A Quantitative Methodology to Test Ecological Modernization Theory in The Malaysian Context

Er Ah Choy

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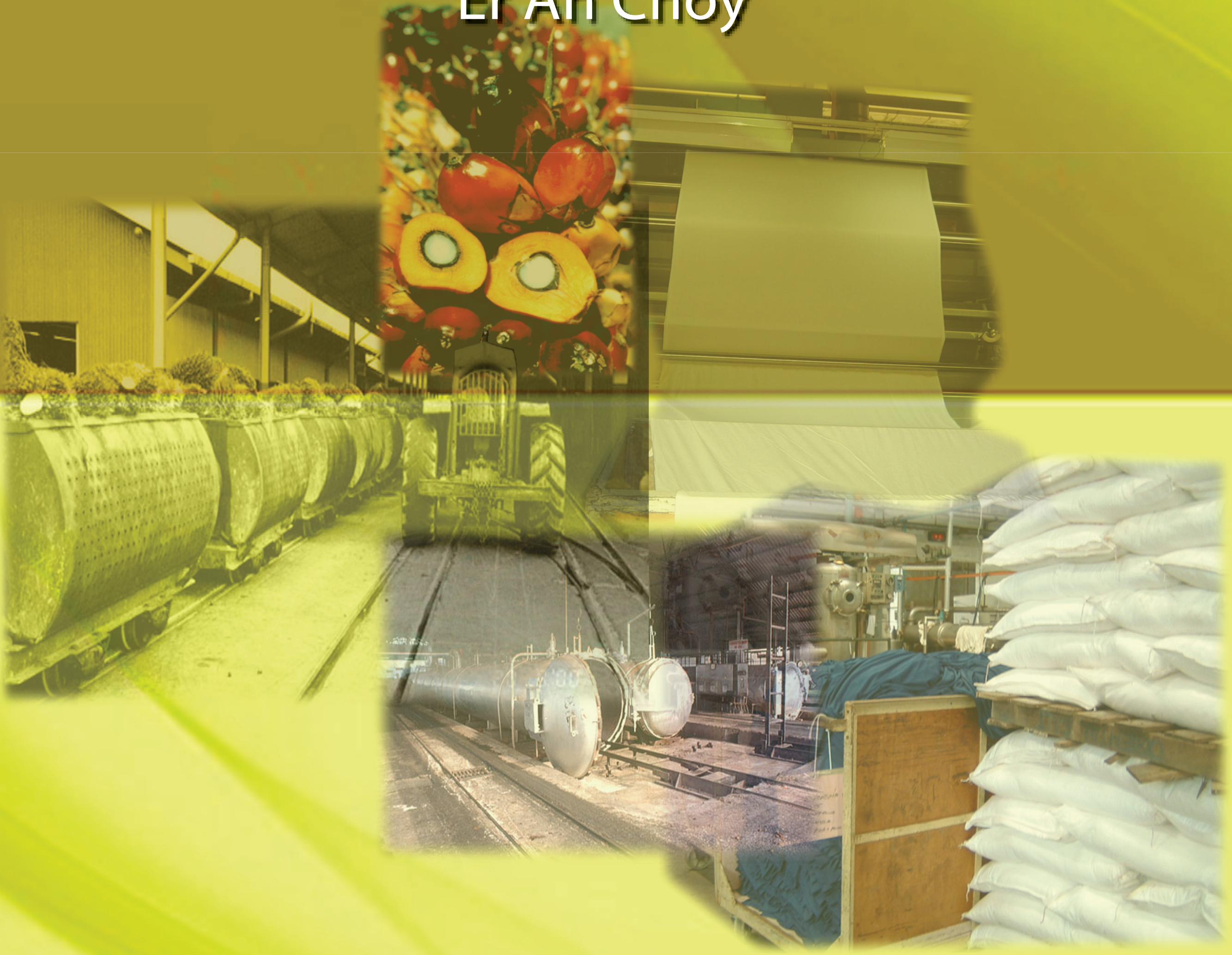

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Promotoren:

Prof. dr. ir. Arthur P.J. Mol	Hoogleraar Milieubeleid, Wageningen Universiteit
Prof. dr. ir. Kris (C.S.A.) van Koppen	Universitair hoofddocent leerstoelgroep Milieubeleid,Wageningen Universiteit en Bijzonder hoogleraar Natuur-en Milieueducatie, Universiteit Utrecht

Samenstelling promotiecommissie:

Prof. dr. H.B.J. Leemans	Wageningen Universiteit
Prof. dr. S.W.F. Omta	Wageningen Universiteit
Prof. Chamhuri Siwar	Universiti Kebangsaan Malaysia
Prof. dr. A.J.M. Schoot Uiterkamp	Rijksuniversiteit, Groningen

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Er Ah Choy

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Er Ah Choy

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Preface

Lao Tzu once said the journey of a thousand *li* begins with the first step. The first step was taken when the late Professor Ishak Shari nominated my name to be a doctoral candidate for the Cleaner Agro-Industries: Agro-Industrial Transformation Towards Sustainability –Southeast and East Asia in Global Perspective (AGITS) Project. For this, I am very grateful to the late Professor Ishak Shari. I am also thankful to Universiti Kebangsaan Malaysia for providing me with study leave. The next big step was meeting up Prof. dr. ir. Arthur P.J. Mol in Bangi, Malaysia, my promoter, for which I am eternally grateful. His friendliness and kindness give me good vibes with regard to my academic pursuit. This was the beginning of my exploration in Ecological Modernization Theory. The themes of sectoral variation and a lack of quantitative methodology interested me. The search for industrial sectors led to the selection of the palm oil production chain and the textile and apparel production chain as these two sectors have different environmental performance. Along this journey the central tenets of political modernization and the increasing importance of market dynamics and economic actors in the era of globalization gelled into my theoretical pillars. The culmination of this is my research proposal.

Another major and very critical milestone for me personally is the determination of my co-promoter cum daily supervisor. This is where I came to know Prof. dr. ir. C.S.A. (Kris) van Koppen. His friendliness, warm and fatherly disposition makes me very comfortable in continuing my academic pursuit.

When I first stepped foot in Amsterdam, The Netherlands, I was surprisingly happy as prior to landing in Schiphol Airport, I saw for the first time in my life, long stretches of flat lands with lots of greenery. This journey continued with a happy note with Peter Oosterveer who fetched me from the airport to Wageningen and also helping me to acclimatize to student life in Wageningen.

The journey of exploring the Ecological Modernization Theory continued in Wageningen. This is where my friends and colleagues in Environmental Policy Group like Corry Rothuizen, Gert Spaargaren, Loes Maas, Zhang Lei, Willy Baak, Bas Van Vliet, Hans Bruyninckx, David Sonnenfeld, Susan Martens, Jan P.M. Van Tatenhove, Simon Bush, Astrid Hendriksen, Haske Van Vlokhoven, Joris Verwijmeren, Sander W.K.van den Burg, Nanke Stein for their kindness, care and a happy home in Wageningen. These sweet memories shall always be cherished. In addition, many sweet and happy moments are also shared with my *fellow mates*, Tran Thi My Dieu, Han Jingyi, Zhang Yuan, Le Van Khoa, Pham Van Hoi, James Semuwemba, Navin Devkota, Orathai Chavalparit, Ajchara Wattanapinyo, Warit Jawjit, Thanes Sriwichailamphan, Synara Sanchez, Victor Sabandeja, Liu Yi, Dries Hegger, Judith van Leeuwen, Elizabeth Sargant, Michiel de Krom, Lenny Putman for tracking through the challenging trajectory together.

After the completion of the research methodology, I reached the next milestone. I was back in Malaysia to do my fieldwork. My husband, Chee Keng Lim, became my driver cum personal assistant for my field research despite his tight personal schedule. Our field trips led us to traverse across nearly the whole of Peninsular Malaysia. This is where the beauty of my country is revealed to me. On a number of occasions, an interesting and perplexing incident in my field trips is reaching a

Y-junction with no signages deep in the oil palm plantations. My husband surprisingly was able to decipher which road to take with 100% accuracy. At this juncture, I would like to take the opportunity to thank all the respondents in the palm oil production chain and the textile and apparel production chain who gave me the opportunity to interview them. Some of them went beyond the confines of the questionnaire by elaborating in-depth on pertinent issues. I am extremely grateful to J.T. Tong for explaining to me in a very thorough fashion the technicalities of the oil palm and palm oil industry. In addition, I am very thankful to Mr. Tang Chong Chin and Ms Rebecca, secretary of Malaysian Knitting Manufacturers Association, for being my resource persons for the textile and apparel industry.

My journey continued by being back in Wageningen for the write-up of my thesis. This is where I would like to thank my corridor mates Odette Smit and Marco de Jager, Edwin Cornelissen, Albert Anne van der Sloot, Sun Zhongkui, Gerdi Hermans, Evelien Spaans, Gisela Slaats, Wang Jing, Emma Hermans and Yves, Maja, for making my stay in Wageningen an enjoyable one. I got to learn and appreciate the Dutch way of living even though this is a microcosm of Dutch society.

The last milestones of this journey were the completion of the writing up of my thesis and the public defense. This is where Arthur and Kris, Environmental Policy Group, Department of Social Sciences, Wageningen University, The Netherlands, proved to be pillars of strength in guiding me to the completion of my thesis. For me, personally, the guidance provided by both my promoters was complementary, for which I am deeply indebted.

I also would like to thank Safiai Sapari for his professional help in typesetting this thesis. His patience in doing the necessary changes is highly appreciated.

This journey has left an indelible mark to me. The applicability of Ecological Modernization Theory in Malaysia gives me hope that the environment is given due attention in Malaysia.

Lastly, this whole journey from the first step to the very last step is made possible with the help of my beloved family, my husband, my two princesses, Hon Yee and Hon Yan together with my parents-in-law Chee Guan Bee and Cho Lai Wah. Their support and encouragement throughout the entire journey acts as a catalyst and also provided me with the strength and fortitude for the final push in completing this journey.

In ending this journey, I would also like to take this opportunity to thank those whom I have not mentioned who have provided me with their support, indirectly or directly.

Er Ah Choy (Evelyn)
Wageningen, The Netherlands, 2007

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Abbreviations

BOD : Biochemical Oxygen Demand
CPO : Crude Palm Oil
CPKO : Crude Palm Kernel Oil
DOE : Department of Environment
DOSH : Department of Occupational Safety and Health
DSM : Department of Standards Malaysia
EMT : Ecological Modernization Theory
EPIs : Environmental Performanc Indicators
EQA : Environmental Quality Act
EQC : Environmental Quality Council
EU : European Union
FDI : Foreign Direct Investment
FELDA : Federal Land Development Authority
FMA : Factories and Machinery Act
G-I : Government-Industry
GLCs : Government-Linked Companies
HACCP : Hazard Analysis And Critical Control Points
I-I : Industry-Industry
IRBM : Inland Revenue Board of Malaysia
ISO : International Organization For Standards
LA : Local Authorities
MATAC : The Malaysian Textile and Apparel Center
MEOMA: Malaysian Edible Oil Manufacturers' Association
MITI : Malaysian International Trade and Industry
MIDA : Malaysian Industrial Development Authority
MKMA : The Malaysian Knitting Manufacturers' Association
MNRE : Ministry of Natural Resources
MOF : Ministry of Finance
MOMG : Malaysian Oleochemical Manufacturers' Group
MOSTE : Ministry of Science, Technology and Environment
MPIC : Ministry of Plantation Industries and Commodities
MPOA : Malaysia Palm Oil Association
MPOB : Malaysian Palm Oil Board
MPOC : Malaysian Palm Oil Council
MTMA : The Malaysian Textile Manufacturers' Association (MTMA)
NASH : National Association of Smallholders
OER : Oil Extraction Rate
PK : Palm Kernel
PKC : Palm Kernel Cake
POFP : Palm Oil Finished Products
POM : Palm Oil Milling
POMA : Palm Oil Millers' Association of Malaysia
POME : Palm Oil Mill Effluent
POPC : Palm Oil Production Chain
PORE : Palm Oil Refinery Effluent

PORAM: Palm Oil Refiners Association of Malaysia
PORIM : Palm Oil Research Institute of Malaysia
PORLA : Palm Oil Registration and Licensing Authority
SIRIM : Standards Industrial Research Institute of Malaysia
TAPC : Textile and Apparel Production Chain
WRAP : Worldwide Responsible Apparel Production

CHAPTER 1
Introduction

1.1 Background Information And Problem Description

During the last two decades Malaysia has experienced rapid economic development, accompanied by severe environmental problems. Manufacturing output increased tremendously, but initially this was not balanced with sufficient environmental management. Positive impacts of this development include higher Gross Domestic Product (GDP) per capita, better infrastructures and a higher standard of living. This is highlighted in Table 1.1 which shows a near five fold increase in the growth of the GDP per capita spanning the period 1980-2004. At the same time, this economic development has given rise to negative side-effects, like environmental degradation. With reference to Table 1.1, the economic development in Malaysia is reflected in the increase in the total number of scheduled waste generators and the total quantity of scheduled waste (specified by the Environmental Quality Act 1974 and subsidiary legislation) generated for the period 1980-2004. However, the percentage compliance with regard to the notification of the scheduled waste generated to the Department of Environment (DOE) and subsequently the proper treatment and disposal at the sole Kualiti Alam Disposal Facility, a scheduled waste treatment plant, has shown an increase for the year 1995 as compared to 1990. However, the percentage of non-compliance and the amount of scheduled waste not reported, even though the amount is not known, is still substantial in nature. The greater likelihood is the scheduled waste is not treated and disposed illegally and subsequently has a detrimental effect on the environment. At the same time the number of pollution complaints has increased a near nine fold for the period 1980-1995. In addition pollution problems related to, among others, suspended particulate discharges and biochemical oxygen demand (BOD) discharges have caused air pollution and deterioration of surface water quality respectively (Markandya and Shibli, 1995).

Table 1.1 GDP Growth And Environmental Indicators, 1980-2004

	Year					
	1980	1985	1990	1995	2000	2004
GDP per capita	RM3,841	RM4,878	RM6,578	RM10,753	RM14,645	RM17,576
Total number of schedule waste generators	na	na	836	1,339	3,493	na
Percentage compliance of notification by scheduled waste generators	na	na	52.9	79.2%	na*2	na*2
Total quantity of scheduled waste generated (MT/year)		218,945*1	390,000	487,100	344,550	469,584
Number of pollution complaints – noise, water, air and others	314	338	528	2758	na*3	na*3

Notes for Table 1.1:

*1 *The amount of toxic and hazardous waste generated in Peninsular Malaysia.*

*2 *From 1999 onwards, data pertaining to the percentage compliance of notification by scheduled waste generators is not available.*

*3 *From 1999 onwards, data pertaining to the number of pollution complaints is not available.*

Source: Environmental Quality Report, various issues.
DOS: Malaysia Economic Statistics Series 2005.

Faced with the challenges of environmental problems, the Malaysia government's commitment to environmental management is evidenced via various environmental strategies put forward in the national Malaysia Plans. The strategies of the various Malaysia Plans strive to achieve harmony between economic growth and environmental quality. In addition, during the entire period of the Seventh Malaysia Plan (1996-2000), the National Environmental Policy was being finalized so as to attain the twin objectives of sustainable development and improvement in the quality of life.

As the Malaysian economy is open and vulnerable to external influences, considerable attention was given to manage external challenges in the development plans. In the Seventh Malaysia Plan, 1996-2000 attention was given to minimize conflicts between trade and environment. The purpose is to align trade with environmental objectives so as to enhance both the competitiveness and the sustainability of production. Moreover, during the Eighth Malaysia Plan, 2001-2005, the manufacturing sector is encouraged to meet (international) customer requirements so as to enhance their competitiveness and therefore to meet the challenges of globalization.

Environmental management in Malaysia is governed under the Environmental Quality Act (EQA) 1974 (Amendments in 1985 and 1996) and the regulations thereunder, which contain provisions for several environmental sectors such as air pollution, noise pollution, degradation of land and pollution of inland waters. In addition, the DOE was established to administer and enforce the EQA 1974 (and its Amendments 1985 and 1996). (DOE 1999b).

National environmental policies, strategies and measures are an important factor in determining environmental performances of industries. Although pollution control measures have been implemented by the Malaysian Government, the improvements and achievements in environmental performance vary from one sector to another. Table 1.2 illustrates the compliance status of the manufacturing industries with regard to the EQA 1974 and subsidiary legislation in Malaysia. As shown in the table, the electrical and electronics sector and the quarrying sector have one of the best environmental performances with regard to sewage and industrial effluents. On the other hand, the food and beverage sector and the textile sector are the worst environmental performers. Compliance with clean air shows that the chemical-based sector and the textile sector as exemplars whereas the cement sector and the non-metallic mineral sector are the worst perpetrators. This raises the question on the reasons for the differences in environmental performances of industrial sectors in one country.

1.2 Problem Definition and Objectives

The core theory that will be used in this research is the Ecological Modernization Theory (EMT). Various studies on the actors, mechanisms and dynamics in shaping environmental management and (improved) environmental performance have been brought together under the EMT as an overarching theoretical framework. The EMT primarily aims to explain and understand the main mechanisms and dynamics in environmental reforms of production and consumption practices. Some authors have also used the EMT in a more normative way, by deriving an agenda for environmental reform from the theory. The development of EMT started in the late 1980s most notably in Germany, The Netherlands and the UK. The focus of ecological modernization theorists in the late 1980s was on national studies in the Western European countries. As a result of these studies, the EMT offers an understanding of the dynamics and mechanisms that have resulted in improved environmental management and performance, particularly for West European states (Mol 1995, Spaargaren 1997, Mol and Sonnenfeld 2000, Boons et al. 2000, Buttel 2000).

From the mid 1990s and beyond, increasing attention has been paid to the global dynamics of ecological modernization, as well as to national studies in non-West European nation-states (developing countries, Central and East European nation-states and also the USA) (Mol 2001). In newly industrializing and developing countries, EMT has been applied among others, Indonesia and Thailand (Sonnenfeld 2000), Vietnam (Frijns, Phung and Mol 2000, Phung 2002, Tran Thi My Dieu, 2003; Le Van Khoa 2006), China (Zhang 2002, Mol 2006) and Thailand (Chavalparit 2006, Wattanapinyo 2006), Taiwan (Rock 2002), Yang, L.F. 2006), Japan (Barett 2005) and South Korea (Rock 2002, Mol 2004).

Most of these studies have a national character, in the sense that the studies do not differentiate between (industrial) sectors in analyzing and explaining environmental management and environmental performance. Moreover, most studies in the EMT are more qualitative by making interesting use of case study research. In building a new theoretical framework, this emphasis on qualitative case study research should not surprise us. Limited quantitative research has been done up till now to test the central tenets laid down in EMT and no methodology has been developed yet to carry out a more substantive quantitative testing.

While the EMT is a broad encompassing theory on environmental reform, this research will especially focus on two claims being made by the theory: one referring to shifts in environmental policy making and one related to the increasing role of economic and market actors and dynamics in environmental improvements.

The first central tenet of EMT, which will be investigated in this research, is the claim that environmental reforms are stimulated and triggered by transformations in environmental policy. Environmental reforms are facilitated when the role of the state in environmental policy is changing from curative and reactive to preventive; from 'closed' policy making to participative policy making; from centralized to decentralized; and from dirigistic to contextually 'steering' (Mol 1997: 141). This is often referred to as political modernization (Janicke and Weidner 1995): a shift from top-down, national, command-and-control environmental regulation to more decentralized, flexible and consensual styles of environmental governance. As

Buttel (2000) depicted, amongst other related literature, this part of ecological modernization is closely affiliated with the notion of embedded autonomy. Evans' (1995) idea of embedded autonomy refers to the fact that close cooperation, interaction and collaboration between the government and authorities on the one hand, and industry and society on the others ensures successful performance of nations on a number of criteria, among which environmental performance. The autonomy of the state is embedded in society, causing synergy and effective policies (Evans 1995).

The second central tenet of EMT in this research relates to the increasing importance of market dynamics and economic agents (such as producers, customers, consumers, credit institutions, insurance companies, etc.) in successful industrial environmental management (Huber 1991, Mol 1997, Mol and Sonnenfeld 2000). Environmental reforms in industry are increasingly facilitated or even caused by economic push and pull actors and factors. Customer demand for certification of products and processes, competitiveness on environmental performance, the emergence of environmentally-defined niche markets, valuation of environmental goods by authorities, and pressures from insurance and credit institutions are examples of this (Mol 1997). Better environmental performance is therefore expected to go together with a larger role of economic actors in environmental governance. In exploring and 'proving' these tenets most empirical studies with the ecological modernization tradition have been carried out via qualitative case studies on a limited number of industries or on one sector. That can be seen as an essential strategy to come to explore the mechanisms via which environmental improvements take place. But it also has resulted to some debate as to whether these case study results can be seen as representative for larger groups of industries. Secondly, discussion has emerged whether there are differences between sectors in the ecological modernization of industries, especially since most comparisons have been rather between nations than within one nation. In this regard, the investigations of Baylis, et al. are interesting as they have looked into sector variations (Baylis, et al., 1998a) and company variations (Baylis, et al., 1998b) as explanatory forces in shaping successful environmental management. Van de Woerd et al. (2000) have also studied the development of strategies to limit greenhouse gas emissions in three US-based sectors, namely, the oil industry, the automobile industry; and banking and insurance industry. The latter study only involved a limited number of (case study) companies.

The two industrial sectors selected for this purpose are the palm oil production chain (POPC) and the textile and apparel production chain (TAPC). The choice of the POPC and the TAPC as the two industrial sectors selected for this research is justified by differences in terms of Pavitt's classification and by their variation in environmental improvement and achievements.

For a further operationalization of research into sector variations of ecological reform, Pavitt's (1984) classification of industrial sectors in four major clusters forms a useful starting point. He distinguishes:

- Supplier-dominated industries, such as textiles, clothing, leather, printing and publishing, and wood product industries. As most of the firms are small, R&D expenditures are limited and innovations are mainly triggered by the diffusion of capital goods and innovative intermediate goods.

Endogenous changes relate to increments in equipment, procedures and organizations.

- Production-intensive sectors with mainly large companies, such as transport equipment, electronic durables, metal manufacturing, food products and glass production. They have deep pockets to encourage product and process innovations; and have high vertical integration in the production of technologies and equipment.
- Specialized suppliers, such as mechanical and instruments engineering, focus at product innovations in the form of capital inputs. Most firms are small, knowledge-intensive and maintain intensive relations with their customers.
- Science-based industries such as the chemical industry, the electronics and electrics. They are mostly large companies with large R&D departments and resources. Product innovations were mainly of intermediate goods or capital goods.

Pavitt's classifications ring true for the two selected industrial sectors. The palm oil production sector falls under the production-intensive sectors as most of the groups (a parent company with a number of subsidiaries and affiliate companies) in the POPC have a long established history and are cash rich in nature with some groups in the billion Ringgit market capitalization category like for example the Sime Darby Group, the Golden Hope Group, the IOI Group, the Guthrie Group and others. These groups have deep pockets, and to a large extent, are vertically integrated. However, at the same time, there are also standalones, be it in milling, palm kernel crushing, and refining and palm oil finished products production. As such, it also allows for a study on intra-sectoral variations.

The textile and apparel production sector falls under the supplier-dominated industries classification as a large majority of firms falls under the small and medium scaled enterprises category. R and D expenditures are very limited and incremental changes take place as a result of not having a deep pocket. However, a small number of firms or groups are large, either in asset investment or market capitalization with the likes of Ramatex Bhd. and PCCS Bhd., both being public-listed companies in the Malaysian Bourse. However, these firms or groups in the TAPC are not as large as the groups in the POPC. Likewise, these differences in the TAPC allows for a study on intra-sectoral variations.

Another interesting reason why these two sectors are selected is the industry life cycle they are in, in the Malaysian context. The palm oil production sector is still undergoing growth and is in a sector, which is of high priority to the government as its contribution to the GDP is immense. In addition, export earnings of oil palm products rose to a commendable RM30.41 billion despite facing strong competition from other palm oil producing countries and unfavorable tariff treatment in some markets (MPOB 2004). The POPC is a resource-based industry as vast tracts of land are dedicated to the cultivation of palm trees. However, in contrast, the TAPC is a sunset industry with the advent of China being a member of the World Trade Organization and also a quota free environment since the beginning of 2005. A number of firms has closed down and many are suffering from a margin squeeze as a consequence of intensified competition from Chinese producers that have lower production costs. The above variations may also impact on differences on environmental performances for both the sectors.

