Analisa antara hubungan ciri utama dengan pengkajian statistik kehidupan manusia oleh pakar mendapati alam sekitar merupakan aspek yang paling penting dalam pembangunan yang mampan mengikut pandangan pakar dalam bidang kajian logam.

Berdasarkan kepada pandangan pakar dan bidang pengkajian statistik kehidupan manusia yang konsisten, peratusan yang tidak konsisten dicapai adalah sangat kurang dari segi perbandingan semua matriks oleh pakar yang berusia 50 tahun dan ke atas dengan pengalaman kerja melebihi 30 tahun.

Berdasarkan keputusan yang diperolehi, dapat disimpulkan bahawa kaedah yang dicadangkan dapat menyediakan rangka kerja untuk penilaian prestasi kemampuan sesebuah syarikat besi dan keluli. Ia boleh menentukan kawasan syarikat yang mempunyai kekurangan dalam perbandingan dengan penanda aras dimana tunjangan akan diberikan untuk tujuan pembaharuan keadaan kepada yang lebih baik. Dengan ini, proses penentuan keputusan dalam pemilihan keutamaan sumber syarikat ke arah pembangunan yang mampan dapat dilakukan dengan mudah. Dalam kes kajian ini, pelaburan dalam penyediaan kemudahan yang peka kepada alam sekitar serta kes kecederaan merupakan dua penunjuk dengan keutamaan yang tertinggi untuk melabur dan meningkatkan prestasi kemampuan.

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