UNIVERSITI PUTRA MALAYSIA

ECONOMIC EFFICIENCY OF MALAYSIAN OLEOCHEMICAL ENTERPRISES

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By

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Dedicated to,

My Children and their Caring Mother

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Doctor of Philosophy

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Chairman: Professor Mohd. Ghazali Bin Mohayidin, Ph.D.

Faculty: Economics and Management

This study comprises a rigorous Micro Econometric and Data Envelopment Analysis (DEA) of the performance of the Malaysian oleochemical enterprises over time. The analysis covers the following sectors: coconut oil, palm oil, palm kernel oil and other oils and fats, as well as twelve out of fifteen working oleochemical enterprises.

The micro-economic data were graciously provided by Malaysian National Productivity Corporation (NPC), Malaysian Department of Statistics and some other respected sources. Panel data have been used in this study. The time series data and cross section data have been both pooled together to constitute panel data. Also maximum likelihood estimation has been incorporated for composed error models as well as DEA. Where appropriate, the literature has been updated. This study shows that the major advantage of the systematic application of the two frontier approaches, which are stochastic and deterministic (DEA), with multiple techniques on panel of data containing two levels, enables the comparison of synthesis of the results obtained to

provide a comprehensive, detailed and insightful understanding of the producer behaviour. This approach is superior and informative than single eyed approaches.

The results from all approaches consistently show that scale inefficiency and allocative inefficiency are the main problems in efficiency analysis. The scale inefficiency is mainly due to production operation at increasing returns to scale. This is noted specially in the coconut oil sector, the palm kernel oil sector and oleochemical enterprises. Allocative inefficiency is mainly due to under-utilisation of inputs relative to capital. Labour was under-utilised relative to capital in palm oil and other fat and oil sector. Allocative inefficiency due to underutilsation of inputs relative to capital is proved in this study. It is in consistent with that found by Seale (1990) in Egyptian Tileries, who claimed that Tileries on average were allocatively inefficient, employing too much capital relative to labour. The estimate of Malaysian oil and fat industry's total factor productivity (TFP) change is –3.705% for the period 1985 to 1996. The major contributor to this negative technological change is the palm oil sector and other oil and fat sector. The palm oil sector's negative contribution is at an average annual rate of 6.818% over the period of this study and other oil and fat sector is at an average annual rate of 5.818%. This implies that the palm oil sector is ailing due to technological regress. It could be concluded that allocative efficiency requires first or second best pricing of final products; scale efficiency requires limitation on sub-optimal entry to the industry; technical efficiency requires cost minimisation by the incumbent firms; and finally product choice and dynamic efficiency require innovation by incumbents and new entrants.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KECEKAPAN EKONOMI PERUSAHAAN OLEOKIMIA MALAYSIA

Oleh

MOHAMED OSMAN AHMED BUSHARA

Mei 2001

Pengerusi: **Profesor Mohd. Ghazali bin Mohayidin, Ph.D**

Fakulti : **Ekonomi dan Pengurusan**

Kajian ini merangkumi Analisis Mikroekonometrik dan Peliputan Data (Data Envelopment Analysis – DEA) prestasi perusahaan oleokimia Malaysia merentas masa. Analisis tersebut meliputi sektor-sektor berikut: minyak kelapa, minyak sawit, minyak inti sawit dan minyak serta lemak lain, di samping dua belas daripada tujuh belas perusahaan oleokimia. Data mikroekonomi telah dibekalkan dengan ehsan Perbadanan Pengeluaran Nasional (NPC), Jabatan Statistik Malaysia dan sumber lain. Data panel telah digunakan dalam kajian ini. Kedua-dua data siri masa dan data keratan silang telah dikumpul untuk mewujudkan satu data panel.

Dalam penyelidikan ini penganggaran kebolehjadian maksimum telah digabungkan untuk memperoleh model ralat tergubah dan juga DEA. Rujukan telah dikemaskinikan apabila didapati sesuai dalam disertasi ini. Kajian ini menunjukkan bahawa kelebihan utama aplikasi bersistem dua pendekatan yang bersifat stokastik dan berketentuan (DEA), dengan teknik berbilang pada data panel yang mengandungi dua tahap membolehkan perbandingan sintesis keputusan yang diperoleh untuk memberikan pemahaman yang komprehensif dan terperinci terhadap gelagat pengeluar. Pendekatan ini adalah lebih baik dan informatif daripada pendekatan bermata tunggal.