Environmental performance

A revisit to Table 1.2 shows that the percentage compliance to environmental legislation by palm oil millers is range bound between the seventies to eighties percentile. Palm oil milling is subjected to the Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations, 1977 within the EQA 1974 and subsidiary legislation with regard to industrial effluents. This highlights that palm oil milling has industry-specific legislation. However, palm oil refining shows a fairly drastic drop in environmental compliance between 1997 and 1998. Palm oil refining is subjected to a different regulation, namely, the more general Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979. A more detailed time-line analysis to determine trend is not possible as the DOE stopped publishing such data from 1999 onwards in the annual Malaysia Environmental Quality Report. On a comparative basis, the textile sector has a generally poorer record in environmental compliance for sewage and industrial effluents. The textile sector is subjected to the more general Environmental Quality (Sewage and Industrial Effluents) Regulations. The main reason is that wet processing in textile operation generates a huge volume of industrial effluents and a lack of proper wastewater treatment can result in polluted discharges into the waterways.

A different scenario exists for compliance with clean air. The textile sector can boast of an impressive record of the high nineties compliance percentile as compared to palm oil refining which recorded a drop. Both these sectors are subjected to the same Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979. One possible reason is poorer boiler maintenance and management and the fuel feedstock used for the boiler. The building of the gas infrastructural network in many industrial estates has negated this problem. The migration from diesel and medium fuel oil to liquefied natural gas for many refiners due to cost efficiency has resolved the problem of air pollution.

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Table 1.2 The Compliance Status Of The Manufacturing Industries In Malaysia For The Period 1990-1999

	1990	1995	1996	1997	1998	1999
Percentage Compliance With Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations, 1977- Industrial Effluents Only						
Palm Oil Milling	82	na	78	76	81	na[*1]
Percentage Compliance With Environmental Quality (Prescribed Premises) (Raw Natural Rubber) Regulations, 1977-Industrial Effluents Only						
Raw Natural Rubber Manufacturing	84	na	89	90	90	na[*1]
Percentage Compliance With Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979-For All Industries Other Than The Two Above						
Cement	na	100	74	91	83	na[*1]
Chemical-based	na	78	85	86	88	na[*1]
Electrical and Electronics	na	89	91	96	86	na[*1]
Feedstock	na	na	na	na	50	na[*1]
Food and Beverage	na	69	69	70	72	na[*1]
Leather	na	82	83	89	88	na[*1]
Machinery	na	79	100	96	81	na[*1]
Metal Fabrication	na	93	92	97	91	na[*1]
Metal Finishing and Electroplating	na	58	66	69	65	na[*1]
Non-metallic Mineral	na	82	95	97	92	na[*1]
Palm Oil Refining	na	na	na	92	77	na[*1]
Paper	na	72	79	71	71	na[*1]
Petroleum Refining	na	na	na	79	85	na[*1]
Plastic	na	95	100	99	94	na[*1]
Quarry	na	97	91	94	97	na[*1]
Rice Milling	na	na	na	na	100	na[*1]
Rubber-based	na	70	72	84	78	na[*1]
Textile	na	56	70	83	60	na[*1]
Vehicle/Transportation-based	na	83	75	82	na[*1]	na[*1]
Wood-based	na	98	99	99	99	na[*1]
Others	na	75	89	85	85	na[*1]
Percentage Compliance With Environmental Quality (Clean Air) Regulations, 1978						
Cement	na	64	84	94	67	na[*1]
Chemical-based	na	99	94	97	94	na[*1]
Electrical and Electronics	na	97	96	97	89	na[*1]
Feedstock	na	na	na	na	67	na[*1]
Food and Beverage	na	85	96	97	92	na[*1]
Leather	na	100	100	88	75	na[*1]
Machinery	na	100	89	92	75	na[*1]
Metal Fabrication	na	95	87	94	79	na[*1]
Metal Finishing and Electroplating	na	68	93	93	72	na[*1]
Non-metallic Mineral	na	81	87	56	64	na[*1]
Palm Oil Refining	na	na	na	89	73	na[*1]
Paper	na	98	97	99	95	na[*1]
Petroleum Refining	na	na	na	86	80	na[*1]
Plastic	na	99	98	91	84	na[*1]
Quarry	na	88	76	76	72	na[*1]
Rice Milling	na	na	na	na	46	na[*1]

	1990	1995	1996	1997	1998	1999
Rubber-based	na	89	83	64	90	na[*1]
Textile	na	95	99	96	99	na[*1]
Vehicle/Transport-based	na	84	96	99	na	na[*1]
Wood-based	na	69	73	86	68	na[*1]
Others	na	90	72	86	57	na[*1]

Note:
[*1] *From 1999 onwards, data pertaining to compliance status for manufacturing industry is not available.*
Source: Environmental Quality Report, 1995-1999.

Research Objectives

This research seeks to contribute to both the literature on sector variations in environmental performance and the ecological modernization paradigm. It does so by investigating quantitatively from an ecological modernization perspective the causes of sector variations in the environmental performance of Malaysian industry.

In a nutshell, Malaysia had experienced rapid industrialization and economic growth. However, this was accompanied by deterioration of the environmental quality. The Malaysian government's commitment to environmental management is given evidence via the measures that have been implemented to curb pollution. These measures strive to achieve harmony between economic prosperity and environmental quality. The results of the Malaysian government policies are not the same for all industrial sectors. This study aims to understand the differences in sectoral environmental performance in Malaysia. In investigating, the study has two main objectives, an empirical one and a theoretical one:

1. In explaining environmental reforms, EMT has become a prominent paradigm. Within the ecological modernization paradigm no methodology has been yet developed to quantitatively investigate its claims on successes and failures of environmental reform. The first objective is thus to develop and apply a methodology to quantitatively test EMT, with a focus on political modernization and the role of economic and market actors and mechanisms.
2. A comparison between two sectors will reveal similarities and differences in terms of the drivers for environmental performances. This will lead to an understanding as to why some sectors are better than the other sectors in terms of their environmental performances. Two industrial sectors are selected for this study: the POPC and the TAPC. The second objective is thus to identify and explain differences in environmental performances between the POPC and the TAPC.

1.3 Research Questions

Based on the two objectives stated above, the research questions are delineated as shown below:

1. How can the central policy and economic tenets of Ecological Modernization Theory (EMT) be operationalized into testable factors that contribute to

improved environmental performances in industries?
2. What factors in the policy and economic domains explain sector variations with respect to environmental performances?
3. What recommendations follow from these factors for the development of sector-based industrial environmental policy in Malaysia?

1.4 Contributions of my study

This section covers the four major contributions of my study to the literature and paradigm of EMT.

1. My study is a continuation of the third phase of the EMT in terms of its geographic coverage, that is Malaysia, a developing and a newly industrializing country in South-east Asia.
2. In exploring and 'proving' the central tenets, most empirical studies with the ecological modernization tradition have been carried out via qualitative studies using the case study approach on a limited number of industries. My study entails the development of a quantitative methodology to test the EMT paradigms. The quantitative methodology and the related statistical tools will be discussed in- depth in Chapter 6 Research Methodology.
3. My study focuses on two industrial sectors, namely the POPC and the TAPC in Malaysia. The POPC has strong government linkage in the form of government linked companies or government agencies involved in the upstream and downstream levels of the chain whereas the TAPC has a more laissez-faire characteristic. The research findings will contribute to the compendium of knowledge in the under-developed theme on sectoral variation.
4. The development and refinement of the Environmental Performance Indicators (EPIs) that are suitable in the context of Malaysia and to a larger extent, developing countries in which data is lacking or the validity of existing data has an element of doubt. The method for deriving the Environmental Performance Indicators will be discussed in-depth in Chapter 6 Research Methodology.

1.5 Outline of the thesis

This section discusses the step-by-step process in terms of chapter flow for this study. Chapter 1 sets the scene by emphasizing on the problem definition, research objectives and research questions in terms of the development of a quantitative methodology and sectoral variations. This chapter also highlights the selection of the POPC and the TAPC for this study. Chapter 2 focuses on the overarching theoretical framework in relation to the central tenets and the selected central themes of political modernization and the increasing importance of market dynamics and economic agents for this study. This is followed by Chapter 3 which provides an overview on development policies and more specifically environmental policies and institutions that are generic to both the POPC and the TAPC. Chapter 4 continues with an overview of the production process, the historical development and the current industry structure, and the environmental issues in relation to the POPC. On the other hand, Chapter 5 is an overview of the production process, the historical development and the current industry structure, and the environmental issues pertaining to the TAPC. Chapter 6 starts with the operationalization of the two selected central tenets in ecological modernization theory, namely political modernization and the increasing importance of market dynamics and economic agents that are represented in terms of the government-industry (G-I) linkage and the industry-industry (I-I) linkage respectively. Five hypotheses were formulated for the G-I linkage whereas four hypotheses were formulated for the I-I linkage. The nine hypotheses postulated based on the EMT were further operationalized into independent variables. This is followed by the operationalization of the EPIs, the dependent variables. Subsequently the research method in terms of research tools, sample size, sampling method, and the statistical tools for comparative analysis is covered. Chapter 7 presents the empirical findings for the POPC by highlighting on hypotheses which are statistically significant for the overall POPC as well as for the sub-sectors in the POPC. Likewise, Chapter 8 presents the empirical findings for the TAPC by highlighting hypotheses which are statistically significant for the overall TAPC and also for the sub-sectors in the TAPC. Chapters 7 and 8 set the scene for Chapter 9 which focuses on comparative analysis to identify sector variations and similarities. This study ends with Chapter 10 which focuses on conclusions and recommendations that are culled from the aforementioned chapters.

CHAPTER 2
Ecological Modernization Theory And Its Application To This Study

2.1 Introduction

This chapter starts by covering the three phases of development (and maturation) of the Ecological Modernization Theory (EMT). This is followed by a discussion of the five core themes identified in the EMT. From these, two selected core themes were adopted for this study. The next section covers the two selected core themes in greater depth. The final section ends with an epilogue.

2.2 Ecological Modernization Theory: Three Phases of Development

The core theory that will be used in this research is the Ecological Modernization Theory (EMT). EMT primarily aims to explain and understand the main mechanisms and dynamics in environmental reforms of production and consumption practices. With respect to production, EMT highlights the relationship between industrial development and the environment. Industries respond to existing and emerging environmental problems whilst policy intervention can result in a win-win situation of economic and environmental benefits.

Ecological Modernization Theory (EMT) is a body of literature that has been developed and is still developing for the past 20 plus years. Amongst the well-known European social scientists that have contributed in an initial stage to the *development* and '*modernization'* of the EMT are Joseph Huber, Martin Jänicke, Udo Simonis, Gert Spaargaren, Martin Hajer, Arthur Mol and Albert Weale. The EMT can be classified into three phases of development as presented below.

2.2.1 The first phase of the development of the EMT

The early 1980s marked the beginning of the development of EMT. Joseph Huber and Martin Jänicke are known as the founding fathers of EMT. Huber's main precepts or contributions in the development of the EMT are: the emphasis on technological innovation in environmental reforms, especially the industrial production dimension; a critical attitude towards the government role and in favor of market actors and entrepreneurs acting as catalyst for ecological modernization; an evolutionary yet deterministic form of ecological modernization (with the analogy of the dirty and ugly industrial caterpillar transforming into an ecological butterfly); limited emphasis on human capital and the struggles of social movements (Huber, translated in Mol 1995).

In his later writings, Huber recognizes the dual development of mutual interaction between technological development and economic development on one side and the developments in other central institutions of modernity on the other (Huber 1991). However, the main domains of his thoughts still focus on the interaction between technology and the economy by way of the transformation processes of production and consumption. On the other hand, the earlier writings of Jänicke (Jänicke 1985) view the environmental crisis as providing the rationale for state intervention in the greening of production and consumption. Jänicke also advocated the adoption of preventive environmental policy at the most favorable point in time. The most favorable point in time refers to state intervention at the earliest possible interruption of the chain of events from which pollution arises. He also emphasized the importance of minimization of state intervention through anticipation to reduce the intervention cost, avoid increased bureaucracy and attain sufficient results. In the second phase of EMT, Jänicke (1995), Jänicke et al., (1997) and Spaargaren and Mol (1992), among others, have emphasized the interdependence amongst technological, socio-economic and political-cultural transformations, which will be elaborated in the following section.

2.2.2 The second phase of the development of the EMT

Studies in the second phase, from the late 1980s till mid-1990s witnessed a decreasing emphasis on the role of technological innovation as the only driving force in environmental reform. The ecological modernization theorists developed in this period a more balanced view of the respective roles of the state and market. In addition, they emphasized on institutional dimension and cultural dynamics. Amongst the theorists are Jänicke(1995) Jänicke et al., (1997), Spaargaren and Mol (1992), Mol and Spaargaren (1993), Hajer (1995), and Cohen (2000).

Martin Jänicke 's contributions to the development of the EMT are in the area of political modernization and macroeconomic restructuring. Jänicke argued that the steering capacity of the state is a necessity due to the structurally weak steering potential of markets and market actors in the field of environmental protection. Weale's contribution in the ecological modernization debate is the assessment of environmental policy choices of government in view of their consistency with the Ecological Modernization Theory. Weale's seminal writing has to be viewed in the context of the global endorsement of Brundtland report and the general acceptance of Agenda 21 at the United Nations Conference of Environment and Development in Rio in 1992 which led to the new environmental policy approach as the dominant force in political debates on ecological affairs (Hajer 1996). Weale argued that the new environmental policy approach was characterized by the following principles: government policy must be in agreement with the central tenet that the environment and the economy is not antithetical and can be mutually supportive; environmental policy goals need to be anchored into all policy areas of the government; explorations must be made of alternative and innovative approaches to environmental policy; and government should direct actions or interventions to innovation, invention and diffusion of new technologies in industrial processes (Weale, 1992). The contributions of Jänicke and Weale provided a more balanced view of the state's role and the essence but also limitations of market dynamics as compared to Huber's.

Spaargaren and Mol (Spaargaren and Mol 1992, Mol and Spaargaren 1993) also advocated institutional reform within modern society, like Huber, to minimize or at least substantially reduce the damage visited upon the nature as a sustenance-base. The authors took a more sociological perspective on ecological modernization by moving away from socio-ecological dimension, and focusing the analysis on the relationship between societies and their environments. The socio-ecological models, they argue, should be left behind as these models lean towards deterministic and functionalistic conceptualizations of human agency. Also, in the analysis of historical developments, these models are usually the prototypes of socio-evolutionary schemes that are convincingly criticized as unfolding models of change by social theorists such as Anthony Giddens. Central to this critique is that societies do not reactively and mechanically adapt to their environments. Members of society can choose to prioritize in solving environmental crisis by underlining it as a central concern in the reflexive organization of society. They also argued that environmental sociologists should orientate themselves to the recent debates in sociology, with the central theme being the analysis of structures, and the extent to which human behaviour is determined by social and/or environmental structures (Spaargaren and Mol, 1992). The contributions by Spaargaren and Mol are relevant as institutional reform, actors and structures are a pertinent part of this research. Spaargaren and Mol joined Jänicke and Weale in providing a more balanced view of the role of state institutions and market dynamics, as compared to Huber's.

The aim of Mol's seminal book *The Refinement of Production: Ecological Modernization Study and the Chemical Industry* is to focus "on the development of a more specific theory on how *environmental* side-effects of globalized and radicalized modernization processes are increasingly transforming modern institutions, and will, consequently, also address the character of modernization as such" (Mol 1995: 25). Radicalized modernization also known as reflexive modernization was analyzed by Giddens, as a phase characterized by globalization and the demise of traditions. Ulrich Beck also understands reflexive modernization as a new phase in modernization, where modernization's side-effects, especially the globalized forms, have gelled into a pivot of societal development. This societal development has instigated a fundamental change for some of the institutions of modernity as mentioned by Huber: "modernizing modernity". The shaping of EMT in terms of institutional reflexivity in Mol's book is built upon the works of Giddens and Beck. Mol's study on ecological modernization builds upon empirical research of the restructuring of the Dutch chemicals industry, a heavy polluter. His empirical study pays attention to the responses of the three sub-sectors (paints, plastics, and pesticides) of the chemicals industry toward ongoing environmental pressures. He concludes that the environment has shifted from the periphery to the centre or core in the decision-making process. In other words, environmental interests induce the transformation process of the Dutch chemical industry. The constant informational influx of the ecological effects of social practices and institutional arrangements leads to the continual redirection of the core institutions of modern society, in order to fit into the ecological 'requirements'. Ecological modernization thus can be interpreted as the reflexive (institutional) reorganization of industrial society.

The policy principles and approaches distilled from EMT are used to assess individual governments on the extent of adoption of the ideas and practices of ecological modernization. Countries that are found to be on the track of ecological modernization are Germany, Netherlands, Scandinavian countries and Japan (Murphy 2000). Thus, the emphasis and empirical studies during the first two phases was focused on OECD countries in North-western Europe. Weale argues that environmental problems supersede the national state, thus requiring the need for a supranational or global approach (Weale 1992). This relates to issues being addressed in the third phase of the development of the EMT.

2.2.3 The third phase of the development and maturation of the EMT

EMT broadened in its theoretical and geographical scope from the mid-1990s onwards. This is the beginning of the third phase on the development of EMT. Initially, the genesis, growth and maturation of the EMT took place against the geographical background of North-western European industrialized societies. Consequently, EMT was said to be Eurocentric and one of the controversies is the value of EMT for non-European settings. This "Eurocentrism" of EMT is grounded in the socio-political, economic and cultural conditions and institutions of this geographical area (Mol 2001). This raised the question whether the EMT could be expanded geographically in the context of globalized modernity. In the second half of the 1990s EMT-related studies expanded into Central and Eastern Europe and into non-European countries like the Newly-Industrializing Countries in Asia. The third phase is also associated with heightened attention to the internationalization and globalization of ecological modernization (Mol 2001). Amongst the ecological modernization studies carried out were that of Rinkevicius (2000), Mol (2001), Mol and Sonnenfeld (2000), Frijns, et al., (2000), Rock (2002a), Zhang (2002) and Tran Thi My Dieu (2003), Liu Yi (2005), Yang (2005), Barrett (2005,) Le Van Khoa (2006), Chavalparit (2006) and Wattanapinyo (2006).

Thus far, the results from these and other studies are ambivalent in terms of the application of EMT in understanding and designing environmental reform trajectories. Mol (2001) argued that the differences between the European developed countries and the newly industrializing countries in Central and Eastern Europe, South-East Asia, East Asia and Latin America are not that large to warrant different environmental reform models and institutions that exist in the 'Triad' (Europe, Japan, and the USA) This, however, is different in Sub-Saharan Africa, the Middle East and several former Soviet republics.

In the context of East Asia and particularly South-East Asia, several ecological modernization-informed studies have been carried out. Frijns, Phung and Mol (2000) focus on Vietnam as a case study in the examination of the applicability of the EMT in an industrializing country, a communist country in transition from a centralized economy to a more market-oriented one. Their conclusion is that EMT is of limited value in analyzing contemporary economic development and attempts at environmental reform in Vietnam. (Frijns et al., 2000). Le Van Khoa's (2006) study on small and medium-sized enterprises in Vietnam indicated that Vietnamese political modernization has yet to be formulated but differs significantly from European political modernization tendencies. Wattanapinyo's (2006) study on small and medium-sized agro-industries in Northern Thailand identified that the various mechanisms of environmental restructuring partially follow the ideas of ecological modernization formulated for Western European countries such as those related to advanced environmental technologies, political modernization, and the increasing role of global economic and market dynamics and agents in environmental reform. The central tenets that are partially followed relate to political modernization in which stagnation rather than swift development is prevailing, the increasing role of market dynamics and economic agents in response to environmental reform at the initial stage, and the growing space provided for social participation. Likewise, Chavalparit's study on the implementation of clean technology for the crude palm oil industry in Thailand reveals various constraints in the implementation of clean technology options and waste exchange. She concludes that Malaysia might be a more successful case of ecological modernization in palm oil production. Rock's study (2002) on globalization indicated that China's and Taiwan's environmental strategy differ with China being influenced more by internal pressures and concerns whereas Taiwan by external ones in relation to environmental improvement. A later contribution by Mol (2006) on China concluded that there is justification to use the term "ecological modernization" in describing China's attempt at economic restructuring along ecological lines. Likewise, a later study by Yang (2005) concluded that ecological modernization is taking place in Taiwan, especially for the high-tech sector, heralded by state technical agencies and economic agents. Barrett's (2005) study of ecological modernization in Japan indicated that in the 1990s, Japan has gradually begun to turn green and started experimenting with more participatory forms of environmental governance.

As mentioned above, the diffusion (or a lack of it) of ecological modernization varies between North-western Europe and other parts of the world. Thus, it may not be a misnomer that this heterogeneity would be extended to the various economic sectors within a particular country. Different economic sectors may have different commitments due to a host of exogenous and endogenous factors. Mol (1995) has also stated that more attention has to be paid to the heterogeneity of industry behavior and the incorporation of environmental imperatives. Studies by Baylis et al. (1998a and 1998b), Revell and Rutherfoord (2003), Van de Woerd et al. (2000) highlighted the existence of sectoral variations. These studies focused on the geographic location of Western Europe and North America (Baylis et al. in UK; Revell and Rutherfoord in UK and Netherlands; and Van de Woerd et al. in Western Europe and North America).

In addition, in the first two phases of the development of the EMT, the emphasis or focus has been on the system of industrial production. The production-consumption loop comes full circle albeit slowly, with the development on the theoretical front for consumption as elucidated by Spaargaren and van Vliet (2000). The theory of consumption as advocated by Spaargaren and van Vliet draws from some of the central concepts in the sociology of consumption. This theoretical model draws on the contribution of Giddens, Bourdieu, Warde, Cowan, Otnes and Shove. The result is a contextual model of domestic consumption which combines an actor-oriented approach via the social practices of actors in pursuit of their daily routines with the system of provision notion in studying consumption practices from an institutional perspective.

My research is a typical product of the third phase of EM studies in terms of geographic location.

2.3 The Core Themes of EMT

The core themes of EMT are:

1. Modern science and technology in environmental reform

Huber's proposal for ecological restructuring focuses on the industrial and not the capitalist dimension of modernity as the point of departure, emphasizing on technology and production forces in the modernization process. Huber's view is evolutionary and in some ways deterministic with the analogical use of the dirty and ugly industrial caterpillar transforming into an ecological butterfly (Huber, translated in Mol, 1995). The later contribution by Mol (1995) deviate from the evolutionary cum deterministic viewpoint but the general emphasis on the importance of science and technology in socio-ecological transformation is an important characteristic in EMT. The ecological modernization theorists are not extremely pessimistic in their evaluation of the surveillance dimension (control of information and social surveillance) as opposed to counterproductivity and risk society theorists (Mol 1995).

The counterproductivity theorists are critical of the complex and high technology as a way of overcoming environmental problems. The counterproductivity viewpoint is also embraced by the risk society theorists like Beck and Baumont. Whilst the counterproductivity and risk society theorists share the negative viewpoint of the influence of science and technology, the EMT focuses on modern science and technology acting as principal institutions in ecological restructuring via the generation of solutions and not viewed as contributors to environmental upheaval which was prevalent in the 1970s. The first generation of environmental technologies of the 1970s is termed as inefficient and ineffective end-of-pipe and clean-up technologies. However, the benefits derived from transformation in technological trajectories for environmental reform are seen in the second generation process integrated and product technologies which do not show the same defects. This is also known as the 'ecologizing of economy' which emphasizes technological transformation and change. Thus, the changing role of science and technology has replaced the curative, end-of-pipe choice to the more preventive, benign option. The innovation and diffusion of new key technologies has become the premise for environmental improvements.

At the same time, there was an ongoing debate about hard and soft environmental technologies. However, Huber did not pay too much attention to this debate. Mol and Spaargaren (1992) argued that the EMT should not be regarded solely as a 'technological fix' approach but should move from end-of-pipe or add-on technologies to preventive technologies as being more relevant than the debate of soft or hard environmental technologies.

By and large, the EMT does not look at technological innovation as the sole causal factor in environment-induced socio-economic change. In his later writings, Huber recognizes the dual development of mutual interaction between technological development and economic development on one hand and the developments in other central institutions of modernity. The later contributions by Jänicke (1995), Jänicke et al., (1997), Spaargaren and Mol (1992), among others, have shown interdependence amongst technological, socio-economic and political-cultural transformation.

2. Transformation in the role of the state in environmental reform

Ecological modernization theorists have indicated that the reactive 'command-and-control' strategies were less effective in solving environmental degradation problems (Weale 1992; Spaargaren and Mol 1992; Jänicke 1985; Mol 2003). To their view, other forms of environmental governance are gaining importance, complementing the role of regulation. Moreover, the roles of non-state actors in environmental policy are becoming more pronounced, and new government styles are replacing the old hierarchic state models (Weale 1992; Mol, Lauber and Lieferink (2000). A trend can be detected in the transformation in the role of the state from a hierarchical command-and-control form of government to participatory, consensual, cooperative and interactive forms of governance. The new forms of private sector involvement encompass the use of market-based instruments (MBIs) as well as intensive negotiation, consultation, interaction and self-regulation (Mol and Spaargaren 1992). Martin Janicke's (1985) contributions to the development of the EMT are in the area of political modernization and macroeconomic restructuring. Jänicke depicted the more cooperative, consensus-oriented relationship between the state and private actors in environmental policies as political modernization. In his earlier writings, Jänicke views the environmental crisis as a legitimation and steering crisis of the nation state. He argued that the environmental crisis provided the rationale for state intervention in the greening of production and consumption. Without state intervention, it would be impossible. Jänicke advocated that the ecological modernization process must be actively abetted by the state via a green industrial policy (Janicke 1995), Jänicke et al., (1997). In contrast to Huber's view where he believes in limited amount of intervention, as state intervention is seen to be an obstacle in environmental reform, Jänicke postulates that the steering capacity of the state is a necessity due to the structurally weak steering potential of the markets and market actors.

Furthermore, late political modernization theorists emphasized the formation of smaller but stronger state as well as the problem-solving capabilities of the private market agents (Van Tatenhove, Arts and Leroy 1993). They also emphasized the importance of higher level of cooperation between the state and business and environmental organizations to achieve their goals, not only through intergovernmental policies but also through 'self-regulation' of market agents (Arts 1998).

Transformations in the role of state and market can also be in the form of higher level of participation of the private and public actors in policy formulation, decision-making and implementation. The participative role can be in the form of a representative status (corporatist arrangements) or control of resources (liberal arrangements) (Van Tatenhove, et al. 1993). The involvement of representatives from relevant government agencies and the industry in the development of environmental policies signifies the increasing opportunities and importance of the involvement of the private sectors in the "traditional administrative, regulatory, managerial, corporate and mediating functions of the states." (Mol and Sonnenfeld 2000). This carries the implication that industry does not merely attempt to influence government policy but is a part of the decision making and implementation process.

Revell and Rutherfoord (2003); Marcus, Gefen and Sexton (2002) and Holiday et al., (2002) have also indicated in their research findings that a more participative role played by industry and/or industry representatives in policy formulation and implementation has led to better environmental performances. Moreover, Angel and Rock (2003) indicated that benefits that can be obtained from close cooperation between the agencies of economic development and the firms (while maintaining autonomy from the firms) include improvements in technological and managerial capability, as well as a wider range of resources and policy tools applicable to enhance economic growth and environmental performances.

The diversification of policy instruments in the form of economic instruments in environmental regulations that occurred in the 1980s and 1990s also signaled the move towards more preventive options. The move towards more preventive options also led to the active involvement of economic actors who themselves were also polluters. These changes, and the fact that they occurred with strong industry participation in the policy making process, also indicate that environmental issues were becoming part of the fabric in conducting business. Kolk (2000) indicated that firms (especially large-scaled enterprises) may opt for cooperative approaches; or self-regulation; or compliance with the existing regulations. This is also compounded by the emergence of international and supra-national institutions, such as WTO and World Bank which either undermine the state or force it to accommodate in ecological restructuring.

3. The increasing importance of market dynamics and economic agents in the era of globalization

Economic development and environmental reform are not antithetical. The third core theme of EMT relates to the increasing importance of market dynamics and economic agents (such as producers, customers, consumers, credit institutions, insurance companies, etc.) in successful industrial environmental management (Huber 1991; Mol 1997; 1999; Mol and Sonnenfeld 2000). Ecological modernization theory depicts the supportive roles played by market actors, abetting the state (Smink 2002). Environmental transformations, therefore, are increasingly caused by economic push and pull factors and actors, such as customer demand for certification of products and processes, competitiveness on environmental performance, the emergence of environmentally-defined niche markets, valuation of environmental goods by authorities, and pressure from insurance and credit institutions (Mol 1997). Economic agents and consumers have increasingly played an important role as social carriers in ecological reform both within and across countries. This is in tandem with the changing state-market relations as mentioned above with regard to the second core theme. Thus, environmental performances are expected to be positively related to the increasing role of market dynamics and economic actors in environmental governance.

Globalization of the world economy has also led to environmental issues. Environmental issues in relation to trade have surfaced and have impacted on both exporting and importing countries. The industries should view environmental challenges as an opportunity and not as a crisis in the process of globalization in the world economy (Blowers, 1997). Environmental challenges or opportunities encompass environmental certification like ISO14001 and eco-labeling of products.

A classic example of supply chain pressure is the ISO14001 environmental management standard (Smink 2002; World Bank 2000; Rock 2002). The attainment of ISO14001 broadens market access and helps in achieving competitive advantage in the global market place (Krut and Gleckman 1998; Porter and van de Linde 1995; Mol 2001). These environmental challenges lead to the "harmonization of national environmental practices, regimes and standards, produce new institutional arrangements at a supra-national level, transfer of environmental technologies, management concepts and organizational models and accelerate the exchange of environmental information around the world." (Mol 2001:96). The convergence or harmonization is aided by international standards like the ISO14000 standards, the HACCP standards and the Oekotex Standard 100 certification, global information networks and supra-national regulations, corporate governance, customers and civil pressure. The global harmonization of environmental practices like the various certifications mentioned above for the industrial sectors, triggers environmental initiatives for products and processes in companies in the Triad and also larger exporting companies and their suppliers in newly-industrializing economies and developing countries (Roberts 1998).

4. *Modifications in the position, role and ideology of social movements, particularly the environmental movement, in the process of environmental reform*

The positions of the environmental non-government organizations in the broader social and specifically environmental struggles differ considerably when the 1970s are compared to the 1990s. The environmental movement in the 1970s and early 1980s was a constituent of a broader movement of social change pertaining to myriad developments in industrialized Western societies. Collectively, they can be interpreted as a movement with a common dominant ideology, notwithstanding the fact that it encompassed a broad spectrum of environmental non-government organizations which differed between and within countries. The 1970s and 1980s also reflected a situation where the environmental movement was located at the periphery or outside the environmental decision-making centers and institutions. However, the 1990s witnessed the transformation of the modern European environmental movement in a relatively smooth and radical way (Mol, 2000). The dominant ideologies, strategies and positions prevalent in the 1970s morphed dramatically due to internal pressures and anticipation of external developments. The environmental non-government organizations in the 1990s differ in their dominant ideologies, in their position vis-à-vis other actors involved in environmental reform, and their strategic operations within and between countries. The surfacing of these differences in the 1990s is due to the wider developments in environmental discourses and reform, but at the same time posing new challenges to the environmental non-government organizations.

Sonnenfeld and Mol (2002) argued that at the global level, a common environmental frame of reference would be virtually impossible to attain. Environmental priorities for people in different parts of the world differ, like for example climate change and clean water. Besides that, the definitions of environmental problems diversify due to the mediation of local backgrounds, history and traditions. It is widely acknowledged that environmental universalism is prevented by local factors articulated in a heterogeneous cultural framework.

Sonnenfeld and Mol also claimed that the most important cause for the absence of a global environmental frame of reference is the unequal distribution of capacities and resources, especially but not only along economic divides, in the articulation of environmental discourse.

The transformation in the 1990s brought about the institutionalization of the environment in the political, economic and socio-cultural domains of industrialized societies and together with the notion of globalization, the changes in the environmental movement proved rather difficult to halt and reverse. This pushes the environmental movement from the periphery or outside of environmental decision-making centers and institutions to be directly involved in decision-making processes within the nation and to a lesser extent, the market, using their strategic resources like legitimacy and political consumerism as leverage.

5. Changing discursive practices and emerging new ideologies

Spaargaren and Mol (1992) distinguished three schools of thought with regard to the relationship between the character of modernity and the environmental crisis. Each focuses on different aspects of modernity and promotes the prescription of different solutions to the incongruous relation between modern society and nature as a sustenance basis. The three schools are: "the neo-Marxist approach, different versions of (post)industrial society theory, and the counterproductivity theory". The neo-Marxist approach adopted by Schnaiberg, with the application of the treadmill of production as the *force ma-jeure,* leads to the continuous disruption of the sustenance base. The treadmill of production is viewed as the mutual process of economic pinching where everyone gets to run faster but advancing only a little, with the tendency of increasing production and sidelining the environment (Bell 1998). This treadmill is interpreted as a form of capitalistic characteristic in the organization of production. Schnaiberg's argument is that the small number of powerful corporations, having the innate capacity for capital accumulation, is able to dominate large sectors of production and together with its domineering economic and political might, has the ability to out-muscle the labor movement and the state.

The counterproductivity school of thought, with authors such as Barry Commoner, Ivan Illich, Andre Gorz, Rudolf Bahro, Oto Ullrich and Hans Achterhuis, criticized Marxist analyses for the preoccupation with the monopoly-capital character and under-theorizing of the *great machine*, an embodiment of the organization of the industrial system (Spaargaren and Mol 1992). The counterproductivity theorists - also known as de-modernization or de-industrialization theorists - share the common belief that the solution is to partially dismantle the existing production systems in order to adapt to the demands of man and nature. As summarized by Spaargaren and Mol (1992), they claim that up to a point in time, the 'social critical point', industrial production has a positive undertone in the increase of *welfare* and *well-being*. After the social critical point, some of the benefits of industrial production will morph into environmental costs.

In the middle ground between the Neo-Marxist school and the counterproductivity theory is the (post)industrial society theory, which can generally be divided into the earlier strand of industrial society theory and the later strand of postindustrial society theory. The scholars that developed the industrial society theory held the central assumption that "the development of industry and its impact on society are the central features of modern states" (Badlam 1984:2 quoted in Spaargaren and Mol 1992). The unity of these scholars and the distinction between them and the counterproductivity theorist is the benign evaluation of the logic of industrialism. Industrial societies move through various phases in their maturation, technology being one of the key propellers in their general development. They also dismissed the neo-Marxist by saying class conflicts belong to the birth period of industrial society and gradually lost its influence henceforth during the later phases of development. The rejection of neo-Marxist theory by these scholars placed them as postindustrial society theorists. However, the role played by science and technology, the meaning of leisure, and the changes to the production system would considerably reduce the burden to the sustenance-base.

Spaargaren and Mol (1992) criticize counterproductivity theorists for the fact that in favouring demodernization and local autonomy they fail to understand the actual political relationships and the way local and regional levels are related to the national or international levels. The advent of globalization and the global village reverberates and impacts on us with regard to what has happened many miles away. Spaargaren and Mol (1992) also argued that the distinction made by the neo-Marxism of Schnaiberg between the analysis of capitalist society and the bourgeois analysis of industrial society is no longer a useful dividing line in environmental sociology.

Spaargaren and Mol viewed that both industrialism and capitalism are essential elements in the understanding of modernity. This is in consonant with the views of Giddens that the institutional dimensions of modernity are industrialism, capitalism, surveillance and military power. They concluded that there is a lack of sophisticated theories regarding the relationship between institutional developments of modern society and the burdening of the sustenance basis. Their proposal of the EMT is to fill in the void in the form of a theoretical framework and also as a political program at the practical level (Spaargaren and Mol 1992).

The development of the scientific discourse on EMT, as exemplified by the analysis of Spaargaren and Mol, corresponds to a fair extent with the concept of sustainable development as espoused in the Brundtland report. The enthusiastic support for the Bruntland report was a major sign that a new belief system was emerging (Weale 1992). As mentioned before, Weale and Hajer termed this new environmental policy approach or discourse as ecological modernization. EMT and sustainable development cherish similar ideas on the relationships between environment and modern society, but the concept of sustainable development as mentioned by Timberlake (1989), one of the contributors to the Brundtland report, lacks scientific underpinning and has a wide range of meanings. In comparison, EMT has a stronger analytical and sociological base (Spaargaren & Mol 1992). The popularity of ecological modernization as a policy discourse is also due in part to the changes in the environmental policy and the dominant ideologies of the environmental movements in Western countries like Netherlands and Germany.

As a consequence of the developments described above, the sustenance base has emerged as a core precept. Complete neglect of the environment and the fundamental counter-positioning of economic and environmental interests are no longer accepted as legitimate positions (Spaargaren and Mol 1992; Hajer 1995).

My research focuses on the core themes of political modernization and the increasing importance of market dynamics and economic agents in the era of globalization. The following section draws on this section by discussing in greater depth the selected core themes adopted for my study.

2.4 Selected Core Themes Adopted

This section starts by discussing in greater depth the core themes of the EMT selected for this study. The core themes are the transformation in the role of the state and the increasing importance of the market dynamics and economic actors. I will now expand on these themes, with a focus on their application for the government-industry linkage and the industry-industry linkage studied in this research.

2.4.1 Transformation In The Role Of The State In Ecological Restructuring

The main characteristics of the second core theme in Section 2.3 are the less effective and reactive command-and-control strategies and the increasing role of non-state actors in forming a more cooperative, consensus-oriented relationship with the state in environmental policies. However, the three studies in Vietnam and likewise the two studies in Thailand as outlined in the third phase of EMT showed the limited role and the obstacles faced by the state and industry in policy matters in relation to ecological restructuring. On the other hand, institutional development in the Malaysian context is fairly matured and as such offers better institutionalized channels for participation in the policy decision making process by both the state and the industry.

Ecological modernizationists have postulated that regulations help solve environmental problems and at the same time enhance industrial competitiveness. Theoretically, regulations encourage the development and application of innovative technologies and production techniques. Murphy and Gouldson (2000:34) indicated that "despite the emphasis that ecological modernization places on the potential for policies to stimulate innovation, existing work in this area has yet to be informed by a detailed understanding of the innovation process". In this regard, Murphy and Gouldson (2000) explored the relationship between environmental regulations and industrial innovation in the industries in England and Wales. The empirical analysis focused on the industrial environmental regulations in England and Wales in the form of the Integrated Pollution Control regulations introduced in 1990 by the Environmental Protection Act. Thus, it also focused on the processes covered by this legislation – largely involving the bulk chemicals and specialty chemical sectors but also including power stations, ferrous and non-ferrous metal smelting works and cement kilns. On an overall basis, they indicated that regulations helped companies to overcome barriers to innovation and moved beyond control technologies to consider clean (cleaner) technologies. They indicated that regulated firms responded to the regulations. The Integrated Pollution Control regulations stimulated innovation thus enhancing economic and environmental performances of companies in the short and medium-term. Moreover, the likelihood of companies exploring opportunities of environmental improvement are enhanced by sustained interaction between the regulator and the regulated companies. The various opportunities are: (i) companies may opt for control technologies (End-of-Pipe) technologies or clean (cleaner) technologies, (ii) they may invest in new technologies together with organizational changes and the interaction of new managerial techniques as well as the adoption of environmental management system, and (iii) they may enhance environmental performance by integrating environmental concerns into their strategic as well as their operational management processes.

Innovation theory concurs with ecological modernization in terms of the role regulation played in driving environmental improvements, but only in the short term and medium term. Murphy and Gouldson also indicated that capacity building can be enhanced through regulation, "something that occurs through a consensus based and cooperative relationship between the regulator and the regulated" (2000: 43). On the other hand, regulations without a framework of specific targets in the long term, fail to stimulate radicalized innovation or adoption of cleaner technology which is associated with EMT. "This argument raises doubts of the technocentric and overly optimistic nature of the core ecological modernization ideas and more research is needed in this area" (Murphy and Gouldson 2000:43). The argument as advanced by Murphy and Gouldson considers regulations as a precursor to innovation. Also, in the context of developing countries like Malaysia, if the full extent of environmental regulations is enforced by 'command-and-control' government agencies, environmental compliance and improvement can occur. The strength of enforcement, however, is not clear. The plethora of environmental regulations, as mentioned in the Malaysian press, can hang an elephant on the wall but the question begets as to who will do the hammering (Goh Ban Lee 2006). At the same time EMT in the Western form also highlights the technological prowess of economic actors in generating clean (cleaner) technologies which are preventative in nature. However, the EMT may have to be modified taking into account the local conditions of developing countries. As many economic actors do not possess advanced technology, therefore the onus on technological development or technological collaboration with industry also falls under the purview of the state. As developing countries do not have an advanced technological base, the relatively easier route would be via the 'soft' preventive managerial approaches like the ISO 9000, 14000 and 18000 certifications.

Improvements in environmental performance are also motivated by public actions. (O'Rourke 2002; Baylis et al. 1998b; Marcus et al., 2002; Rock 2002; Angel and Rock 2003; Afsah and Vincent 2000; Ditz and Ranganathan, 2002). O' Rourke (2002), for instance, indicated in his research that close cooperation among local communities and the relevant authorities have impacts on the environmental performances of the industries in Vietnam. This is often carried out by going to media or higher governmental bodies. In this regard, the community's activities complement state functions and actions, thus leading towards better environmental performances. Baylis (1998b) also indicated that communities can complain directly to the regulators and following suit, the regulators can monitor and enforce the regulation via the issuances of licenses for the company to begin or to continue with its operations. Public pressure may increase the 'bargaining hand' of governmental regulators or officials. The monitoring and enforcement of regulations by the governmental regulators or officials will be facilitated by the long-standing relationships with important actors in the private sector (Rock 2002). In Malaysia, the political and government institutions are heavily intertwined and have even extended to the village level. Thus the constituents of a particular locality have convenient access to the local political institutions, which in turn can channel the constituents' complaints or information to the respective government institutions.

The transformation in the role of the state in my study is viewed from the perspectives of industry involvement in policy formulation, cooperation between government and industry in technological development and transfer, regulatory efforts emphasizing on environmental issues, preventive approaches advocated by the various government agencies, and local community involvement vis-à-vis government institutional structure in relation to environmental reform.

2.4.2 The Increasing Importance Of Market Dynamics And Economic Agents In The Era Of Globalization

Two dimensions are taken into consideration when evaluating the role of market dynamics and economic agents for my study. The first is the transfer of some of the environmental tasks to the market and the second is the impact and influence of globalization on market dynamics and market actors. The rationale why the theme of globalization is added here is because both the POPC and the TAPC in Malaysia are highly export-oriented and a fair amount of the trade is with the triad economies or countries in OECD. As such, globalization and the role of market dynamics and economic agents are heavily intertwined.

The first dimension involves the transfer of responsibilities, incentives and tasks from the state to the market (Mol, 1995). This transfer can act as a catalyst in accelerating environmental reform as the market is viewed to be a more efficient and effective mechanism in resolving environmental problems than the state. In the Malaysian context, the critical role played by the state in identifying priority economic sectors can lead to a situation in which the state provides the necessary conditions and incentives to stimulate self-regulation via economic instruments or technological facilitation. One of the aims of EMT is to transfer some of the environmental tasks to the market and at the same time to concentrate on the remaining environmental tasks that cannot be transferred.

The second dimension of globalization concerns economic mechanisms and dynamics as triggers or mediators in environmental reform (Mol 2002). The self-regulating economic actors especially the TNCs have to be put under pressure by the state, civil society, and citizen-consumer demand before they embrace environmental demands. Economic actors like the transnational industrial companies, global markets and trade, global information and communication networks and global economic institutions like the European Union, North America Free Trade Agreement and investment banks like the World Bank and the Asian Development Bank are playing a dynamic role in environmental reform. Mol further asserts that the developing regions are more affected by global markets and economic actors than by supranational political institutions although variation exists in accordance to the degree of integration of each country. Contemporary markets are regulated by political systems in which global companies and global markets depend on political legitimation of their products and production processes. Their operation at the national level is not fundamentally different from that of the global level. Further to that, despite the vast increase in geographic flexibility, Dickens mentioned that "even in a globalizing world, all economic activities are geographically localized" (Dickens 1998 :10). In these localities, the economic interactions are moulded by extra- economic logics like local, social, cultural, political and physical conditions. Parallel to this the global market and economic actors are under constant scrutiny in terms of their legitimacy in environmental performance.

Environmental issues in relation to trade have surfaced and have impacted on both exporting and importing countries, which also include the POPC and TAPC in Malaysia. Environmental challenges should be viewed by the industries as an opportunity and not as a threat or crisis in the process of economic globalization (Blowers 1997). Free trade has been found to stimulate prosperity, which in turn creates opportunity to the devotion of additional resources for environmental protection (Esty 1994). At the same time, free trade also promotes the transfer and adoption of best practices (Beghin and Potier 1997). Christmann and Taylor (2001) in their empirical study on the influence of market pressure on environmental performance showed that Chinese firms exporting to customers from industrialized countries had better environmental performance. A study by Corbett (2002) via a survey on 500 firms in nine countries highlighted firms which have high exports are inclined to adopt ISO standards earlier. This is in part due to the downstream customers from OECD countries exerting pressure through the global supply chain on firms or suppliers in developing countries. Both studies show that exporting has been linked positively to the adoption of international environmental management standards.

The global environmental challenges encompass "harmonization of national environmental practices, regimes and standards, produce new institutional arrangements at a supra-national level, transfer of environmental technologies, management concepts and organizational models and accelerate the exchange of environmental information around the world." (Mol 2001:96). Examples of market-driven environmental requirements are ISO14001 certification, HACCP certification, Oeko-Tex Standard 100 certification and eco-labeling of products for sale in the OECD markets. The ISO14001 environmental management standard is a classic example of supply chain pressure (Smink 2002; World Bank 2000; Rock 2002). The attainment of ISO14001 broadens market access and aids in achieving competitive advantage in the global market place (Krut and Gleckman 1998, Porter and van de Linde 1995, Mol 2001). Environmental management systems are viewed as mechanisms for attaining improvement in environmental performance and at the same time in support of trade prospects of 'clean' firms (World Bank 1997 Online). Ecological reforms induced by the global market actors have led to the institutionalization of the environment. As such, "international standards, global information networks, international regulations and global liability, codes of conduct and civil pressure show convergence toward a harmonization of environmental practices."(Mol 2001: 97-98). As such, market dynamics of harmonization of environmental practices and standards play a crucial role in ecological reform.

One very influential market actor in the global supply chain is transnational enterprises or multinationals. Transnational enterprises are often deemed as drivers of harmonization of national environmental regimes. The transnational enterprises impose their requirements on their suppliers in the form of environmental management and audit systems (EMAS), new environmental technologies, cleaner production methods and new organizational principles that reflect environmental concerns (Mol 2001). Another dimension of global standards is firm-based global environmental standards. The empirical study by Angel and Rock (2005) via case studies on a cement plant in Thailand and an electronics manufacturing plant (export-oriented) in Penang, Malaysia revealed that firm-based global environmental standards are emerging as a mechanism in managing the complex production networks' environmental performance. Angel and Rock define firm-based global environmental standards "as a uniform set of process and product environmental performance requirements which must be adhered to by all of a firm's facilities around the world." (Angel and Rock, 2005). These standards are even broader when applied to the suppliers of multinationals, a part of the global supply chain. These common firm-based standards can exceed national and local environmental requirements in order to meet the regulatory requirements of all the markets the firm is involved in. A key characteristic of these global production networks as compared to the earlier multinational production forms is the vigorous engagement of global sourcing and global supplier qualification. The two key drivers of firm-based standards are the protection of 'reputational' capital and operational capacity. The most visible examples relate to the campaigns carried out by nongovernmental organizations on labor standards and fair employment in the apparel sector (Mannheim 2001). The transnational enterprises or multinationals act as a catalyst in eliciting (triggering) environmental improvements and reform in supplier and client companies via their centrally powerful position as spiders in the economic webs (Mol 2001).