Keputusan daripada pendekatan secara konsisten menunjukkan bahawa ketakcekapan skala dan ketakcekapan peruntukan adalah masalah utama dalam analisis kecekapan. Ketakcekapan skel ini disebabkan oleh operasi pengeluaran pada pulangan ikut skel yang meningkat. Kes ini diperhatikan bagi sektor minyak kelapa, sektor minyak inti sawit dan perusahaan oleokimia. Ketakcekapan peruntukan berlaku disebabkan kurang penggunaan input berbanding dengan modal. Buruh kurang digunakan berbanding dengan modal dalam semua sektor minyak dan lemak dan industri oleokimia. Dalam industri ini ketakcekapan peruntukan disebabkan kurang penggunaan buruh berbanding dengan modal telah dibuktikan. Ini adalah konsisten dengan apa yang ditemui oleh Seale (1990) dalam perusahaan genting atap di Mesir. Beliau mendapati bahawa pada keseluruhannya perusahaan tersebut adalah tidak cekap secara peruntukannya kerana menggunakan terlalu banyak modal berbanding dengan buruh.Anggaran perubahan TPF bagi industri minyak dan lemak Malaysia adalah – 3.705% dalam jangka masa 1985 – 1996. Penyumbang utama bagi perubahan teknologi yang negatif ini adalah sektor minyak dan sektor minyak serta lemak yang lain. Sumbangan negatif sektor minyak sawit adalah pada kadar purata tahunan 6.818% dalam jangka masa kajian ini dan bagi sektor minyak dan lemak yang lain adalah pada purata tahunan 5.818% . Ini memberi implikasi bahawa sektor minyak sawit adalah bermasalah disebabkan regresi teknologi.

Boleh dirumuskan bahawa kecekapan peruntukan memerlukan letak harga pertama dan kedua terbaik; kecekapan skala memerlukan pembatasan keatas kemasukan sub-optimum ke dalam industri, kecekapan teknikal memerlukan peminimumam kos di kalangan firma yang ada; dan pilihan keluasan dan kecekapan dinamik memerlukan inovasi di kalangan firma yang ada dan yang baru.

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LIST OF ABBREVIATIONS

AE	Allocative Efficiency
CPO	Crude Palm Oil
CRS	Constant Reruns to Scale
DEA	Data Envelopment Analysis
DEAP	Data Envelopment Analysis Program
DFA	Deterministic Frontier Analysis
DRS	Decreasing Returns to Scale
EC	Efficiency Change
ECE	Economic Efficiency
EFFCH	Efficiency Change
OECD	Organisation for Economic Cooperation and Development
FELDA	Federal Land Development Authority
IMP	Industrial Master Plan
GLY	Glycerine
IRS	Increasing Returns to Scale
LS	Least Squares
MIDA	Malaysia Industrial Development Agency
MLE	Maximum Likelihood Estimator
NPC	National Productivity Corporation
OLS	Ordinary Least Squares
PEFFCH	Pure Efficiency Change
PORIM	Palm Oil Research Institute of Malaysia
PORLA	Palm Oil Registration and Licensing Agency
PPO	Processed Palm Oil
RBD	Refined Bleached and Deodorised
RISDA	Rubber Industry Small Holders Development Authority
SECH	Scale Efficiency Change
SFA	Stochastic Frontier Analysis
SUR	Seemingly Unrelated Regression
TC	Technological Change
TE	Technical Efficiency
TECHCH	Technical Change
TFP	Total Factor Productivity
TFPCH	Total Factor Productivity Change
VRS	Variable Return to Scale

CHAPTER 1

INTRODUCTON

This chapter is organised in four sections. After this introduction, the palm oil industry is described in perspective in section one, with two sub-sections: one elaborates on the resource oriented and multipurpose industry; the second defines the concept of oleochemicals. Section two takes care of the meaning of economic efficiency. Section three explains the measurement of efficiency frontier. Section four discusses economic efficiency and performance measurement, and technical change.

1.1 Development of the Palm Oil Industry in Malaysia

Four seedlings of Dura palm (Elaeis guineensis) from West Africa were established in the Botanical Gardens, Basar in Java in 1848, and latter distributed between 1853-1856 to Sumatra.

In Malaya, around 1911 and 1912, palms of Deli origin were planted in Rantau Panjang, Kuala Selangor. The planting of 1911 and 1912 came into bearing in 1917 and seedlings of those palms were planted at Tennemaran Elmina Estates. Commercial introduction and planting were made in Malaya only in 1917 and most

of the planting materials came from Sumatra as Deli dura. By 1925, Malaya had 383 hectares of oil palm, and the oil palm industry gained full momentum only after 1930. By 1940 the area in oil palms reached 31,000 hectares. It was only during the 1960s that Malaysia took on oil palm cultivation as a major crop to diversify the economic base in order to reduce the heavy dependence on the traditional exports of rubber and tin.