Vertical integration also exists within the global supply chain and can by itself be a driver for environmental reform. Vertical integration is often seen as a process of concentration along the vertical line of a manufacturing process, encompassing the formal-legal integration (e.g. ownership) as well as other forms of integration in the vertical line (either upstream or downstream): closer vertical collaboration, influence on decisions of vertically-related organizations, co-makership in the form of long-term contracts between users and suppliers, increasing information flows (Mol 1995). The concept of embeddedness was introduced by Granovetter (1985) within a social context. The interdependency from a myriad of inter-firm relationships that has developed over time is known as embeddedness. The two commonly cited types of network embeddedness are structural and relational (Gulati 1998). Baum and Dutton (1996) and Darcin, Ventresca and Beal (1999) identified structural embeddedness as based on inter-firm vertical linkages within a supply chain. The impersonal relationships and linkages among people and business is encapsulated in structural embeddedness. Nahapiet and Ghoshal (1998) depicted relational embeddedness by associating with such characteristics like respect, friendship and sociability in enhancing collaborative capacity, thus leading to mutual gains among the firms. The existence of interdependencies between firms in a vertical chain may trigger better environmental performances of the firms.

Moreover, proactive firms often initiate technological innovations and share those among firms with which they have established a long-standing relationship. Forms of structural and relational embeddedness existing in highly vertically-integrated firms may also drive better environmental performance.

The core theme of the increasing importance of market dynamics and economic agents in my study is viewed from the perspective of the exposure to international trade, the level of vertical integration, the intensity of international relationship, and the amount of local collaboration in relation to environmental reform.

2.5 Epilogue

Criticisms or comments on EMT encompass amongst others its Eurocentric focus, comparative studies mainly across nations rather than within nations and a lack of quantitative analysis. Amongst the findings of Frijns, Phung Thuy Phuong and Mol (2000: 257), the recommendation is that "if EMT is to be used to outline a feasible path of environmental reform, it has to be refined, however, to fit the specific local conditions and institutional developments of industrializing countries." Hills, Welford and Roberts (2003) concur with this idea, stating that the selection of ecological modernization as a theoretical framework for the analysis of environmental reform processes in other parts of the world, particularly Asia, reinforces the observation that it is not a single theory but one needing to be reworked and refined in different locations. As such, it is the intention of my research to innovate and develop a quantitative methodology to test ecological modernization theory in a non-European context, an Asian context and more specifically in the industrial sectors in the Malaysian context. The main aim of this research is to test quantitatively the EMT from the political modernization theory (Government-Industry linkage) and the role of market dynamics and market actors (Industry-Industry linkage). One of the main potential contributions is that this is a pioneering research from a quantitative perspective. This research also seeks to contribute to both the literature on sector variations in environmental performance and the ecological modernization paradigm. It does so by investigating quantitatively from an ecological modernization perspective the causes of sector variations in the environmental performance of the industrial sectors in Malaysia. Chapter 6 depicts in greater detail the methodology applied in this research, i.e. from the postulation of hypotheses based on the theories (as discussed above) to the operationalization of the variables and followed by the research methods.

CHAPTER 3
Environmental Policies And Institutions For The Palm Oil Production Chain And The Textile And Apparel Production Chain

3.1 Introduction

This chapter starts with an overview of Malaysia's Development Strategy with particular emphasis on the Environmental Policy as a background prior to the discussion of the institutional framework. The institutional framework is viewed from a G-I linkage perspective. The roles of the common government institutional cluster in relation to the POPC and the TAPC and the industry-specific government institutional cluster in relation to the POPC will be discussed with one of the foci being the environment. Incidentally, there is no industry specific government institutional cluster for the TAPC and this belies the government's priority placed on the POPC. This is followed by the roles including the environmental role, played by the industry representational cluster in relation to the government for the POPC and also the TAPC. The chapter ends with a diagram on the G-I linkage in terms of the interface for both the POPC and TAPC. This also lays the groundwork for the operationalization of the hypotheses as discussed in Chapter 6.

3.2 An Overview of Malaysia's Development Strategy with Particular Emphasis on Environmental Policy

The New Economic Policy (1971-1990), the National Development Policy (1991-2000) and Vision 2020 (1991-2020) have a common core focusing on national unity. The hope of the three documents is to achieve a prosperous and progressive nation, which in turn will help to attain national unity. The New Economic Policy and the National Development Policy have an overriding socio-economic objective whereas the Vision 2020 has broader objectives, which encompass the traditional socio-economic, political, spiritual, cultural and psychological dimensions. These three individual documents act as the pivot in the formulation of the Outline Perspective Plans, which are operationalized via the various Malaysia Plans, the Industrial Master Plans, the National Agriculture Policies, and all other government related policies, plans and programmes.

One of the major catalysts for the enactment of the Environmental Quality Act (EQA) 1974 was the pollution caused by palm oil mill effluent (POME). A Factories and Machinery Department study confirmed that 50% of the mills do not have a treatment plant whereas the remaining 50% did not have an effectively designed treatment plant (Abdul Aziz and F. Lee 1974). It has been estimated that POME amounted to 9.5 million tons in 1978 or the BOD equivalent of a 16 million population which exceeded that of Malaysia (Factories and Machineries Department in Mahinder Santokh Singh (1981). The EQA passed by Parliament in 1974 was and is the most comprehensive legislation on the environment to date but it is basically curative in nature. The curative thrust embodied in the EQA is officially endorsed in the Third Malaysia Plan and continued to be the environmental thrust for the subsequent Five-Year Malaysia Plans (Sham Sani 1997).

The enactment of the EQA happened during the tenure of the New Economic Policy where the overarching socio-economic objective was the mainstay. The deficiency on environmental concern in the New Economic Policy was addressed in the National Development Policy where amongst the goals is the need for adequate attention given to the protection of the environment and ecology in the pursuit of economic development to ensure long-term sustainability in Malaysia's development effort.

Overlapping the National Development Policy is the Vision 2020, which covers the period 1991-2020, and also the National Policy on the Environment with its launching date being 14 November 2002. Vision 2020 is not a distinctive developmental policy but an overarching framework, which guides all policies, programs and actions taken be it by the public or private sector. Vision 2020 also encompasses environmental care where development must be done in a holistic manner so that the fixation on growth will not compromise the preservation of the environment and natural resources. The cornerstone is that growth and development must be sustainable (ESCAP 2001, Online). The National Policy on the Environment encompasses all ongoing and future development projects. The National Policy on the Environment takes a holistic view in terms of development where this policy is meant to support the green strategy embodied in the various Malaysia Plans. The green strategy encompasses natural resource management and the prevention and control of environmental degradation (DOE 2002).

The Second Outline Perspective Plan (1991-2000) overlapped the National Development Policy and Vision 2020 Policy as seen in Table 3.1. As mentioned earlier, the National Development Policy has begun to embrace the environment as a part of the policies formulated. The Second Outline Perspective Plan was guided by the environmental principle of prudent management of the natural resources and the ecology, the preservation of natural beauty and a clean environment so that sustainable development can benefit the current and future generations.

The Third Outline Perspective Plan (2001-2010) also overlaps with the National Development Policy, Vision 2020 and National Policy on the Environment. The Third Outline Perspective Plan has amongst the new policy thrusts, an embodiment of the environment via the increase in the dynamism of the manufacturing sector through greater infusion of knowledge and "pursuing environmentally-sustainable development to reinforce long-term growth" (The Third Outline Perspective Plan, 2001:8). The pursuit of environmentally sustainable development has to be achieved in an integrated and holistic manner. This includes:

(i) the integrative management of land resources;

(ii) reducing pollution intensity, i.e. a paradigm shift from the current pollution abatement and clean-up approach to that of technology-retrofit where technology is used as the source to prevent pollution and reduce resource intensity. This also embraces the recycling of materials;

(iii) increased use of economic instruments with the continued implementation of the Polluter-Pays-Principle and the intensified enforcement of environmental laws and regulations to ensure compliance. This will also be abetted by the utilization of innovative economic and tax instruments; and

(iv) the establishment of environmental performance standards as a basis for integrating market forces and community engagement pertaining to environmental issues. This includes the utilization of sustainable development indicators and various environmental standards like ISO14000.

From a policy perspective, the Third Outline Perspective Plan has not only continued with the curative policy but also has embraced preventive policies via technology, by integrating market forces and community engagement as mentioned above.

Table 3.1 Malaysia's Development Policies and Plans Framework: 1955-2020

Macro Policy	Outline Perspective Plan	Plan	Industrial- specific Policy
		Report on the Economic Development of Malaya by the International Bank for Reconstruction and Development (IBRD) in 1955	
		Federal Government Report of the Industrial Development Working Party in 1957	
		First Malaysia Plan 1966-1970	
New Economic Policy (NEP) (1971-1990)	First Outline Perspective Plan (1971-90)	Second Malaysia Plan 1971-1975	
		Third Malaysia Plan 1976-1980	
		Fourth Malaysia Plan 1981-1985	
		Fifth Malaysia Plan 1986-1990	First Industrial Master Plan (1986-1995)
1. National Development Policy (1991-2000)	Second Outline Perspective Plan (1991-2000)	Sixth Malaysia Plan 1991-1995	
2. Vision 2020 (1991-2020)		Seventh Malaysia Plan 1996-2000	Second Industrial Master Plan (1996-2005)
3. National Policy on the Environment (14 November 2002 onwards)	Third Outline Perspective Plan (2001-2010)	Eight Malaysia Plan 2001-2005	
		Ninth Malaysia Plan 2006-2010	Third Industrial Master Plan (2006-2010)

3.3 Institutional Framework For The POPC And The TAPC

This section will firstly cover the common government institutional cluster for the POPC and the TAPC. The common government institutional cluster are Ministries, National Councils, statutory bodies or government agencies, state governments, city or local councils or authorities where policies and implementation apply across board for all industries concerned. This will be followed by industry-specific government institutional cluster for the POPC and the industry-specific representational organizations' cluster for both the POPC and TAPC. The purpose for doing this is to study the relationship and interlinkages between the government and the industry.

3.3.1 The Common Government Institutional Cluster for The POPC and The TAPC

The common government institutional cluster that has a direct or indirect relationship with the POPC and the TAPC can be divided into three levels:
(i) Federal level
(ii) State level
(iii) Local level

3.3.1.1 Federal Level

The governmental institutions at the Federal level that have both a direct or indirect impact on clean technology and the environment are:
(a) Ministry of Natural Resource and Environment (MNRE)
    (1) Environmental Quality Council (EQC), a national council under MNRE.
    (2) Department of Environment (DOE), a department under MNRE.
(b) Ministry of International Trade and Industry (MITI)
    (1) Malaysian Industrial Development Authority, a statutory body under MITI.
    (2) Small and Medium Industries Development Corporation (SMIDEC), a corporation under MITI.
    (3) Malaysian Industrial Development Finance Berhad (MIDF), a public limited investment bank owned by MITI.
(c) Ministry Of Finance (MOF)
    (1) Department of Standards Malaysia, a department under MOF.
    (2) SIRIM Berhad, a wholly-owned subsidiary under MOF.
    (3) Inland Revenue Board of Malaysia.
    (4) Development banks: Bank Pembangunan Malaysia Berhad (BPMB), a wholly-owned subsidiary of MOF and SME Bank, a wholly-owned subsidiary of BPMB.
(d) Ministry of Human Resources (MOHR)
    (1) Department of Occupational Safety and Health (DOSH).
(e) Ministry of Science, Technology and Innovation (MOSTI)
    (1) Malaysian Technology Development Corporation (MTDC).
(f) Ministers and Executive Councilors of the Environment (MEXCOE).

(a) Ministry of Natural Resources and Environment (MNRE)

The MNRE is the main Ministry overseeing the development of natural resources and macro environmental matters in Malaysia. This Ministry is aided by the EQC which is established under Section 4(1) of the Environmental Quality Act (EQA) 1974 to advice the MNRE with regard to matters in relation to the implementation of the EQA and concomitantly provides strategic and policy directions to the DOE (ILBS 2004).

The main roles of the then Ministry of Science, Technology and Environment (MOSTE) and the now Ministry of Natural Resources and the Environment (MNRE) in relation to the environment are to formulate policy, laws and guidelines for natural resource management and environmental conservation and at the same time monitor, coordinate, enforce and assess the implementation of the above (MNRE 2005 Online).

(a) (1) Environmental Quality Council

The role of the Environmental Quality Council (EQC) is to advise the MNRE on matters in relation to the Act and any matter referred by the Minister concerned. The EQC draws its members from the academia, the states of Sabah and Sarawak, the various related Ministries, industry representatives and non-governmental organizations. One of the industry representatives comes from the palm oil sector. This council also provides policy guidance to the DOE, which is basically involved in enforcement work in relation to the EQA.

EQA, 1974

The focus of the coverage here are laws and regulations within the EQA that are related to activities in the POPC and the TAPC. As shown in Table 3.2, the Third Schedule as contained in the Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979 [Regulation 8(1), 8(2), 8(3)] in the EQA in relation to parameter limits of effluent of Standards A and B applies to treated effluent discharge into any inland waters or onto any land for refiners and POFP manufacturers, palm kernel crushers and oleochemical manufacturers in the POPC and all the actors in the TAPC. Palm oil millers are excluded from this as the EQA has a specific regulation which will be discussed later. The parameter limits for Standard A refers to catchment areas which are areas upstream of surface or above sub-surface water for public water supply intakes meant for human consumption, inclusive of drinking. The parameter limits for Standard B applies to other areas with the exclusion of areas as stated in Standard A. The parameter limits of effluent of Standards A and B are as follow:

Table 3.2 Third Schedule In The EQA In Relation To Parameter Limits Of Effluent Of Standards A And B

	Parameter (1)	Standard: Unit (2)	A (3)	B (4)
(i)	Temperature	^{0}C	40	40
(ii)	pH Value	-	6.0-9.0	5.5-9.0
(iii)	BOD_5, at 20^0 C	mg/l	20	50
(iv)	COD	mg/l	50	100
(v)	Suspended Solids	mg/l	50	100
(vi)	Mercury	mg/l	0.005	0.05
(vii)	Cadmium	mg/l	0.01	0.02
(viii)	Chromium, Hexavalent	mg/l	0.05	0.05
(ix)	Arsenic	mg/l	0.05	0.10
(x)	Cyanide	mg/l	0.05	0.10
(xi)	Lead	mg/l	0.10	0.5
(xii)	Chromium, Trivalent	mg/l	0.20	1.0
(xiii)	Copper	mg/l	0.20	1.0
(xiv)	Manganese	mg/l	0.20	1.0
(xv)	Nickel	mg/l	0.20	1.0
(xvi)	Tin	mg/l	0.20	1.0
(xvii)	Zinc	mg/l	2.0	2.0
(xviii)	Boron	mg/l	1.0	4.0
(xix)	Iron(Fe)	mg/l	1.0	5.0
(xx)	Phenol	mg/l	0.001	1.0
(xxi)	Free Chlorine	mg/l	1.0	2.0
(xxii)	Sulphide	mg/l	0.50	0.50
(xxiii)	Oil and Grease	mg/l	Not Detectable	10.0

Source: ILBS 2004: 121.

Palm oil millers, on the other hand have to abide by the Second Schedule as contained in the Environmental Quality (Prescribed Premises) (Crude Palm-Oil) Regulations, 1977, (Regulation 12 (2) and (3)) in the EQA in relation to parameter limits for watercourse discharge. These regulations are focused specifically on palm oil milling or the production of crude palm oil (CPO). As seen from Table 3.3, the parameter limits for watercourse discharge over six periods of time highlight the government-industry relationship in pollution abatement. In the early 1970s, when there was no effective treatment technology developed for POME was discovered yet, the higher BOD load was allowed. Once an effective treatment system was found and gradually adopted by palm oil millers, the parameters were eventually tightened as shown in Table 3.3. However, the Director-General can impose a more stringent limit if he or she considers it necessary. The pilot survey reveals that for a particular mill in Pahang, the BOD parameter is 20 mg/l or ppm or less for treated POME to be discharged into waterways. The polluter pays principle is also applied where for watercourse discharge on or after 1 July 1979, an amount of RM10 per metric tonne or part of a metric ton imposed with a BOD concentration effluent limit as determined by the Director General by way of license condition. For treated POME to be discharged onto land, every license issued before but expiring on 1 July 1979 and also on and after this date must have a BOD maximum concentration limit of 5000 ppm. The polluter pays principle also applies for watercourse discharge on land on 1 July 1979 where an amount of RM50 per thousand metric tons or part of a thousand metric tons imposed with a BOD concentration effluent limit as determined by the Director General by way of license condition.

Table 3.3 Second Schedule in the EQA in Relation to Parameter Limits for Watercourse Discharge for Palm Oil Millers

Parameters	Limits According To Periods of Discharge					
	1-7-1978-30-6-1979	1-7-1979-30-6-1980	1-7-1980-30-6-1981	1-7-1981-31-12-1982	1-7-1982-31-12-1983	1-1-1984-and thereafter
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Biochemical Oxygen Demand (B.O.D.) 3-day,30^{0}C; mg/l	5,000	2,000	1,000	500	250	100
Chemical Oxygen Demand (C.O.D.); mg/l	10,000	4,000	2,000	1,000	-	-
Total Solids; mg/l	4,000	2,500	2,000	1,500	-	-
Suspended Solids; mg/l	1,200	800	600	400	400	400
Oil and Grease; mg/l	150	100	75	50	50	50
Ammoniacal Nitrogen; mg/l	25	15	15	10	150*	150*
Total Nitrogen; mg/l	200	100	75	50	300*	200*
pH	5.0-9.0	5.0-9.0	5.0-9.0	5.0-9.0	5.0-9.0	5.0-9.0
Temperature ^{0}C	45	45	45	45	45	45

*Note: * Value of filtered sample.*
Source: ILBS 2004: 59.

Air quality comes under the ambit of the Environmental Quality (Clean Air) Regulations, 1978 in the EQA. The permissible dark smoke limit of any color from a new facility with the exception of fuel burning equipment using solid fuel should not be darker than Shade No. 1 on the Ringelmann Chart. However, for existing facilities, the permissible dark smoke limit is Shade No. 2 on the Ringelmann Chart. This regulation is enforced on all the actors in the POPC with the exception of palm oil millers, and all the actors in the TAPC. For palm oil millers, the fuel burning equipment utilizes solid fuel and as such this regulation does not apply.

Another regulation that is applicable to all in the POPC and TAPC is smoke emission in aggregate of less than five minutes in any period of an hour provided that it does not exceed the aggregate of 15 minutes within any period of 24 hours.

In the EQA, air impurities encompasses smoke, soot, dust, ash (including flyash, cinders, grit, solid particles of any kind inclusive of particulates, gases, fumes, mist, odors and radioactive substance). The total mass of solid particles concentration before admixture with air, smoke or other gases must not exceed Standard A:0.6 gram, Standard B:0.5 gram and Standard C:0.4 gram for each normal cubic meter of effluent gases. A new facility must comply with Standard A and for existing facility, the compliance with Standard A is within the stipulation of two years and Standard B within three years the date the regulations come into force. These regulations also allow for direct compliance with Standard B for existing facilities, a more stringent regulation, and also for accelerated compliance in justified cases of complaints and nuisance evidences.

(a)(2) Department of Environment (DOE)

The DOE, in turn, is the main implementer i.e. enforcement and monitoring of the EQA 1974. The DOE at the Federal level is located at Putrajaya whereas for each of the 14 states in Malaysia, there is a local state DOE office with the exception of the Federal Territory where there is a local DOE office at the Federal Territory of Labuan and also at the Federal Territory of Kuala Lumpur. The State DOE has on occasions held dialogues with industry associations in the development and implementation of environmental policies like Zero Burning and Zero Waste.

However, the enforcement of EQA 1974 is not without its problems. A DOE report in 1986 indicated that even though the maximum allowable fines were high, the actual amount paid for non-compliance was relatively low. This implies that it is much more convenient and cheaper to flout the regulations than to comply with the parameters (Sham Sani, 1997). Till today, the problem of low fine has still persisted. Enforcement of the EQA is also compounded by the lack of resources, especially human resources in the DOE, for effective implementation of environmental management (Farah Naz Karim 2006).

The DOE has also formulated the Guidelines on the Siting and Zoning of Industries 1976, which was later revised in 1994 with regard to noise at the factory boundary fence. The noise at the factory boundary fence, according to this guideline, should not exceed the following levels:-

Regulatory Provision	Regulation Number/Order
60 dBA during day-time	7 am – 10pm
50 dBA during night -time	10pm – 7 am

Source: DOE Guidelines on Siting and Zoning of Industries, 1976 (revised 1994).

(b) Ministry of International Trade and Industry (MITI)

The MITI which basically oversees the promotion and safeguarding of Malaysian interest in international trade, spurring the development of industrial activities, and enhancing Malaysian economic growth so as to realize Vision 2020. (MITI, Online). Malaysia, being a member of the World Trade Organization, is represented by MITI in the trade talks in which MITI will address environmental concerns raised on such platforms. MITI has played a role in promoting and safeguarding the interest of the POPC and the TAPC. MITI's contribution to the palm oil sector is by promoting the international trading of palm oils and fats and concomitantly encouraging value-added downstreaming of the said industry. This Ministry, at times, has also come to the defence of the palm oil sector when environmental and health issues are raised in the international arena. MITI, together with the Ministry of Plantation Industries and Commodity, at the supranational level, have time and again come to the defence of the oil palm and palm oil sector, especially when provocative environmental and health issues from a Malaysian perspective, are raised in the international arena.

For the TAPC, MITI has played a role in the then Multi-Fiber Agreement, which expired at the end of 2005, by negotiating and obtaining Malaysian quota, and in turn dividing the quota amongst existing textile and apparel firms in Malaysia. Under the Multi-Fiber Agreement, each country is given a quota for its export to the USA and Canada, European Economic Commission and Turkey. With the passage of time, the expiry of the quota system under the Multi-Fiber Agreement that did not give rise to fair international competition has resulted in freer trade and a more competitive climate with China eating into the international market share. At this point in time, MITI is basically overseeing the international trading of textile and apparel under the World Trade Organization regime of fair international trade, where bilateral and regional free trade agreements when concluded would be a boon to the TAPC.

The agencies under MITI that has a direct or indirect impact on both the chains and directly or indirectly on the environment is Malaysian Industrial Development Authority (MIDA) which will be discussed below.

(b)(1) Malaysian Industrial Development Authority (MIDA)

Malaysian Industrial Development Authority (MIDA) oversees the promotion and coordination of industrial development in Malaysia. Inclusive in this are direct and indirect environment-related projects that are either preventive or curative in terms of environmental management. MIDA is the agency responsible for the approval of manufacturing licenses under the Industrial Coordination Act (ICA) 1975 for a balanced and healthy growth for the manufacturing sector in Malaysia. Manufacturing companies with shareholders' funds of RM2.5 million and above, and also employing 75 or more full time employees, are mandatory to apply and seek approval for a manufacturing license from MIDA (MIDA 2003). A licensed company that seeks to expand production capacity or add new manufactured products also has to seek approval from MIDA.

MIDA is also the agency responsible for the processing and approval of incentives, inclusive of direct and indirect environment-related incentives for the manufacturing sector. The incentives for the manufacturing sector come under the ambit of the Promotion of Investments Act 1986 (MIDA, 2003). The incentives for high technology companies are in relation to promoted activities and products which also incidentally are related to activities in the POPC and TAPC. Incentives for environmental protection, and research and development apply across board for all companies. The terms and conditions for these incentives are found in Appendix 1. Below is the list of incentives that is applicable to both the POPC and the TAPC in relation to technologies that can directly or indirectly lead to better environmental management.

1. Incentives for High Technology Companies

A high technology company is classified based on its engagement in promoted activities or the production of promoted products with new and emerging technologies. A high technology company is eligible for:

(i) Pioneer status
(ii) Investment Tax Allowance

If however a Malaysian owned company were to acquire a foreign owned company based abroad for the purpose of acquiring high production technology or to tap new export market for local products, an annual allowance of 20% on acquisition cost would be granted for the next 5 years.

Table 3.4 lists the promoted activities and promoted products that are applicable to the POPC and the TAPC for high technology companies that are eligible for Pioneer Status and Investment Tax Allowance under the Promotion of Investments Act 1986.

Table 3.4 List of Promoted Activities and Products for the High Technology Companies Which Are Eligible For Consideration of Pioneer Status and Investment Tax Allowance Under the Promotion of Investments Act 1986

Type of production chain	List of Promoted Activities and Products for the High Technology Companies which are eligible for consideration of Pioneer Status and Investment Tax Allowance under the Promotion of Investments Act 1986
POPC	Biotechnology o Development, testing and production of • Fine chemicals • Food or food ingredient • Feed or feed supplements o Development and production of • Biopolymers • Biomaterials o Development and production of biotechnology processes for waste treatment Alternative Energy Sources • Renewable energy
TAPC	Biotechnology o Development and production of • Biopolymers • Biomaterials (as in the case of Ramatex by utilizing corn for making fiber).

Source:MIDA 2003.

If companies were to adopt any of the high technologies above, it would lead to better environmental management and value added production via biotechnology and also value added down-stream activities. In the area of biotechnology for the POPC, the utilization of biomass waste to generate high value added biomaterials or bio-products, and also the application of palm oil, a renewable resource, in bio-fuel development leads to better environmental management. Likewise, for the TAPC, the development and higher utilization of biomaterials can lead to the reduction or substitution of man-made feedstock in the production of fiber. As biomaterial is renewable and easier to degrade, its utilization, in itself, will lead to better environmental management.

2. Incentives for Environmental Protection

The incentives for environmental protection for both the POPC and the TAPC under the Promotion of Investments Act1986 are either:

(i) Pioneer Status
(ii) Investment Tax Allowance

The choice of either Pioneer Status or Investment Tax Incentive is applicable for the activities as listed below:

- storage, treatment and disposal of toxic and hazardous waste. These incentives are offered so as to encourage companies to set up proper facilities to store, treat and dispose of toxic and hazardous wastes in an integrated manner.
- energy conservation
- dual purpose of reduction in operational cost as well as environmental preservation.
- waste recycling activities
- waste recycling activities that are high value-added via the application of high technology. These activities also encompass the recycling of agricultural wastes and chemicals.
- use of renewable energy resources
- use biomass in the generation of energy as biomass is a renewable cum environmentally friendly resource. Energy generated can be in the form of electricity, steam, chilled water and heat.

The incentives for the storage, treatment and disposal of toxic and hazardous waste are applicable to both the POPC and the TAPC. The refining sub-sector in the POPC produces spent bleaching earth in the production process, which is classified as hazardous waste whereas the oleochemical manufacturing activity produces spent catalysts. For the TAPC, the dyeing and printing activity produces wastewater that contains many hazardous and toxic chemicals. The dyeing and printing activity is the most polluting in the TAPC. A proper set-up of integrated facilities to store, treat, and dispose toxic and hazardous waste will go a long way in improving environmental management. Likewise, the incentives for energy conservation are applicable to both these sectors. However, the incentives for waste recycling activities and the use of renewable energy resources are much more pertinent to the POPC. Palm Oil Mill Effluent produced by the palm oil milling activity, a major source of pollution and the most polluting in the POPC, can benefit from these incentives as MPOB has the technology to convert this effluent to fertilizer and together with water recovery form the liquid waste, is able to meet half the operational demand of a palm oil mill. However, these incentives would not be relevant for the feedstock wastes of the TAPC as fiber waste, yarn waste and clothe waste are not voluminous in nature and is either disposed off at sanitary landfills or recycled for fairly low-value added products like rag cloth and mats (from waste cloth). However, if wastes from other sectors, like wood wastes, are used as solid fuel for boiler operation, then this incentive is applicable.

Biomass and biomass wastes are produced in a voluminous nature from the palm oil milling process. Biomass, in the form of shell and fiber, is mainly used as fuel for the boiler, whereas the empty fruit bunches are used for mulching purposes in the field. Likewise, biogas from biomass waste can be utilized to generate electricity. These resources, in turn, can be used to generate electricity, which can then be supplied to the national grid. The Federal Government has a green energy policy where 5% of total energy produced should come from renewable sources. However, this is dependent on Tenaga, the national electricity supplier in Malaysia, as to whether to purchase such energy as it is more costly as compared to the conventional form of energy generation that utilized coal, petroleum related oils and gas.

3. Incentives for Research and Development

Research and Development is defined in the Promotion of Investments Act 1986 as "any systematic or intensive study carried out in the field of science or technology with the object of using the results of the study for the production or improvement of materials, devices, products, produce or processes, but does not include:

- Quality control of products or routine testing of materials, devices, products or produce
- Research in the social sciences or humanities
- Routine data collection, efficiency survey or management studies
- Market research or sales promotion

The main incentives for Research and Development that are applicable for the POPC and the TAPC are:

(i) Research and Development Company
(ii) In-house Research

These two incentives for Research and Development, if applied by companies in the POPC and the TAPC can lead to production efficiency and new value-added down-stream products. Production efficiency leads to better utilization of inputs with lesser wastage and rejects and indirectly relates to better environmental management. Likewise, new higher value-added downstream products are linked to better utilization of scarce economic resources, which in turn indirectly leads to better environmental management. However, for the POPC, which generates voluminous amount of biomass, the ability of turning the biomass into new products not only creates new higher value added down-stream products but also helping rid of some of the environmental problems facing the industry. A good example is the conversion of POME into economic resources or products. For the TAPC, research and development, as mentioned earlier, can lead to the development of bio-yarn, dyes that are less polluting, utilization of less water in the dyeing process, and better effluent treatment systems.

(b)(2) Small and Medium Industries Development Corporation (SMIDEC)

SMIDEC is the principal agency in the development of small and medium-scaled enterprises in the manufacturing sector. SMIDEC, established in 1996, under the purview of MITI, is tasked with the coordination of small and medium-scaled enterprises' programs delivered through nine Ministries and 22 government agencies (SMIDEC 2002). SMIDEC is the secretariat for the Industrial Technical Assistance Fund (ITAF), the largest and most popular government grant scheme. ITAF 2 provides grants for product and process improvement including environment-related projects. ITAF 3 provides grants for productivity and quality improvement and certification schemes like the ISO 9000 standards and the ISO 14000 standards.

(b)(3) Malaysian Industrial Development Finance Berhad (MIDF)

Malaysian Industrial Development Bank (MIDF), as a public limited investment bank owned by MITI, has a wide range of investment banking related activities (MIDF Online 2007a). One of its financing activities is development financing, which provides medium and long-term financing for new projects, expansion, modernization and relocation programs for manufacturing including environment related activities, manufacturing-related services, infrastructure and utilities, and tourism sectors in Malaysia (MIDF Online 2007b).

(c) Ministry of Finance (MOF)

The main roles of the MOF are the formulation and implementation of fiscal and monetary policies in ensuring effective and efficient distribution and management of financial resources. At the same time, government expenditure via fiscal allocation on environment-related projects are disbursed to the respective ministries, mainly to the MNRE, which in turn will provide the allocation to the respective departments and government agencies under their own hierarchical structure. The Internal Revenue Board the Department of Standards Malaysia, SIRIM Bhd and development banks are the government bodies under the MOF hierarchical structure which directly and indirectly impact on both chains as well as directly and indirectly impact on the environment.

(c)(1) Department of Standards Malaysia (DSM)

The main role of the Department of Standards Malaysia (DSM), as the national standardization and accreditation body, is to "foster and promote standards, standardization and accreditation as a means of advancing the national economy, promoting industrial efficiency and development, benefiting the health and safety of the public, protecting the consumers, facilitating domestic and international trade and furthering international cooperation in relation to standards and standardization" (Malaysian Standard MS 1514 : 2001, DSM). A Malaysian Standard is developed by consensus through a committee which comprises of the producers, users and other relevant parties. The standards developed are governed by the Standards of Malaysia Act 1966 (Act 549) which are reviewed periodically. The utility of Malaysian Standards is voluntary unless is made mandatory by regulatory authorities. SIRIM Bhd is the agent appointed by the Department of Standards Malaysia for the development of Malaysian Standards and also the distribution and sale of Malaysian Standards. The promotion of standards, inclusive of Malaysian Standards in the areas of ISO 9000 standards, ISO 14000 standards, ISO 18000 standards (Occupational Safety and Health) and ISO 22000 standards (HACCP) by MITI, MNRE and the Ministry of Plantation Industries and Commodities, help to develop the national psyche amongst the local companies that such standards are a prerogative in international trade, especially to developed regions. These standards, which are preventive in nature, help put in place production processes and products that meet traceability requirements, quality, food safety, occupational safety and health and environmental standards.

(c) (2) SIRIM Berhad

SIRIM Berhad, a wholly government-owned company under the Ministry of Finance Incorporated, came into operation on 1 September 1996. SIRIM Berhad plays a pivotal role in the provision of the necessary vehicle for technology transfer via institutional and technical infrastructural-support mechanisms. The three main business portfolios of SIRIM Berhad are: (i) research and technology development, which includes environmental and energy technologies, (ii) standardization which includes MS ISO 9001 standard, QS 9000 standard, MS ISO 14001 standard, OHSAS 18001 standard, and (iii) technology transfer.

Research and development services in the area of process technology includes environmental and energy technology. Research and development activities in environmental and energy technology encompasses sustainable waste treatment and management processes and systems, in addition to clean, efficient energy utilization and management for industrial application.

SIRIM Berhad, designated as the national standards development agency by the Department of Standards Malaysia (DSM), manages the national standards development infrastructure. Under its purview are 20 Industry Standards Committees, 14 appointed Standards Writing Organizations and 234 Technical Committees reporting to the Industry Standards Committees (SIRIM Berhad 2004). Some of the Industry Standards Committees, Standards Writing Organizations and Technical Committees are involved in the planning, drafting and finalization of the standards for palm oil and textile and apparel related products.

SIRIM Berhad's active participation in the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC) and Codex Alimentarius Commission has resulted in the appointment of SIRIM Berhad into the ISO Governing Council (1991-93 and 1995-96) and also into the ISO Technical Management Board (1996-97). SIRIM Berhad also represented Malaysia in the APEC Standards and Conformance Sub-Committee and the ASEAN Consultative Committee on Standards and Quality.

The involvement of SIRIM in standards and quality assurance program has resulted in it being accepted as an inspection agent for 20 foreign quality certification agencies from 12 countries including United Kingdom, Canada, China and Japan. This aids Malaysian manufacturers in the export of Malaysian products to the overseas market.

(c)(3) Inland Revenue Board of Malaysia (IRBM)

The Internal Revenue Board acts as the government agent in administering, assessing, collecting and enforcing payment of taxes. The tax incentives discussed below are not sector specific and are applicable to companies that are domiciled in Malaysia. For such incentives, the applications need to be submitted to the Internal Revenue Board. These tax incentives can lead to direct and indirect contribution to environmental management. The terms and conditions for these tax incentives are found in Appendix 2.

- **Reinvestment Allowance for the Manufacturing Sector**
  The eligibility of Reinvestment allowance is for the expansion of production capacity, modernization and upgrading production facilities, product diversification and automation of production facilities.

- **Accelerated Capital Allowance**
  After the expiry of the Reinvestment Allowance that runs consecutively for 15 years, a company can apply for Accelerated Capital Allowance if it continues to reinvest in the manufacture of promoted products.

  The Reinvestment Allowance and the Accelerated Capital Allowance have the capacity to improve efficiency and also moving into value-added down-stream products. The move down-stream can also lead to better industrial linkages in the form of a more vertically integrated structure. As both the POPC and the TAPC are both basically export-oriented, a move towards a more vertically integrated structure will put the companies nearer to or in the export markets. As such the demands of the export markets will impinge on the requirements of a supplier in terms of its business conduct and operation.

- **Double Deduction for Research and Development**
  Companies are eligible for double deduction on non-capital expenditure for research and development activities that are approved by the MOF.

  This incentive can spawn the possibility of new technology for environmental protection, increasing the efficiency of production processes, and product development that abets the creation of new value-added downstream products. If these possibilities were to realize, this incentive can lead to better environmental management.

- **Accelerated Capital Allowance for Environmental Protection Projects and Equipment**
  The Accelerated Capital Allowance is eligible for a company which must abide by the following criteria:
  - o The company is a waste generator and will undertake the establishment of facilities to store, treat and dispose of their own wastes, either on-site or off-site.
  - o The company must undertake waste recycling activities.

  Accelerated Capital Allowance is also applicable for energy conservation projects. This allowance is also applicable for investment in environmental protection equipment.

  If any company pursues this incentive, it will definitely lead to better environmental management as wastes are turned into recycled materials, which in turn help in the conservation of limited resources. For the incentive that is related to energy conservation, this would have a positive impact on environmental management as energy is a valuable and limited resource and a higher level of utilization can have a knock on effect on air pollution and global warming.

- **Incentive for the Implementation of RosettaNet**
  RosettaNet is an open Internet-based common business messaging standard that enables supply chain management link-up with global suppliers. The expenditure and contributions by companies in the form of equipment, salaries for full-time staff seconded to RosettaNet Malaysia, software contribution, software sharing and programming, and staff training of local small and medium-scale companies in using RosettaNet qualify for this incentive.

  The Incentives for the Implementation of RosettaNet has the ability to enhance local and international collaboration as local companies are linked-up with global suppliers, mainly multinationals, which in turn can contribute directly or indirectly to better environmental management. As multinationals are present in a host of countries, collaboration with local companies in terms of meeting environmental related requirements can lead to better environmental management.

(c)(4) Development Banks Owned By The MOF

Bank Pembangunan Malaysia Berhad (BPMB) is a development bank wholly-owned by the MOF (BPMB Online 2007a). This development bank provides financing for infrastructure, maritime and high technology projects. Amongst the target sectors that are environment-related are: (i) bio-technology, which includes the development and production of biomaterials and biopolymers, as well as the development and production of bio-technology processes for waste treatment and (ii) alternative energy sources like renewable energy. Another target sector that is related to this research is food production and food processing which encompasses the development, testing and manufacturing of food products using emerging technologies and advanced manufacturing systems (BPMB Online 2007b).

Small and Medium-scaled Enterprises (SME)Bank, formerly known as Bank Industri Malaysia Berhad, is a wholly-owned subsidiary of BPMB. As a development bank, SME Bank is a one-stop financial centre to meet the unique financial needs of small and medium-scaled enterprises including environment-related financing (SME Bank Online 2007).

(d) Ministry of Human Resources (MOHR)

The main functions of the MOHR are employment matters, industrial relations, social security, worker's welfare, skills development, and increasing employment opportunities. A department under the MOHR which has an environmental impact from the "human-ecological" perspective is the Department of Occupational Safety and Health. This department would be discussed below.

(d)(1) Department of Occupational Safety and Health (DOSH)

The DOSH started off as the Machinery Department with the enactment of the Machinery Ordinance 1953. The enactment of this ordinance led to the development of a Board of Inspectors with the power to conduct inspections and approve certificate of fitness with regard to machineries and persons operating the machineries. The roles of the inspectors covered not only steam boiler or machinery safety but also all aspects of workers' safety in the handling of those machineries. This ordinance lacked a comprehensive coverage of workers' health despite having regulations on safety, health and welfare of workers. The Factories and Machinery Act (FMA) was approved by Parliament in 1967 and the FMA and eight regulations were enforced from 1970 till today. The enactment and enforcement of the FMA led to a name change to that of the Factories and Machinery Department (DOSH Online 2007). This act was drafted to provide minimum standards of workers' safety, health and welfare at the workplace with five employees or more. However, this act only covers machinery used at the manufacturing, mining, quarrying, and construction sectors. A new legislation in the form of the Occupational Safety and Health Act (OSHA) 1994 was approved by Parliament in 1993 and gazetted in 1994. This legislation was expanded to all sectors with the exception of those working on ships and in the armed forces. The OSHA will supersede any existing legislation like the FMA if conflicts were to arise. However, the permissible exposure limit for ambient noise as specified in the FMA is relevant for this research as there is no such provision in the OSHA. The permissible exposure limits to noise under the Factories and Machinery (Noise Exposure) Regulations 1989 are as follow:-

Part II Section 5. (1) No employee shall be exposed to noise level exceeding equivalent continuous sound level of 90 dB (A) or exceeding the limits specified in the First Schedule or exceeding the daily noise of unity.

(2) No employee shall be exposed to noise level exceeding 115 dB (A) at any time.
(FMA 2004: 406).

The First Schedule as mentioned in Part II Section 5 is as follows:-

Table 3.5 FIRST SCHEDULE
(Regulation 5 (1))
Permissible Exposure Limits

Noise Level(dB (A) – slow)	Duration of Exposure Permitted per day (hours-minute)
85	16-0
86	13-56
87	12-8
88	10-34
89	9-11
90	8-0
91	6-58
92	6-4
93	5-17
94	4-36
95	4-0
96	3-29
97	3-2
98	2-50
99	2-15
100	2-0
101	1-44
102	1-31
103	1-19
104	1-9
105	1-0
106	0-52
107	0-46
108	0-40
109	0-34
110	0-30
111	0-26
112	0-23
113	0-20
114	0-17
115	0-15

Source: Factories and Machinery Act with Regulations 2004: 414-415.

The primary purpose of OSHA is the promotion and adoption of effective occupational safety and health measures by workers including self-employed workers and employers. There are three underlying principles in this Act. The first principle of self-regulation is for employers to develop a good and orderly occupational safety and health management system. The second principle is the consultation amongst the tripartite parties, namely the employees, the employers, and the government in the negotiation process to settle occupational safety and health issues and problems. The third principle is the cooperation between the employers and employees in nurturing and increasing the quality of occupational safety and health in the workplace. The Factories and Machinery Department also has to undergo a name change to that of DOSH to reflect on the new legislation. The main functions of DOSH are the study and review of policies and legislations of occupational safety and health, the enforcement of OSHA 1994 and its regulations, FMA 1967 and its regulations, and part of the Petroleum Act 1984 (Safety Measures) and its regulations, and the provision of advisory service and information to the government and the private sector in relation to management and technical aspects of occupational safety and health.

(e) Ministry of Science, Technology and Innovation (MOSTI)

After the environment portfolio has been transferred to the MNRE as mentioned above, the then Ministry of Science, Technology and Environment became Ministry OF Science, Technology and Innovation (MOSTI). The main foci of MOSTI are the awareness, understanding and appreciation played by the role of science and technology as well as the implementation of research and development in the field of science and technology. A government agency under its purview that is directly or indirectly related to environment-related matters will be discussed below.

(e)(1) Malaysian Technology Development Corporation (MTDC)

MTDC was incorporated on 10 March 1992 as a corporation under MOSTI to spearhead the development of Malaysian technology business (MTDC Online 2007a). MTDC as an integrated venture capital company provides financing from the laboratory to full commercialization. The core activities provided by MTDC are technology financing, provision of government grants, technology incubation and consulting (MTDC Online 2007b).

One of the grant schemes managed by MTDC is the Technology Acquisition Fund (TAF). This fund is to facilitate the acquisition of strategic and relevant technology for the Malaysian industrial sector. A partial grant is provided to acquire new technology to enhance the technological and production processes including environmental related activities (MTDC Online 2007c).

(f) Ministers and Executive Councillors of the Environment (MEXCOE)

MEXCOE, a coordinating institution between the Federal and State Level focuses on environmental matters. MEXCOE is chaired by the Minister from the MNRE and consists of Ministers (for the state of Sabah and Sarawak) and Executive members from the various states that are responsible for the environment portfolio. This committee is constituted to coordinate, discuss and negotiate environmental matters as land matters are managed by the State Governments.

3.3.1.2 State Pollution or Environmental Committee

At the state level, the State Pollution or Environmental Committee which reports to the State Executive Council is chaired by the Ministers (for the state of Sabah and Sarawak) or Executive Councillor holding the environment portfolio. Members of this Committee comprise of heads of department or unit at the state level. Amongst others, the heads of the State Economic Planning Unit, the State Department of Environment, the State Forestry Department, the Town and Country Planning Department, and the Department of Wildlife and National Parks are in this Committee. This Committee is the conduit for incorporating environmental consideration in the state development programmes. As each state faces different environmental problems and issues, the operations of this committee come in various forms (International Development Centre of Japan, 1993).

3.3.1.3 Local Authorities

At the local level, the administrative and implementation arm of the State Government is undertaken by the Local Authorities. Local Authority comes in the form of City Hall, Municipal Council and District Council (Suzanna Mohammed Isa, 2006). Local authorities are empowered to manage the environment directly via control over local activities and indirectly by land use planning (Jamaluddin Md Jahi 1999). Each local authority has to prepare a structural plan, a local plan every five years for the Ministry of Housing and Local Government with inputs from the Department of Environment's officer, taking into account the environmental perspective. Factories or production plants have to interface with the Local Authority with regard to factory siting to fulfill zoning requirement, waste disposal, local license (for operating a business concern) and all matters pertaining to land and waterways. As the Local Authorities issue license for the conduct of business, the Local Authorities have the right to inspect factory premises and in tandem environmental matters like the proper disposal of industrial wastes. If firms were to indiscriminately dump the industrial wastes on and in land as well as waterways, the Local Authorities can impose fines for violation and in serious cases withdraw the license and close the premises of the offending parties, thus effectively shutting down operation.

However, if the Local Authority has a shallow pocket or small in terms of revenue, environmental matters are of the least concern (Jamaluddin Md Jahi 1999). The Local Authorities constantly claim that their short-handedness always result in lack of enforcement. This is also substantiated by claims from the public that the local authorities are dragging their foot and are very lax in enforcement against the polluters. At the same time, the local by-laws do not have criteria and standards for enforcement work. As Local Authorities come under the state government bureaucratic structure, the Ministry of Housing and Local Government can only advise and has no capacity to impose implementation measures in compliance with the National Environmental Policy. Even though the Local Authorities are under the purview of the State Government, this is also compounded by the problem that the Executive Council members of the Local Authorities are political appointees and not elected representatives and thus their loyalty is towards their political masters. As such, environmental matters may be put to the back burners for expediency purposes.

Resident Associations and Village Committees

The community, which is living in a particular locality, has Resident Association/s, Village Committee(s) or a combination of both, serving their local interest. In very urban areas, like Kuala Lumpur, more often than not, Resident Association/s will be serving the social and community interest whereas in suburban areas, a combination of Resident Association/s and Village Committee(s) will co-exist side by side. In rural areas, the Village Committee(s) is the representative voice. The Village Committee, can also be considered as part of the state government hierarchy as the appointed headman is also provided with remuneration by the state government. These Village Committees act as the eyes and ears of a particular local authority and state government (Dass 2007). The Resident Association and the Village Committee can be vocal if matters related to their well-being are affected. Issues like indiscriminate dumping, and water and air-borne pollutants, noise pollution emitted by factories in the neighbourhood are very quickly reported, in most cases, to the authorities like the Department of Environment, the Department of Safety and Health (for noise pollution as a result of production using machinery) and the City Council, Town Council or District Council. As most, if not all the Resident Associations and Village Committees have political affiliation with the parties in the National Front, the government of the day, such complaints will be given their due consideration.

3.3.1.4 The Conundrum of Overlapping Responsibilities And Ineffective Environmental Policing

From a bureaucratic structural process, the cascading of policies adopting a top-down approach should result in alignment but in reality, dichotomies do appear as land and waterway come under the purview of the state government. Federal policies in general and national environmental policies in particular may not be adopted lock, stock and barrel, partially adhered to or totally neglected by the state governments. The hands of the Federal Government are to a certain extent bounded as land is a state matter and the Federal government has no jurisdiction over it. As in matters pertaining to the environment, the Federal Department of Environment is represented by the state Department of Environment and matters judicial to it are governed by the Environmental Quality Act 1974. As a case in point, this also gives rise to ambivalency or overlapping responsibility as pollutants discharged into the rivers technically comes under the jurisdiction of both the state government via the local authority as well as the state Department of Environment However, river management solely comes under the jurisdiction of the local authorities. This overlapping responsibility should result in closer or tighter scrutiny but in reality the oft quoted claim (Salleh Buang 2006) that both the Department of Environment and the Local Authorities are so short of staff that it prevented effective implementation of environmental policing.

3.3.2 Industry–Specific Government Institutional Cluster For The Palm Oil Production Chain

The governmental institutions at the Federal level that have both a direct or indirect impact on the palm oil production sector is:
Ministry of Plantation Industries and Commodities (MPIC)
a. Malaysian Palm Oil Board (MPOB), a statutory body under the MPIC
b. Malaysian Palm Oil Council, a council under the MPIC

3.3.2.1 Ministry of Plantation Industries and Commodities (MPIC)

The MPIC oversees on an overall basis the development of the plantation industries and the production of related commodities which includes the downstream sector. (MPIC Online 2004). The MPIC has given the palm oil sector priority attention as this sector is one of the biggest contributors to the Gross Domestic Product (GDP). The MPIC is also primarily the first line of defence for this sector when sector specific environmental and health issues are raised (MPIC Online 2004).