Oil palm plantations replaced about 2.2 million hectares of old rubber estates and virgin jungle land, thanks to Federal Land Development Authority (FELDA), Rubber Industry Smallholders Development Authority (RISDA) and other organisations, successfully created by the Malaysian Government. In 1996 Malaysia emerged as the world's largest producer of palm kernel oil with approximately 55.8% of the total world production of palm kernel oil (Table1.1). Out of the total production of palm kernel oil, 70% was being consumed by the oleochemical industry. Furthermore the palm oil industry has been providing employment for more than 250,000 people, while it together with palm kernel oil and palm kernel meal, it produced close to 6 billion ringgit, contributing 7% of the total Malaysian exports value (Bek-Nelsen, 1996).

Table 1.1: World Production of Palm Kernel Oil, 1984 -1998 ('000 Tonnes)

Country/Year	1984	1987	1992	1996	1998
Total	766.6	1006.4	1533	1950	2055
Malaysia	430	583.0	812	1088	1127
Indonesia	90.5	145.8	277	481	543
Others	71.0	44.3	133	75	79
Nigeria	60	104	171	178	179.1
Eu-15	46.9	36	3	2	0.1
Zaire	20.3	18.9	23	-	-
Cameron	13.1	20	24	25	26
Ivory Coast	13.0	23.2	30	29	26.4
Colombia	11	14.5	29	31	33
Thailand	6.3	12.3	25	35	35.1
Philippines	4.5	4.4	6	6.4	6.1

Source: Oil World Annual, 1989-1999

Lim (1995) stated that the Government of Malaysia has adopted the three-pronged strategy to ensure that the multi-billion ringgit palm oil sector continues to chart robust growth in the coming years. Under the new strategy the palm oil industry would: (1) Be striving for a higher level of productivity through the use of better clones and agronomic practices; (2) Place a stronger emphasis on off-shore oil palm plantation to counter shrinking agricultural land hectarage at home; and (3) Step up and relocation of refining, processing and packaging activities to consumer countries to further tighten market footholds. By year 2000, oil palm industry attained crude palm oil (CPO) production level of 10.8 million tonnes and was expected to attain 12.1 million tonnes by year 2020 (Table 1.2).

Table 1.2: Production of Palm Oil, 1960-2010 (Tonnes)

Year	Peninsular	Sabah	Sarawak	Total	% Change
1960	91,793	-	-	91,793	
1965	148,682	1,729	-	150,411	22.4
1970	402,307	28,762	-	431,069	22.4
1975	1,136,796	116,248	4,529	1,257,573	20.2
1980	2,396,733	156,471	22,378	2,575,582	17.7
1985	3,799,289	285,044	49,061	4,133,394	11.2
1990	5,307,979	678,995	107,651	6,094,622	0.6
1995	6,094,560	1,493,623	222,363	7,810,546	8.2
1996	6,407,234	n.a	n.a	8,385,8860	7.4
2000	6,776,000	n.a	n.a	10,800,000	12.5
2005*	7,602,000	n.a	n.a	10,619,000	20.5
2010*	7,592,000	n.a	n.a	11,609,000	9.3

Source: Oil World Annual, 1989-1999; and PORLA, 2000.
Note: * Forecast by PORIM, 1996-2010.
na = not available

In order to achieve these production targets, another 2 million hectares of new oil palm plantings must be added to the current 2.53 million hectares. Beyond the year 2020 there will be no substantial expansion in hectarage. The increase in the output beyond 2020 will come purely from production increases through improved planting materials, better agronomic practices, mechanisation and improvement in mills efficiency (Table1. 3).

Table 1.3: Oil Palm Planted Area, 1960-2010 (Hectares)

Year	Peninsular	Sabah	Sarawak	Total	% Change
1960	54,634	-	-	54,634	4.6
1965	96,947	-	-	96,947	6.6
1970	261,199	28,947	1,117	291,263	12.9
1975	568,561	59,139	14,091	641,791	11.3
1980	906,590	93,967	22,749	1,023,306	8.3
1985	1,292,399	161,500	28,500	1,482,399	7.9
1990	1,698,498	276,171	54,795	2,029,464	3.2
1995	1,906,910	491,073	117,859	2,515,842	4.8
1996	1,926,378	626,008	139,900	2,692,286	7.0
2000	2,196,000	n.a	n.a	3,500,000	10.2
2005*	2,268,000	n.a	n.a	3,223,000	10.9
2010*	2,303,000	n.a	n.a	3,550,000	10.1

Source: Oil World Annual, 1999; and PORLA, 2000;
Note: * Forecast by PORIM, 1996-2010;
na = not available

Rapid expansion of Malaysian palm oil was primarily due to higher returns per hectare of palm oil as compared to other vegetable oils (PORIM, 1996). The expansion was attributed to the economic and technical advantage palm oil over other sources of vegetable oils. Table 1.4 shows the vegetable oil and meal components for a tonne of soyabean, rapeseed, and sunflower seed and fresh fruit bunch (FFB). The December (Rotterdam) prices for each of these products were used to calculate the value of a tonne of the beans, seeds, or FFB. Each was, in turn,