The Ministry of Plantation Industries and Commodities (MPIC) as the name suggests, covers all agro-industries of which the palm oil production chain is one (MPIC, Online, 2004). Its responsibility encompasses production, processing, marketing and research for primary commodities like palm oil, rubber, wood and wood-based products, cocoa, pepper and tobacco (MPIC Online 2004). As the oil palm and palm oil sector is at the apex in terms of importance amongst the plantation industries and primary commodities, the Federal government and the relevant ministries, including the MPIC have given the oil palm and palm oil sector very heavy attention in terms of policy formulation and implementation, with due attention given to environmental matters. The MPIC, together with the MITI are also tasked with protecting national interest with regard to the well being of the plantation industries and commodities, especially the oil palm and palm oil sector. These two ministries have countered the concerted efforts by the soybean lobby in USA to discredit palm oil as being not a healthy oil, and the environmental related issue of deforestation and loss of bio-diversity as a result of oil palm cultivation.

(a) Malaysian Palm Oil Board (MPOB)

The Malaysian Palm Oil Board (MPOB), established on 1st May 2000 by an Act of Parliament and under the Ministry of Plantation Industries and Commodities' hierarchy, has taken over the functions of Palm Oil Research Institute of Malaysia (PORIM) and the Palm Oil Registration and Licensing Authority (PORLA). The MPOB Board comprises a Chairman and 12 board members which govern MPOB. The 12 board members appointed by the MPIC include a representative each from the MPIC, MOF, MITI, Federal Land Development Authority (FELDA), National Association of Smallholders (NASH), Malaysian Palm Oil Association (MPOA), Palm Oil Millers' Association (POMA), Palm Oil Refiners' Association (PORAM), Malaysian Oleochemical Manufacturers' Association, Sarawak State Government and Sabah State Government, and the Director General of MPOB (Malaysia Palm Oil Directory 2003-2004: 45).

MPOB is also the regulatory and licensing authority for the industry. In addition, MPOB collects cess of RM11 from the palm oil millers and palm kernel crushers on the basis of every tonne of Crude Palm Oil and Crude Palm Kernel Oil produced to fund its activities. Funding also comes from the Intensification of Research in Priority Areas (IRPA) for approved projects provided by the Federal Government's budget allocation. The MPOB is also given the role to enhance the well-being of the Malaysian oil palm industry through research, development and ancillary services so as to ensure the viability and sustainability of this sector. On this regard, MPOB with the support of the Programme Advisory Committee which comprises of eminent scientists and experts from local and abroad would review the research programs and proposals and provide recommendations for future research. MPOB has adopted a three prong research and development strategy, namely high income strategy, zero waste strategy and value-addition strategy. High income strategy is to increase oil palm and palm oil productivity through modern production processes and good management practices. Zero waste strategy is the optimization of biomass utilization as recycling inputs for plantations, production of commercial products, and energy generation. Value-addition strategy is downstream research and development to enhance the value chain of edible and non-edible palm based products.

As of 2005, the MPOB has developed 300 new technologies, inclusive of both intermediate and end products. The types of technologies developed thus far by MPOB are related to the food, oleochemical-based products, planting materials, farm machinery, milling and analytical equipment, nutraceuticals, fiber products and other palm based products. A number of these technologies have also contributed both directly and indirectly to clean technology/production. A good example is the closed loop evaporation technology invented by MPOB. This zero waste technology has the capacity to totally eliminate palm oil mill effluent (POME), a liquid waste, and converting the remnants into fertilizer. This technology is very environmentally friendly as the water recovered from evaporation is adequate to meet nearly half of the water requirement to run a mill. The new technologies developed by MPOB are also used to counter arguments that palm oil is not a healthy oil.

The technologies from MPOB are made available on a number of platforms. One of the means of technology transfer is in the form of licensing in which patent, know-how, process data specifications etc are given to the licensee/s for a fee. One of the main grouses by industry players is that cess payment for a ton of crude palm oil or crude palm kernel oil produced goes into the coffers of MPOB, but at the same time, the acquisition of technology from MPOB is also borne by the industry players who indirectly funded the research. Exclusive acquisition of technology means that the rights and patents to the technology would be given solely to the purchaser on an unlimited or limited time basis whereas non-exclusive acquisition of technology allows MPOB to license the technology concerned to a number of parties. However, MPOB has the right to withdraw the license three years after signing the agreement if no commercial production or application has commenced. MPOB also has incubation facilities where it allows its pilot plant and facilities to be utilized for either trial manufacturing or test-marketing. If there is the necessity to scale-up to pilot plant testing in pilot plant development, MPOB can jointly carry this out with the party involved. The cost is negotiable where MPOB and the party involved have to come up with an amicable agreement. MPOB has also initiated collaborative research and development projects with industry players like Golden Hope Berhad and Guthrie Berhad to develop new technologies. The intellectual property right and the development cost is normally shared on a 50:50 basis. In addition, MPOB also provides consultancy and advisory services, and training to industry players. Some research findings from consultancy services can be transferred without royalty payment as the firm has already paid a fee for the consultancy services rendered.

The genesis of the Oil Extraction Rate (OER) policy was initiated by the joint undertaking of the Johore state MPOB and Southern Peninsular POMA (Tay 2003; Yu, 2003). Millers from Southern Peninsular POMA faced the problem of unripe or not fully ripe Fresh Fruit Bunches (FFBs) sold by the oil palm smallholdings to the millers. Some of the small holdings were more concern about drawing in a regular or higher income as the FFBs were sold on a tonnage basis. The more the smallholders can sell to the millers, the more they will eventually earn. This consequently led to lower extraction rate and poorer quality of crude palm oil as a result of lesser quality FFBs. A dialogue was held between the Johore State MPOB and Southern Peninsular POMA to resolve this issue. The measures taken eventually led to the situation that the millers would not accept unripe or not fully ripe FFBs. These unwanted FFBs would be placed in an area where the smallholders, if they so wish, could collect for themselves. The smallholders would also incur a penalty of RM10.00 per bunch. This return cum penalty policy, to a very large extent, has led to better harvesting practices not only from the smallholdings but also the plantations as these good practices were diffused and assimilated in the oil palm growers' fraternity. Concomitantly, ripe FFBs would also ensure a higher Oil Extraction Rate (OER).

As the licensing requirement for mill operation comes under its purview, the MPOB has imposed a minimum 18% Oil Extraction Rate Policy (MPOB Online 2006). Millers flouting this policy, that is an Oil Extraction Rate which is lower than 18%, will have their license withdrawn. This policy has a positive effect, both from an economic and environmental perspective as more oil is recovered and in tandem lesser unrecovered oil will contribute to lesser waste generated.

MPOB has been active in the development of the ISO 14000 environment management standards by virtue of being a member of the ISCZ 14000 National Committee on environmental standards. MPOB is a member of the Malaysian delegation to the ISO/TC 207 on ISO 14000 Environment Management Standards plenary meetings and is providing leadership to the ISO/TC 207 WG 5 on Climate Change. Workshops and national seminars on the awareness and application of ISO 14000 standards are also organized by MPOB in cascading such practices in the oil palm and palm oil chain.

(b) Malaysian Palm Oil Council (MPOC)

In the 1980s, a campaign was waged in the USA against tropical oils. This backdrop led to the establishment of the Palm Oil Promotion Fund in 1988 by the oil palm and palm oil industry. The Palm Oil Promotion Fund Committee responded with success against the negative claims of the campaign organizers. The Palm Oil Promotion Fund Committee's success laid the foundation for the Malaysian Palm Oil Promotion Council's (MPOPC) establishment on January 25, 1990. MPOPC, today is known as MPOC. MPOC is involved in the promotion and marketing of Malaysian palm oil so as to create a positive image which in turn will lead to the maximization of returns for the Malaysian palm oil industry (MPOPC and Jora-Aki Technology Sdn. Bhd., 2003). This also encompasses the removal of obstacles and the creation of opportunities in enhancing the marketability and image of Malaysian palm oil in the international markets.

The Malaysian Palm Oil Council, also under the Ministry of Plantation Industries and Commodities' hierarchy, is committed in making Malaysia palm oil the world's leading vegetable oil and Malaysia the focal point of the international oils and fats market. The institutions which play an advisory role in the Board of Trustees of MPOC are the Malaysian Palm Oil Board (under the aegis of the same ministry) and industry representatives like the Malaysian Palm Oil Association (MPOA), the Palm Oil Millers' Association of Malaysia (POMA), the Malaysian Edible Oil Manufacturers' Association (MEOMA), the Palm Oil Refiners Association of Malaysia (PORAM), the Malaysian Oleochemical Manufacturers Group (MOMG), a group in the Federation of Malaysian Manufacturers and the National Association of Smallholders (NASH).

The operation of MPOC is funded entirely by the oil palm and palm oil industry in the form of cess contribution of RM2 per ton of CPO and CPKO produced to the Palm Oil Promotion Fund. MPOC has a three prong approach in marketing and promoting palm oil, namely marketing communication, technical marketing and market promotion. Marketing communication entails positioning palm oil "as the natural and excellent choice" via the various communication media locally and abroad. Technical marketing encompasses the gathering and updating of scientific and technical information on palm oil, developing linkages with the scientific community, locally and abroad and lastly acquiring third party endorsement on Malaysia's palm oil nutritional merits. Market promotion is the provision of a positive image of palm oil through seminars and workshops, gathering market information and monitoring new market and business opportunity.

The MPOC has been very active in countering the argument that palm oil is not a healthy oil and palm cultivation being not environmentally friendly. Whenever such issues are raised both in the international or local arena, MPOC would be in the forefront in countering such argument with scientific evidences and research works carried out by MPOB. The recurrent global concern on oil palm cultivation with regard to deforestation, bio-diversity loss, and forest fire led to the formation of the Task Force on the Environment in 2001 to respond to such criticism. Members of this Task Force on the Environment consist of representatives of MPOB, DOE, NASH, MPOA, POMA, PORAM, MEOMA and MOMG.

MPOC has been involved in the development of ISO 14000 Environmental Management Standards via its participation in the ISCZ National Committee on Environmental Standards and also as a member of the Malaysian delegation to the plenary meetings of ISO/TC 207 since 1998. The MPOC Council and MPOB have co-organized national seminars to raise the level of awareness and application of ISO

14000 standards in the oil palm and palm oil industry. The Dialogue between the Oil Palm and Palm Oil Industry and WWF Malaysia cum WWF Switzerland was co-organized and hosted by MPOC on 21 March, 2002.

3.3.3 The Industry Representational Cluster for the POPC

The industry representatives' cluster for the POPC in Peninsular or West Malaysia (industry organizations from East Malaysia is excluded as the focus of this study is on West Malaysia) has the following institutions:

(a) The Malaysian Palm Oil Association (MPOA),
(b) The Palm Oil Millers Association of Malaysia (POMA),
(c) The Palm Oil Refiners Association of Malaysia(PORAM),
(d) The Malaysian Edible Oil Manufacturers Association(MEOMA),
(e) The Malaysian Oleochemical Manufacturers Group (MOMG), a group in the Federation of Malaysian Manufacturers and
(f) The National Association of Smallholders (NASH).
(g) Federal Land Development Authority (FELDA).

(a) Malaysian Palm Oil Association (MPOA).

The Rubber Growers' Association, the United Planting Association of Malaysia and the Malaysian Palm Oil Growers' Council were dissolved in a rationalization exercise where it led to the formation of an umbrella entity in 1999 known as the Malaysia Palm Oil Association (MPOA) (MPOA, 2002). The purpose of this rationalization is to provide the industry with a united single voice.

The MPOA has been tasked with the long-term growth and development of the Malaysian palm oil industry, especially that of the oil milling and the plantation crop industry which covers oil palm, rubber, coconut, sugar cane, cocoa, tea, banana and pineapple. It also provides industry representation at both the domestic and international levels. The MPOA Council is drawn from members within and is the main policy and decision making body in MPOA. This Council is supported by an Executive Committee together with three Standing Committees, namely Government Affairs, Marketing and Promotion, and Research and Development. The Research and Development Standing Committee has working committees of Agriculture Research and Technical Research which in turn have a number of sub-committees focusing on priority areas. The Technical Research Working Committee has an Environmental Working Sub-committee to address issue related to the environment and oil palm cultivation.

Membership is open to individuals and companies with a minimum ownership of 40 hectares of plantation crop. The big plantation players which have a higher level of integration in the palm oil production chain are members of MPOA. Members like the Felda Group, IOI Group, KL-Kepong Group, and Consolidated Plantation, a part of the Sime Darby Group have moved downstream and are involved in palm kernel crushing, refining and specialty fats manufacturing and oleochemical manufacturing. Funding is solely by membership fees based on the planted hectarage of a member. MPOA's core activities are enhancing the competitive position of the industry globally via cost reduction and research and development, providing representation at both the domestic and international levels, supporting national marketing and promotion efforts and disseminating industry-relevant information to its members. Enhancing global competitiveness also encompasses a strong focus on the environment and sustainable development.

At the national level, MPOA, because of its influence drawn from membership of big players which also include government agencies and government linked companies, is appointed as a member of the following institutions:

1. EQC
2. MITI Task Force Committee for Palm Oil Industry
3. MITI /MIDA Industry Task Force on Palm Oil Based (Food) and Oil Palm Based (Non-Food) Products
4. MPOB Board
5. MPOC Board of Trustees
6. MPOC Task Force on the Environment

MPOA is actively engaging WWF Malaysia cum WWF Switzerland in the sustainable development of the oil palm and palm oil industry. This includes the promotion of Best Management Practices in oil palm cultivation. At the same time, MPOA has participated in the WWF Malaysia Partners-for-Wetlands forum and also co-organized the Dialogue between the Oil Palm Industry and WWF Malaysia cum WWF Switzerland.

(b) Palm Oil Millers' Association (POMA)

POMA was established as the official representative of the millers and also to act as a mediator in the settling of disputes among its members and also between the millers and suppliers of fresh fruit bunches (MPOPC Online 2004). The POMA hopes by having its own code of conduct and regulations, its members will be able to attain the production of high quality products. Membership is open to all millers but the members of POMA tend to be the smaller players with some of them being standalone mills (without plantation).

Funding is solely by membership and its core activities, being purely a trade organization, are related to the business and operational activities of milling. Based on existing available information, it does not have activities that are related directly to the environment with the exception of the operational activities of millers, like complying with EQA parameters.

At the national level, POMA, despite its much lesser influence as compared to MPOA, is appointed as a member of the following institutions:

1. MITI Task Force Committee for Palm Oil Industry
2. MITI /MIDA Industry Task Force on Palm Oil Based (Food) and Oil Palm Based (Non-Food) Products
3. MPOB Board
4. MPOC Board of Trustees
5. MPOC Task Force on the Environmen

(c) The Palm Oil Refiners' Association (PORAM)

The Palm Oil Refiners' Association of Malaysia (PORAM) was formed as a trade association in 1975 to represent the refining and processing industry. Its role is to promote the refining and fractionation of palm oil and the manufacture of all palm products and by-products. The Management Board of PORAM is responsible for the running of PORAM and is the main policy and decision making body. The management Board is supported by four key committees, namely Commercial and Contracts, Technical, Training and Education, Price Settlement, and Associate Members.

Funding is mainly by membership fees with three categories of membership. Full members are directly involved in processing, refining and fractionation of palm oil. PORAM's 18 full members account for more than 75% of total exports of processed palm oil. The 18 full members consist of the vertically integrated groups like the Felda Group, the Sime Darby Group, the Golden Hope group, IOI Group the PBB group, and others, together with independent palm oil refiners and subsidiaries of multinational companies like Cargill and Aditya Birla. Associate members are involved in the oils and fats trade but not involved in processing, refining and fractionation. Supplementary members are subsidiaries or associate companies of the full members.

PORAM's main activities are in disseminating market information, building business contacts, promoting products by full members for export, advising on government regulations and procedures, arbitrating and resolving common problems, publishing and organising seminars, workshops and training courses for the industry. It also has to support its members in attaining standard specifications for refined palm oil and its derivatives. PORAM has issued a bulk contract for refined palm oil products for the past 15 years which has gain wide acceptance by shippers, traders and dealers in Europe, the USA and Asia. However based on existing available information, PORAM has no specific focus on the environment.

At the national level, PORAM, because of its influence drawn from the 18 full members which incidentally consist of a number of big players that include a government agency and government linked companies, is appointed as a member of the following institutions:

1. MITI Task Force Committee for Palm Oil Industry
2. MITI /MIDA Industry Task Force on Palm Oil Based (Food) and Oil Palm Based (Non-Food) Products
3. MPOB Board
4. MPOC Board of Trustees
5. MPOC Task Force on the Environment

On the international front, PORAM is affiliated to the:

1. National Institute of Oilseed Products (NIOP), USA
2. Federation of Oils, Seeds and Fats Associations Ltd (FOSFA) International
3. Founding member of the ASEAN Vegetable Oils Club (AVOC) and is currently the Secretariat for AVOC

(d) The Malaysian Edible Oil Manufacturers' Association (MEOMA)

The MEOMA was formed in 1961 for the vested interest of the edible oil millers. It grew from eight core members to 81 members, representing approximately 80% of Malaysia's edible oils manufacturing industry. The key objective of MEOMA is to promote, protect and represent the industry for the benefit and welfare of all edible oil millers. MEOMA is run by a General Working Committee and is supported by the Palm Kernel and Products Sub-committee, Copra and Products Sub-committee, Cooking Oil, Edible Fats, and Margarine Sub-committee, Technical Sub-committee and Price Settlement Sub-committee.

Funding is by membership fees. Palm oil millers, palm kernel crushers, palm oil refiners, cooking oil manufacturers and oleochemical manufacturers make up part of the membership of MEOMA. Several members are involved in the production of coconut oil and coconut oil cakes with others being involved in insurance and broking. With varied business activities, many MEOMA members are also members of other industry organizations like MPOA, POMA, PORAM and MOMG. The core activities are mainly related to the business and operational aspects of edible oil milling. To date, there is no specific focus on the environment.

At the national level, MEOMA with its strong representation in the edible oils manufacturing industry, is appointed as a member of the following institutions:

1. MITI Task Force Committee for Palm Oil Industry
2. MITI /MIDA Industry Task Force on Palm Oil Based (Food) and Oil Palm Based (Non-Food) Products
3. MPOB Board
4. MPOC Board of Trustees
5. MPOC Task Force on the Environment
6. Palm Oil Committee of the Malaysian Derivatives Exchange Berhad
7. SIRIM Technical Committee on Oils and Fats
8. SIRIM Technical Committee on Packaging (for cooking oil)

MEOMA's affiliation to international organizations on oils and fats are:

1. Grain and Feed Trade Association (GAFTA), UK
2. National Institute of Oilseed Products (NIOP), USA
3. Federation of Oils, Seeds and Fats Associations Ltd (FOSFA) International
4. ASEAN Vegetable Oils Club (AVOC)

(e) The Malaysian Oleochemical Manufacturers' Group (MOMG)

The Malaysian Oleochemical Manufacturers' Group was established in 1984 as a group under the Chemistry Industries Council of Malaysia. Today it is also a group under the Federation of Malaysian Manufacturers. The primary objective of this group of 12 members is to promote, foster and represent the interest of the oleochemical industry in Malaysia. The MOMG has considerable weight as these 12 members account for 20% of the global capacity. MOMG has two committees, namely the MOMG Executive Committee and the Technical Committee. The MOMG Executive Committee is the main policy and decision making body. The Technical Committee organises Technical Workshops which focus on training in the areas of environment, safety and health. This Technical Committee provides MOMG with a specific focus on the environment. Funding is from contributions by its 12 members which are involved in the manufacturing of primary oleochemicals. The core activities are liaising with the government authorities, presenting the oleochemical industry domestically and abroad, and collating, publishing and disseminating information to its members.

MOMG is appointed as a member of the following government institutions in Malaysia:

1. MITI Task Force Committee for Palm Oil Industry
2. Annual MITI Industry Dialogue
3. MITI /MIDA Industry Task Force on Palm Oil Based (Food) and Oil Palm Based (Non-Food) Products
4. MPOB Board
5. MPOC Task Force on the Environment
6. Budget Dialogue
7. Dialogue with DOE on environmental cum regulatory issues face by members

MOMG, at the international arena, is a member of the ASEAN Oleochemical Manufacturers Group.

(f) The Incorporated Society of Planters (ISP)

The establishment of the ISP in 1919 representing the estate managerial executives in 1919 grew from an inaugural membership of 200 planters to more than 4350 members of whom 600 are overseas members from 37 countries. The primary objective of the ISP is the provision of professional academic qualifications and training and development programmes. The ISP is managed by a Board of Directors, supported by the Executive Committee, Technical Education Scheme Committee, Planter Editorial Committee, Finance Committee and Library Committee.

Funding comes from member subscription and income generation from the organisation of professional academic programmes, seminars and conferences. Even though there is no specific focus on the environment, The Planter, a journal, has numerous editorials on environmental matters. In the seminars and conferences, various aspects of the environment and sustainable development have also been covered. The ISP was also an active participant in the WWF Malaysia cum WWF Switzerland Partners-for-Wetlands. However, its influence is rather limited in the government-industry framework as it does not sit in any of the committees in either the government or industry representational cluster.

(g) National Association of Smallholders (NASH)

As a result of a number of smallholding associations in existence, the Government in 1975 initiated the move to combine all such associations, thus culminating in the formation of NASH. A smallholding refers to a singular or co-ownership of land on an aggregated basis which is below 40.5 hectares. The NASH, an umbrella body for all smallholders' associations in the country, has the primary objective of protecting and promoting the socio-economic well-being of smallholders. Till today, NASH is recognised by the Government as the national organisation and the official voice of the smallholders, regardless of whether the smallholders are involved in the cultivation of oil palm, rubber, coconut, vegetables, fruits or others. However, in terms of acreage, rubber and oil palm are the two largest crops cultivated by smallholders. The membership of NASH is open to all smallholders with the token life-membership fee of RM12. The cumulative membership of such smallholders to date is more than 60,000. NASH also accepts associate membership from cooperatives, especially agriculture cooperatives. To date 17 cooperatives are associate members with membership proxy of 40,000. In totality, NASH represents 100,000 members and in tandem being the official mouthpiece for 1 million smallholders (MPOPC and Jora-Aki Technology 2003).

NASH, a non-profit organisation, is run by a bureaucratic structure consisting of a President, Deputy President, three Vice-Presidents, a Secretary General, a Treasurer, 11 State Representatives and six Bureau Chiefs. The major activities of NASH are initiating research and development with government bodies, running an advocacy programme by bringing to attention smallholders' problems associated with weaknesses in policy implementation to the various government bodies, building up a networking capacity in terms of two-way communication between the government and smallholders, capacity building emphasising on leadership development and information technology, running the Smallholders Plantation Cooperative which owns 2500 hectares of oil palm and generating income by providing services in the areas of plantation development, supply of seedlings, fertilizers and other agriculture inputs, and marketing palm oil as the meagre income from the token membership fees and the ex-gratia from Smallholders Plantation Cooperative are insufficient for the administration of the association.

As NASH is given the national recognition as the official voice of the smallholders, NASH is invited to sit in the following government institutions:

1. MITI Task Force Committee for Palm Oil Industry
2. MITI /MIDA Industry Task Force on Palm Oil Based (Food) and Oil Palm Based (Non-Food) Products
3. MPOB Board
4. MPOC Board of Trustees
5. MPOC Task Force on the Environment

(h) FELDA

Due to the special role bequeathed by the Federal Government as discussed in Chapter 4, FELDA is directly appointed and not through industry representation to sit in the following government institutions.

(1) MITI Task Force Committee for Palm Oil Industry
(2) MITI/MIDA Industry Task Force on Palm Oil Based (Food) and Oil Palm Based (Non-Food) Products
(3) MPOB Board
(4) MPOC Board of Trustees
(5) MPOC Task Force on the Environment

FELDA, on the other hand, also sits in the Councils or Boards of MPOA, PORAM, MEOMA and MOMG. As a whole, FELDA wields immense influence either as a direct appointee or through the industry representational associations in the government-industry linkage. As mentioned earlier, FELDA has given special focus on the environment as it is a government agency and is dictated by the requirement to adopt government policies inclusive of environment policy and also abide by existing laws and regulations, inclusive of the EQA.

3.4 The Industry Representational Cluster for the TAPC

The industry representatives' cluster for the TAPC in West Malaysia has the following institutions:
(a) Malaysian Textile Manufacturers Association (MTMA)
(b) Malaysian Knitting Manufacturers Association (MKMA)
(c) Malaysian Garment Manufacturers Association (MGMA)

Both the MTMA and MKMA are national as well as parallel associations representing the textile and apparel industry but, however, in terms of influence in the government-industry framework, MTMA has greater influence as it is recognized by the Government as the national body.

(a) Malaysian Textile Manufacturers Association (MTMA)

MTMA is a company limited by guarantee which was incorporated in 1973 (MTMA 2003). It is recognised as the national body for the textile industry with the primary objective of promoting, protecting and acting as the spokesman for the textile and apparel industry in Malaysia. MTMA has an Executive Committee appointed by the members themselves with representation from nearly all the sub-sectors in the TAPC, namely the spinners group, the weavers group, the knitters group, the garment-makers group, and the industrial textile cum accessories group. Industrial textile does not come under the ambit of textile and apparel but under the broader umbrella of textile. However, as stated above, this association's primary focus is the textile and apparel industry. The synthetic or man-made fiber manufacturing sub-sector, and the dyeing, finishing and printing sub-sector do not have sub-sectoral representation. The reason being is that for synthetic fiber manufacturing, there is only one such organisation in Malaysia. At the same time, the organisation belongs to a highly vertically integrated group and the representatives from the other sub-sectors can represent the synthetic fiber manufacturing interest. For the dyeing, finishing and printing sub-sector, a number of players, especially the bigger players which are vertically integrated, has dyeing, finishing and printing activity in its operation. As such, the interest of this sub-sector is also taken care of by the representatives from the other sub-sectors. The MTMA Executive Council is the main policy and decision making body.

MTMA membership is drawn from all sectors as mentioned above with the present membership having a combined paid-up capital of more than 80% of the total equity in the textile industry. MTMA is financed by member subscription, entrance fees and the surplus arising from specific activities like organising seminars, conferences and trade promotions. As such MTMA can be viewed as having more leverage in negotiating with the Government as compared to MKMA which will be discussed later. The main activities of MTMA are the representational and consultative role in relation to the Government and by providing services like trade opportunities, advice on the latest developments on government policies and procedures, the provision of Government forms and the endorsement of the Certificate of Origin of all textile products as MTMA is appointed the authorised body by MITI. MTMA, however, has no specific focus on the environment but it does disseminate information via e-mails, circular, and newsletter with regard to environmental and human right related regulations or requirements as required in the EU and North American markets to its members.

MTMA and MITI have jointly set-up the Malaysian Textile and Apparel Centre (MATAC), a training centre, in 1994 to organise training programmes for the textile and apparel industry. MATAC, a company limited by guarantee, was established with a launching grant from the Government. The main objectives of MATAC are the promotion and development of a culture of training and raising the skill level of occupational competency in the textile and apparel industry. At the same time MATAC also strives to acquire new and relevant technologies, especially in the area of training and development. MATAC, a Human Resource Development Berhad (a company incorporated by the government to provide training) approved training centre, also provides academic programmes at the certificate level. From an environmental perspective, MATAC provides training in the area of environmental management, especially that of ISO 14000 standards.

MTMA is appointed as a member to the following government institutions in Malaysia:

(1) SIRIM Technical Committee on Textile and Apparel
(2) Human Resource Development Berhad
(3) Management Committee of the Industrial Technical Assistance Fund for Small and Medium Enterprises (ITAF)

(b) Malaysian Knitting Manufacturers Association (MKMA)

MKMA was established in 1975 as a national textile trade association with its sole focus being on the textile and apparel sector (MKMA 2003). Anecdotal evidence suggests that the formation of MKMA was a result of discontent amongst some of the members of MTMA, mainly knitters, which led to a breakaway group forming the MKMA. As its name implies, the membership is dominated by knitters. However, MKMA membership is not only drawn from the knitting sub-sector but inclusive of the spinning sub-sector, the dyeing, finishing and printing sub-sector, the garment manufacturing sub-sector, and suppliers of dyestuff, accessories and machinery with the exception being the synthetic or man-made fiber manufacturing sub-sector. In terms of size from production volume and paid-up capital viewpoint, many MKMA members belong to the small and medium scale enterprise category. This association also has a Batu Pahat-centric characteristic or Batu Pahat being the locational centre of gravity. MKMA has its head office located at Batu Pahat with a large number of members having their factory locations sited in or near the vicinity of Batu Pahat, known as the textile and apparel capital of

Malaysia. Besides Batu Pahat's lofty association with being the textile and apparel capital, MKMA's influence as compared to MTMA is lesser as MTMA has a larger number of big players in its membership league. However, a number of players in the TAPC holds dual membership in MTMA and MKMA.

MKMA's funding comes from member subscription and surpluses from its activities like organising training programmes. The main activities of MKMA is the dissemination of information, liaising with government bodies, assisting member participation in trade fair, organising trade exhibition locally and trade missions overseas, and training and development. MKMA does not have a specific environmental focus but it disseminates information via e-mails, circular, and newsletter with regard to environmental and human right related regulations or requirements as required in the EU and North American markets to its members.

(c) Malaysian Garment Manufacturers Association (MGMA)

MGMA is a small trade association representing mainly garment makers, garment traders and suppliers of accessories. However, it is not as active and much lesser in influence as compared to both MTMA and MKMA.

3.5 Summary

Based on the above discussions, the institutional framework in terms of the government-industry linkage for the POPC and TAPC are illustrated via Figure 3.1 and Figure 3.2 respectively.

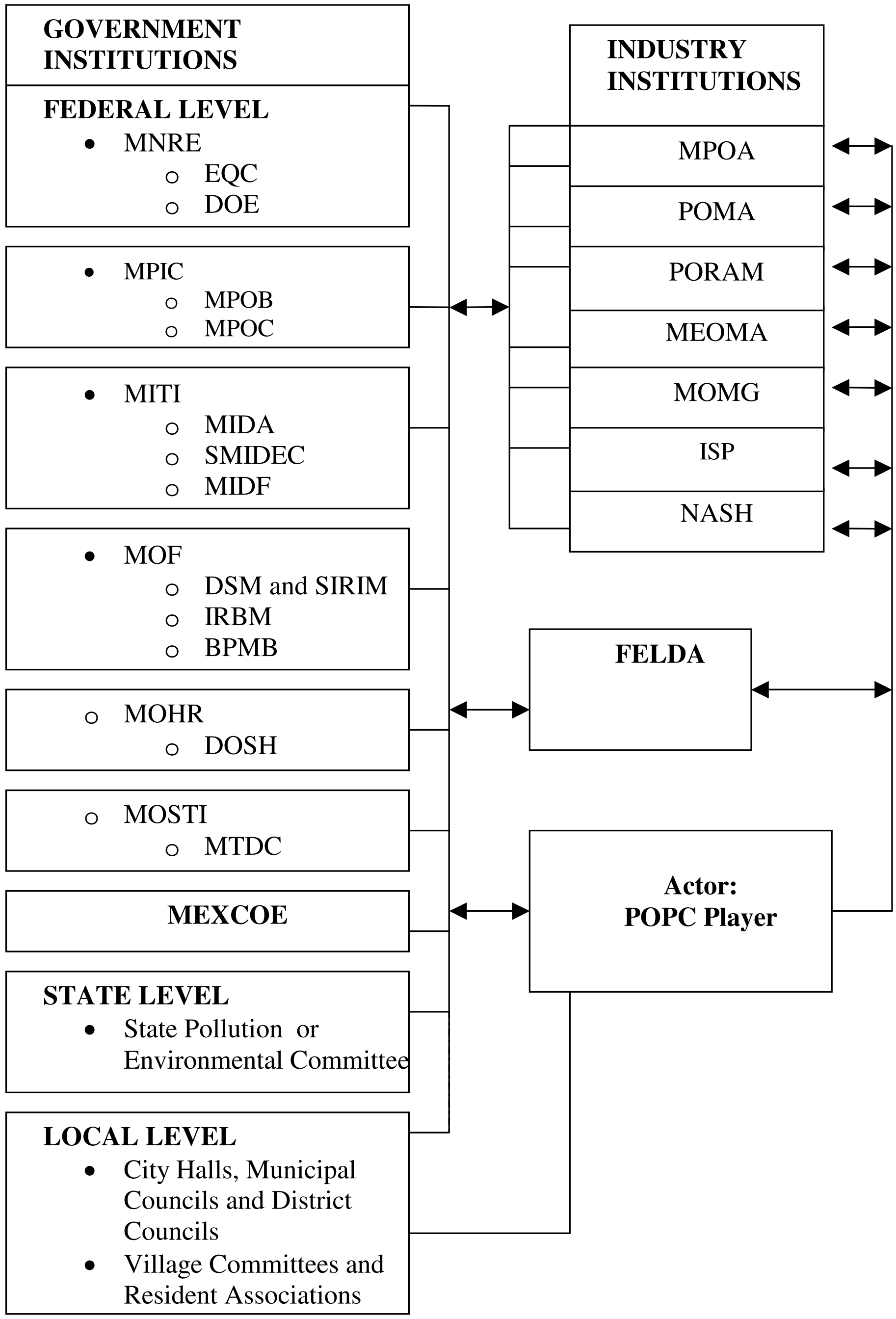


Figure 3.1 The Institutional Framework For POPC

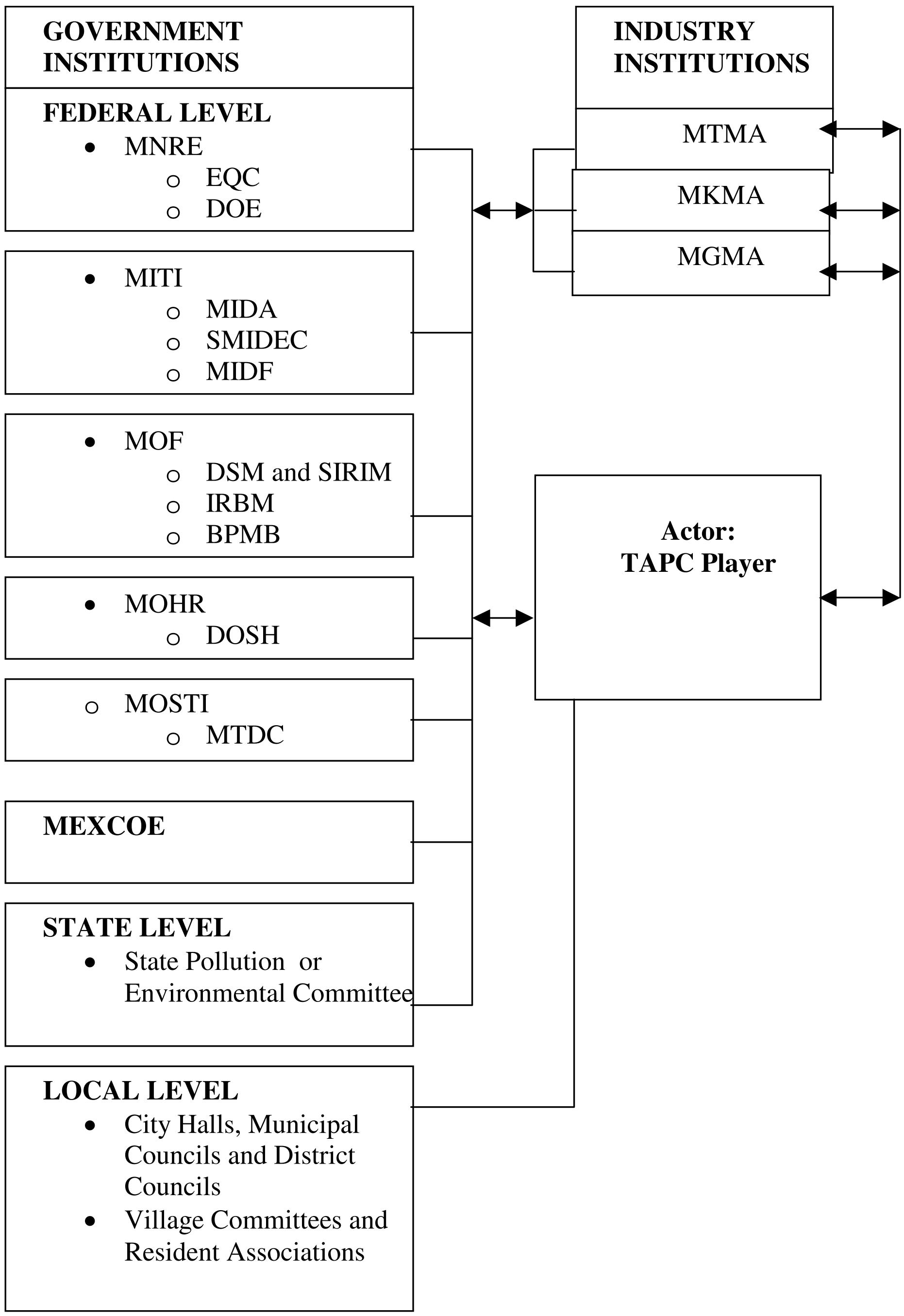


Figure 3.2 The Institutional Framework For TAPC

CHAPTER 4
The Palm Oil Production Chain in Malaysia

4.1 Introduction

This chapter starts with the coverage of the production process of the oil palm and POPC, with particular emphasis on the industrial or manufacturing part of the chain (POPC) as a starting point. The second section covers the evolution of the POPC in Malaysia. The third section focuses on the export of the POPC with the fourth section covering the current industry structure of the POPC in Malaysia. The final section focuses attention on environmental issues pertaining to production in the POPC. The above sections lay the groundwork for the operationalization of the hypotheses as discussed in Chapter 6.

4.2 The Production Process of the Oil Palm and Palm Oil Production Chain

The main elements of the oil palm and palm oil chain consist of the nursery, production of fresh fruit bunches (FFBs), palm oil milling, palm kernel crushing, refining and cum POFP and oleochemical production, biodiesel production, biomass production, bulking installations, trading which encompasses export-import activities, shipping, wholesaling and retailing, and testing (laboratory testing) and advisory services. The entire oil palm and palm oil chain in Malaysia is as shown in Figure 4.1. While this sector has a long chain from the production of raw materials to final consumers, the focus of this research is on the POPC. For the purpose of this research in relation to the POPC, the principal actors are millers, biomass producers, crushers, refiners cum POFP producers and oleochemical producers. This section, however, will not only cover the POPC but also the FFB producers or growers. The FFB growers and the millers have an interdependent relationship. The FFB producers or growers supply the feedstock to the millers and in return the EFBs and treated industrial effluent are channeled to the fields.

The FFB producers or growers consist of oil palm plantations and smallholdings which contribute feedstock in the form of FFBs to the palm oil millers. The main resources for FFB producers or growers are land mass or size, planting materials (replacement of old palms or old rubber trees with palm plantlets), agro-management (good agricultural practices), and infrastructural network (roads and railway network for transporting the harvested FFBs to the mill. For plantations, land size is important for the attainment of economies of scale. For corporations that have a deep pocket, the expansion of hectarage together with good agro-management practices and a more efficient infrastructural network can lead to higher yield, better environmental practices and cost efficiency (Starbiz 31 July 2006).

The FFBs received from the plantations and smallholdings are used as feedstock in the milling process. The milling process is the first industrial stage of the POPC. The main resources utilized to produce outputs in the form of CPO and kernels are capital expenditure on plant, machinery and equipment, management and labor. As shown in Figure 4.2, the extraction of CPO involves the following processes:

reception, transfer and storage of FFBs; sterilization via steam-heat treatment where a voluminous amount of water is required; stripping where the fruits are dislodged from the bunch stalks; digestion where the fruits are mashed by rotating arms; pressing where twin screw presses squeeze the oil out from the digested fruit mash; clarification and purification of the CPO as the initial CPO from the screw presses consists of CPO, water and fibrous materials in varying proportions and thus oil separation is carried out in the clarification tank with the remnants being water and fibrous debris discharged as separator sludge or clarification wastewater; depericarping and nut fiber separation where the press cake discharged from the screw presses is conveyed to the depericarper for nut and fiber separation with fiber being the by-product; nut cracking; separation of kernels and shells with the most popular separator being the hydrocyclone where the last source of wastewater is known as the hydrocyclone wastewater and a by-product, the broken shells; and finally palm kernel drying to prevent mould growth and longer storage time (DOE 1999b). The outputs from palm oil milling are CPO and kernels with the by-products being fiber and broken shells. The CPO is used as feedstock by the refining cum POFP producer, oleochemical producers and biofuel producers. The kernels are the feedstock for the palm kernel crushers whereas the fiber and broken shells can be used as feedstock for the biomass power plants and biomasss-based products such as the production of medium-density fiberboard and activated carbon. Biomass, the by-products of milling, has great potential in terms of the production of value-added products as they are easily available in a voluminous nature.

Palm kernel crushing undergoes two major processes in the extraction of palm kernel oil and they are kernel pretreatment and oil extraction. There is a choice of two methods in oil extraction, one being mechanical extraction and the other solvent extraction, respectively shown in Figure 4.3(a) and Figure 4.3(b). The palm kernel crushers will undergo the following stages in kernel pretreatment, namely cleaning, size reduction and cooking. The cleaning of palm kernels is for the purpose of removing foreign matters like stones and metal pieces by way of a magnetic vibrator and separator screen respectively. In size reduction, the kernels are broken by a swinging hammer and by breaker rollers to produce small pieces and flakes to increase surface area for pressing, thus enabling better oil extraction. Cooking is carried out in a stack cooker to regulate the meal's moisture content, to enable further ruptures of the cell walls, to reduce oil viscosity, and to coagulate protein in the meals to aid oil filtration. This complete pre-treatment is one of the variations in mechanical extraction. However, for some mills, the cleaning and grinding of palm kernels are not followed by the intermediate stages of flaking and cooking prior to oil extraction, which is known as partial pre-treatment, the second variation of mechanical extraction.

The third variation is direct screw pressing, a technology invented by Malaysian machinery fabricators. Figure 4.3(a) also shows the third variation of mechanical extraction. The kernels, after being cleaned, are unloaded to a horizontal silo which is located above the screw presses. The kernels are released to the parallel lined screw presses to extract an approximately 30% of the oil. The screw presses operate at a lower pressure, thus eliminating the need for cooking or steam conditioning. After the first pressing, the discharged cake is conveyed to another horizontal silo for a second pressing to recover the remaining oil. The final discharged cake is the palm kernel cake.

Figure 4.3(a) indicates that for the first two variations of mechanical extraction, the first stage after kernel pre-teatment is screw pressing where the meal goes through the press barrel by a revolving worm by force, thus enabling the expelling of oil from the meal with the remnants being expeller cakes with residual oil content of between 6 to 10%. The expelled oil or raw palm kernel oil, which contains fines and solid impurities, is clarified via a coarse vibrating screen filter, followed by filter pressing to produce one of the main outputs being Crude Palm Kernel Oil (CPKO) (PORLA). The removed solids are routed to the screw presses whereas the fines are added to the palm kernel cakes. The other main output is palm kernel cake (PKC) or sometimes known as palm kernel expeller (PKE) (Tang and Teoh, 1985). The CPKO is used as feedstock by the refiners and POFP manufacturers, and oleochemical manufacturers, whereas the PKC is used in the formulation of animal feed. The PKC is excellent for ruminants and also suitable for feed formulations for poultry, swine and horses (Collingwood, 1958; Hutagulung et. al., 1982; Yeong et al., 1983). With the rising or high petroleum prices, the PKC is increasingly used as a source of bio-fuel for power generation plants in UK and elsewhere.

For solvent extraction, hexane is used to extract palm kernel oil from the cooked meals. The extractor designs can be broadly categorized into two, namely percolation and immersion. The percolation method is the preferred choice in Malaysia. The first stage in solvent extraction for the percolation method involves the solvent being pumped from above and allowed to percolate across a moving bed of kernel meal. The oil enriched solvent trickles through and is retrieved via a perforated screen. For the immersion method, the kernel meal is immersed totally in solvent (PORLA 1988). The oil enriched solvent from the two extraction methods is channeled to the miscella (a solution of oil in solvent) section where through the stages of distillation and stripping, the solvent is removed from the oil with the recovered solvent being recycled. The extracted oil generally contains less than 500 mg kg^{-1} solvent (**T**hang Thin Sue 2005:34). However, the solvent enriched kernel meal or "wet" meal, passes through a desolventiser toaster where the solvent is removed from the meal for the purpose of recycling. The residual solvent remaining in the dried meal ranges from 0.5% to 1.0% (Lurgi, 1988 in Thang Thin Sue 2005). The dried meal is then palletized and bagged and is known as palm kernel extraction pellets (Refer to Figure 4.3b).

The refiners will transform the CPO as feedstock into refined oils and fats for cooking and edible purposes. The primary aim of refining is to transform CPO into quality edible oils that meet industry and international standards like FAO's Codex Alimentarius by the removal of objectionable impurities in the most efficient manner to the desired levels or quality parameters specified for a particular oil or fat like the percentage of free fatty acids (FFA), percentage of moisture and impurities (M & I), iodine value (IV), peroxide value (PV), anisidine value (AV) deterioration of bleachibility index (DOBI), melting point, color, and flavor. The objectionable impurities are FFA, gums (phospholipids, phosphotides), dirt, trace shell, moisture and impurities, trace metals, oxidation products and total carotenoids. CPO as feedstock is processed via two methods: (1) physical or steam refining with the output being Refined, Bleached and Deodorized Palm Oil (RBDPO) and (2) chemical or basic refining which produces Neutralized, Bleached and Deodorized Palm Oil (NBDPO). As shown in Figure 4.4, the first step in physical refining is degumming in which food grade phosphoric acid or citric acid is added to the CPO. This process leads to the coagulation of phospholipids, phosphotides and other organic waxes in the oil prior to bleaching. Bleaching is carried out with activated earth or Fuller's Earth under vacuum so as to trap the gums, some color compounds (oxidation products, carotene and carotene polymers), trace metals, pro-oxidant metal ions, soap traces, and other minor impurities and also peroxide decomposition. The reacted bleaching earth or spent earth is discarded via a Niagara filtration system. The degummed and bleached oil (RBO) is then channeled for simultaneous deacidification and deodorization under high temperature. The deodorization process or steam distillation process removes the residual FFA, denatured carotene, moisture, and, aldehydes and ketones which are accountable for unacceptable odor and flavors. The hot RBDPO is channeled through another trap filter for final oil polishing for the removal of earth traces and is subsequently cooled down. The main output is RBDPO and the by-product is Palm Fatty Acid Distillate (PFAD) (Refinery of Palm Oil Online 2006, Teoh Cheng Hai 2002, PORLA 1988; Abdul Azis Ariffin 2000).

In chemical refining, the FFA in CPO is eradicated by alkali neutralization with caustic soda or sodium hydroxide, the concentration of which is dependent on the quality of the CPO feedstock. The chemical reaction creates Neutralized Palm Oil (NPO) and a soap stock in which the latter is separated from the NPO via a high speed separator. The soap stock undergoes acidulation via sulphuric acid to produce palm acid oil. Under chemical refining, an effluent plant is required for the soap stock whereas for physical refining, the FFA is removed via steam distillation. As such, physical refining produces a lower effluent load. The NPO is later subjected to bleaching and deodorization, where these two processes are very similar to the identical processes in physical refining with the exception being that in physical refining, the FFA is removed via deodorization whereas in chemical refining, the FFA is removed via alkali neutralization. Of these two refining processes, physical refining is the prevalent mode as it is simpler in operation, less capital intensive, more efficient and has a lower effluent load (Refinery of Palm Oil Online 2006, Teoh Cheng Hai 2002, PORLA 1988, Abdul Azis Ariffin 2000).

The RBDPO and NBDPO are subsequently subjected to fractionation to obtain the liquid olein fraction and the solid stearin faction. The liquid olein fraction is the superior product whereas the solid stearin faction is the discounted product. Fractionation can be carried out via dry fractionation, detergent fractionation and solvent fractionation, with the most common being dry fractionation. In dry fractionation, the refined oil is crystallized under controlled temperature, with the resultant slurry being pumped through a membrane filter press to procure the liquid olein fraction and the solid stearin fraction. If the liquid olein fraction is subjected to a second round of fractionation or double fractionation, the outputs are super olein and solid palm mid-fraction (PMF). PMF is the feedstock for the production of specialty fats and other products (Refinery of Palm Oil Online 2006, Teoh Cheng Hai 2002, Abdul Azis Ariffin 2000). Likewise, CPKO also undergoes the same processes either by physical or chemical refining.

Palm oil and palm kernel oil have very different chemical compositions and as a result, the properties of the blends for the above two oils can be altered substantially through interesterification to produce specialty fats. Interesterification is the process where the fatty acids are rearranged in a random manner in relation to their position in the triglyceride molecules in the presence of a catalyst. This rearrangement brings about an alteration of the physical properties which are suitable in the production of certain food products. Specialty fats, especially hardened fats are suitable for the production of toffee fats, non-dairy fats and cream filling fats among others as they are very stable against oxidation. This provides food processors with an assortment of alternative materials rather than hydrogenated soft oils (Yusof Basiron, N. Balu, and D. Chandramohan 2004).

The underlying premise for refining is the removal of impurities. However, Malaysian refiners are also involved in fractionation, hydrogenation and interesterification. These latter three processes are known as modification (Kellens 2000). The involvement in modification is also an indicaion that the refiners have moved further downstream into the production of palm oil finished products like shortening, vegetable ghee, margarine, confectionary and non-dairy creamers among others. This also reflects on the ability of Malaysian refiners to supply tailor made products so as to meet customer expectations. The move downstream into palm oil finished products is a strategy to differentiate their offerings in a commoditised market.

Oleochemicals are derived from natural oils and fats, of which palm oil and palm kernel oil are major feedstocks. The basic oleochemicals are fatty acids, methyl esters, fatty alcohols, fatty amides and a by-product, glycerine also known as glycerol. These basic oleochemicals, also acting as building blocks for the production of derivatives, have a wide variety of industrial and end-user applications. Both palm oil and palm kernel oil have almost the complete entire range of fatty acids from which all oleochemicals practically can be derived from (A.S.H. Ong, Kien Yoo Chiah, Yuen May, Choo (1989). As shown in Figure 4.5, prior to splitting/hydrolysis or methanolysis, crude palm oil and crude palm stearin requires pre-treatment to remove impurities like gums, soaps and solid matters. However, palm kernel oil requires no pretreatment as it is a relatively clean oil (Suan, L.O. and Ho, K.P. 1985). The process of splitting or hydrolysis, in which either oil or fat is hydrolysed with water, will yield fatty acids and sweetwater. The sweetwater can be further processed via pretreatment, evaporation, distillation, and bleaching into glycerol or glycerine (A.S.H. Ong, Kien Yoo Chiah, Yuen May, Choo 1989, Gunstone 2001). Splitting or hydrolysis is a highly heat-dependent process.

Crude fatty acids can be used in their original form but can be further processed into high purity acids. Crude fatty acids can be fractionated to produce fractionated or individual fatty acids having more than 99% purity and if further processes of esterification and steam distillation were undertaken, the products would be distilled fractionated methyl esters. The crude fatty acids can also take another route via hydrogenation to produce hydrogenated fatty acids and after a further process of distillation to produce distilled hydrogenated fatty acids. Another route would be for the crude fatty acids to be esterified and steam distilled to produce distilled methyl ester for biodiesel utilization. Monick (1979) indicated that the distilled methyl ester can be hydrogenated with the aid of catalysts like copper chromite, nickel or copper carbonates, or copper and chromium oxide to produce fatty alcohols. As shown in Figure 4.5, another route in the production of methyl ester is via methanolysis or transesterification, the most common industrial scale process for ester production. Naturally occurring oils and fats are mixed with an excess of methanol with the aid of an alkaline catalyst like sodium methoxide or sodium hydroxide (Sonntag 1982; Kreutzer 1984; Freetman et al., 1984; Farris 1979) in the methanolysis process to produce crude methyl esters and a by-product, sweetwater. As mentioned above, the sweetwater can be processed into glycerine. The crude methyl esters can be processed into high purity esters via steam distillation to produce distilled methyl esters. Likewise, as mentioned above, the distilled methyl ester can be hydrogenated with the aid of a heterogenous catalyst to produce fatty alcohols.

The crude fatty acids can take another route via steam distillation to produce distilled fatty acids, and after the saponification process, to produce soaps and a by-product, glycerine. Another possibility is for the crude fatty acids to undergo amidation with ammonia in the presence of a catalyst like zinc oxide, manganese acetate, bauxite or cobalt salts to produce fatty nitriles. The fatty nitriles are reduced via hydrogenation in the presence of a nickel or copper chromite to produce secondary amines, or nickel catalyst to produce trifatty amines, one of the three types of tertiary amines. Primary or secondary amines can be reduced via alkylation with formaldehyde in the presence of a nickel to produce methyl difatty amines or dimethyl fatty amines, another type of tertiary amines. The third type of tertiary amines, amine-ethoxylate addiucts are produced from primary or secondary amines with the aid of ethylene oxide, propylene oxide or by mixtures thereof (Billenstein et al., 1984).

Figure 4.5 shows the raw material or feedstock used in the production of basic oleochemicals, which in turn are used to produce oleochemical derivatives. The basic oleochemicals and oleochemical derivatives have wide industrial and end-use applications.

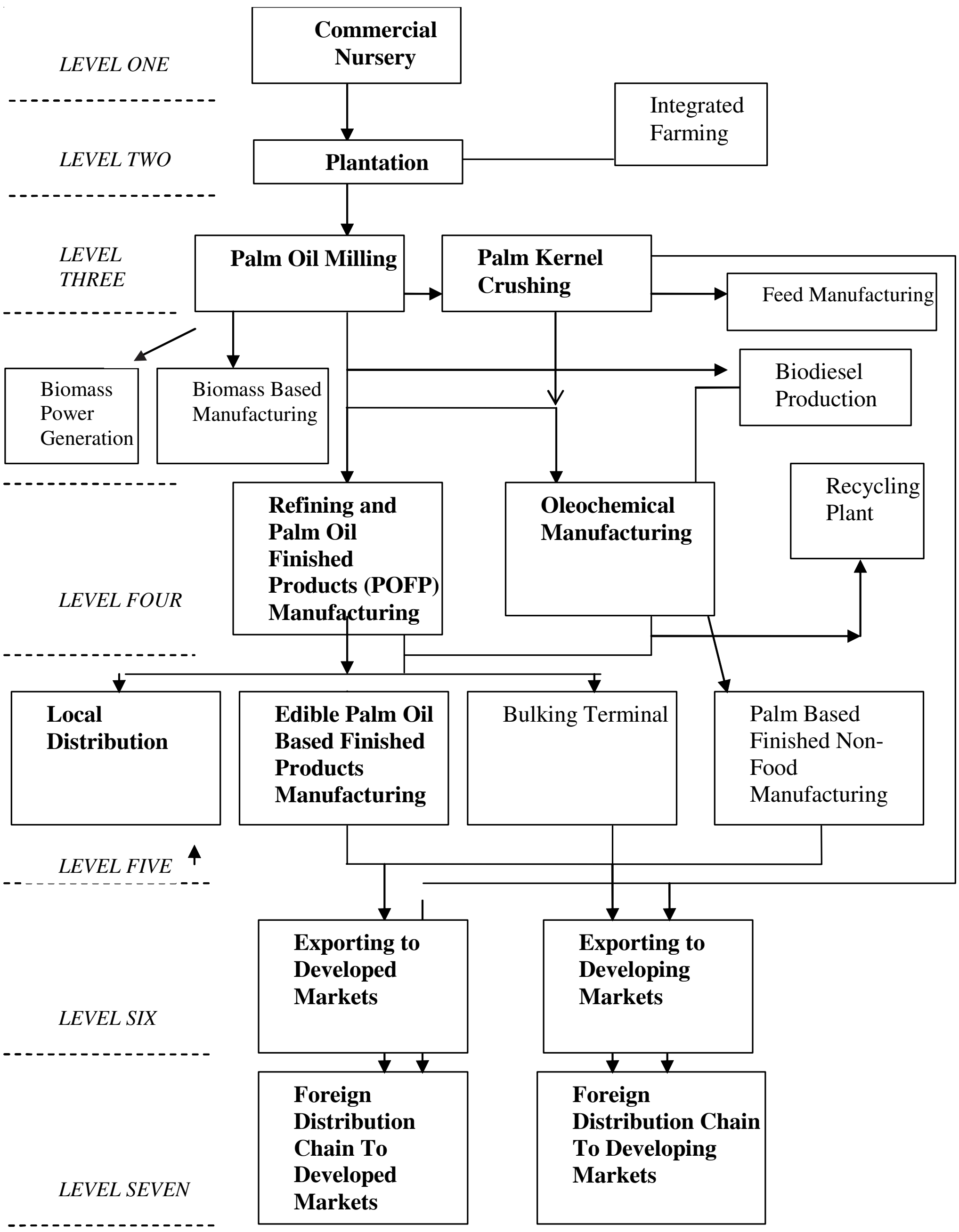


Figure 4.1 The Oil Palm and Palm Oil Production Chain

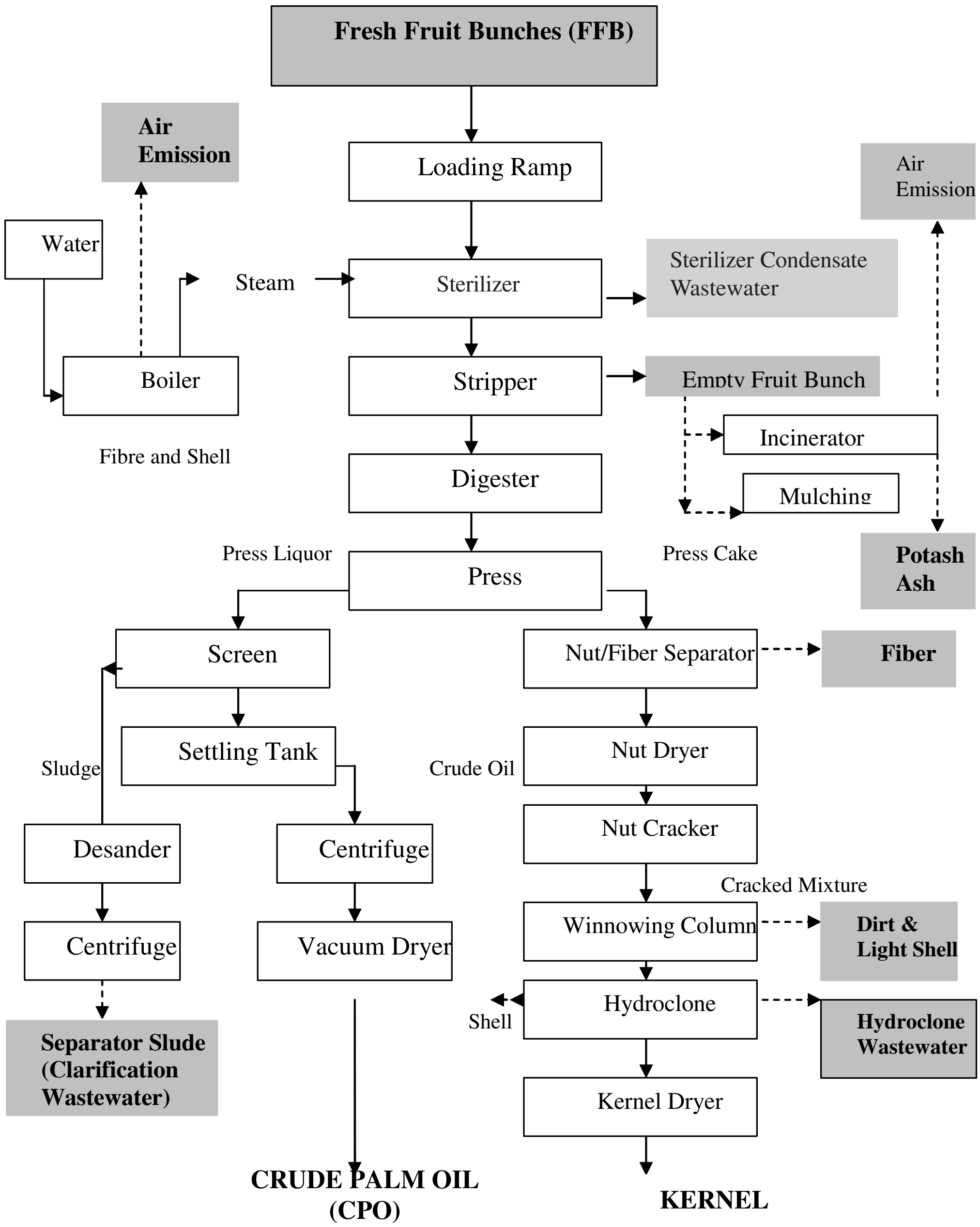


Figure 4.2 Conventional Palm Oil Extraction Process and Main Sources of Waste Generation and Emissions

Source: DOE 1999b: 12

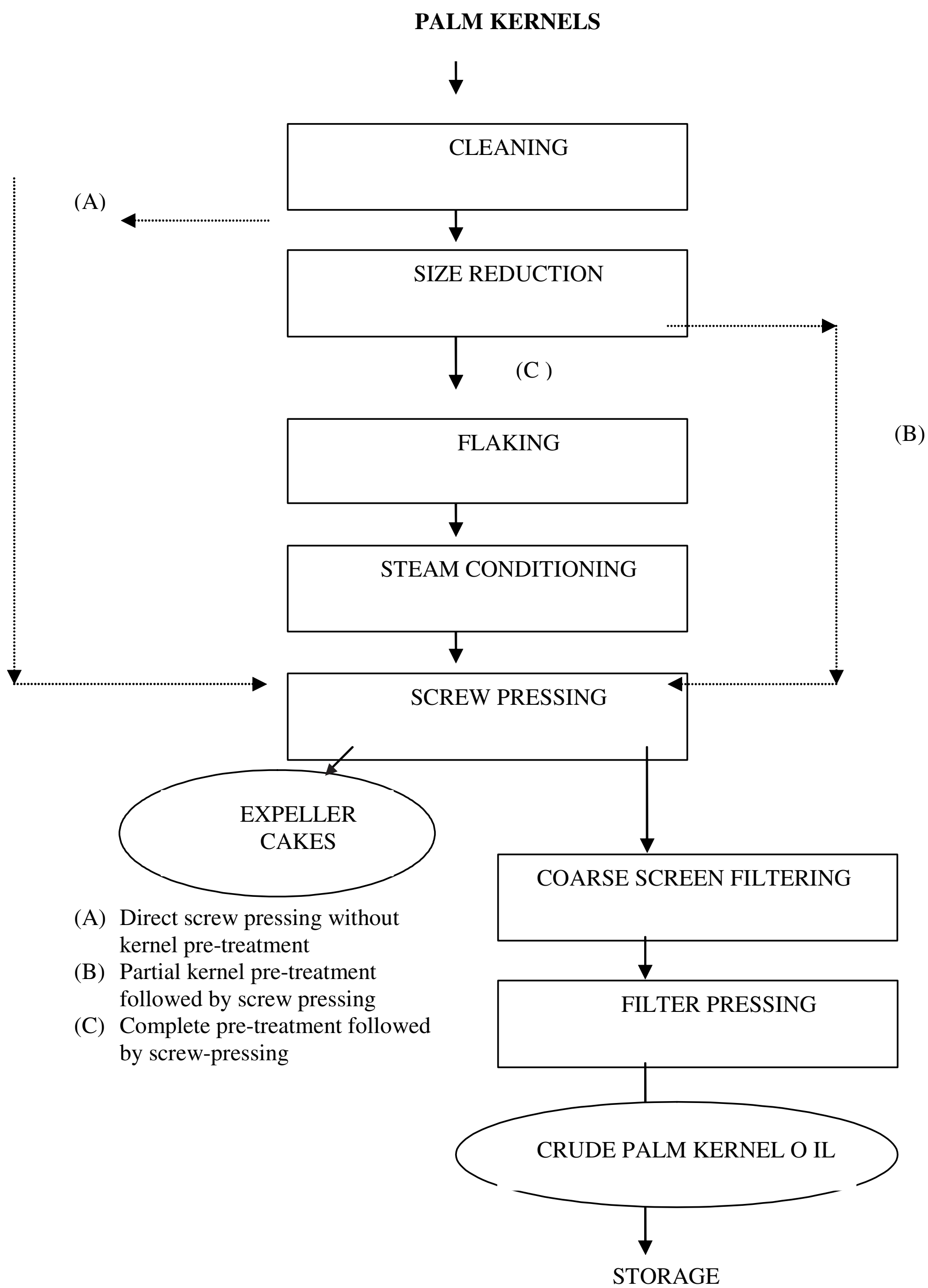


Figure 4.3(*a*) Flow chart of palm kernel oil extraction by screw-pressing
Source: Yusof Basiron et al., 2005: 30.

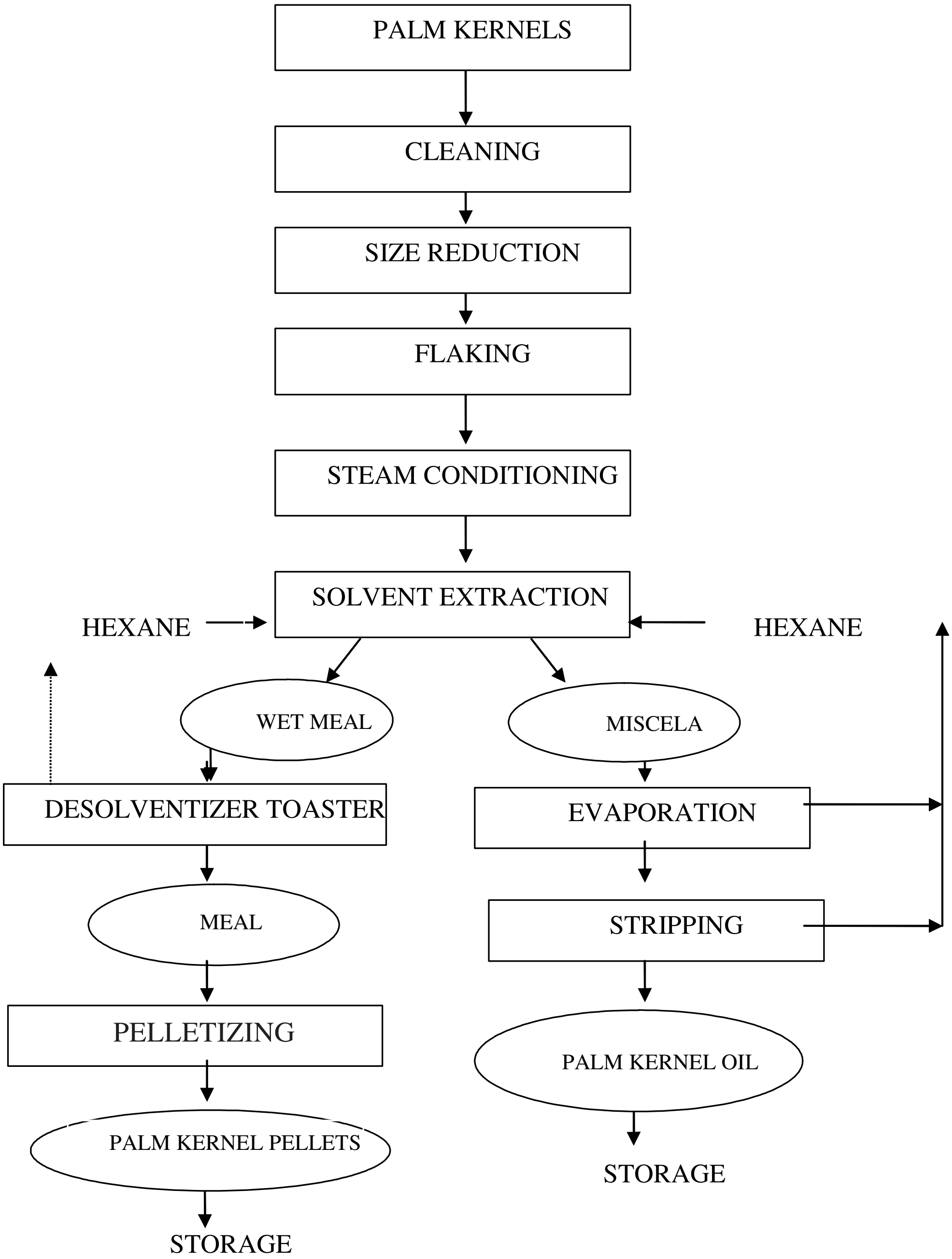


Figure 4.3(b) Flow chart of solvent extraction of palm kernel oil

Source: Yusof Basiron, et al., 2005: 32.

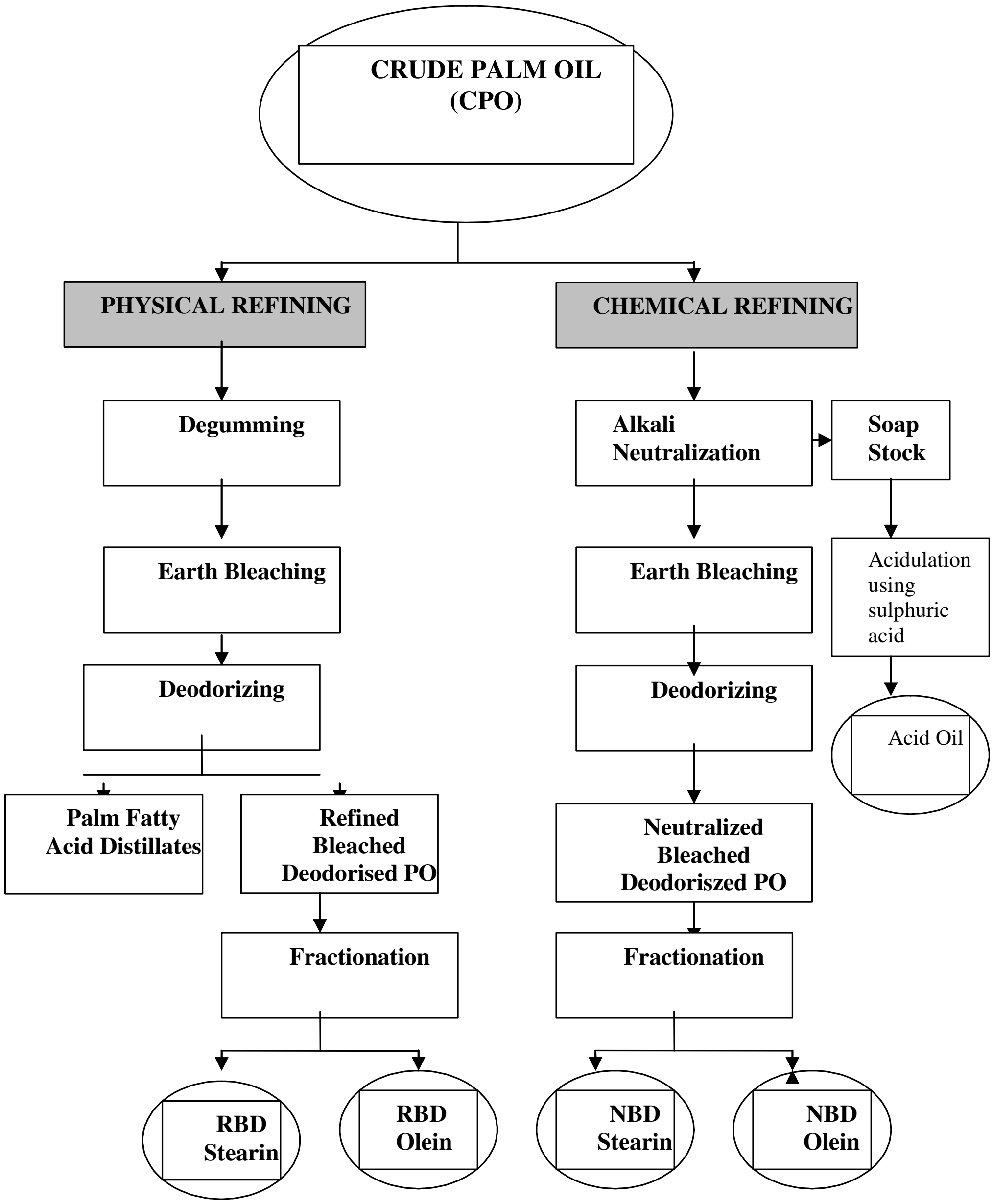


Figure 4.4 Palm Oil Refining Process

Source: (1) Teoh Cheng Hai 2002, (2) PORAM

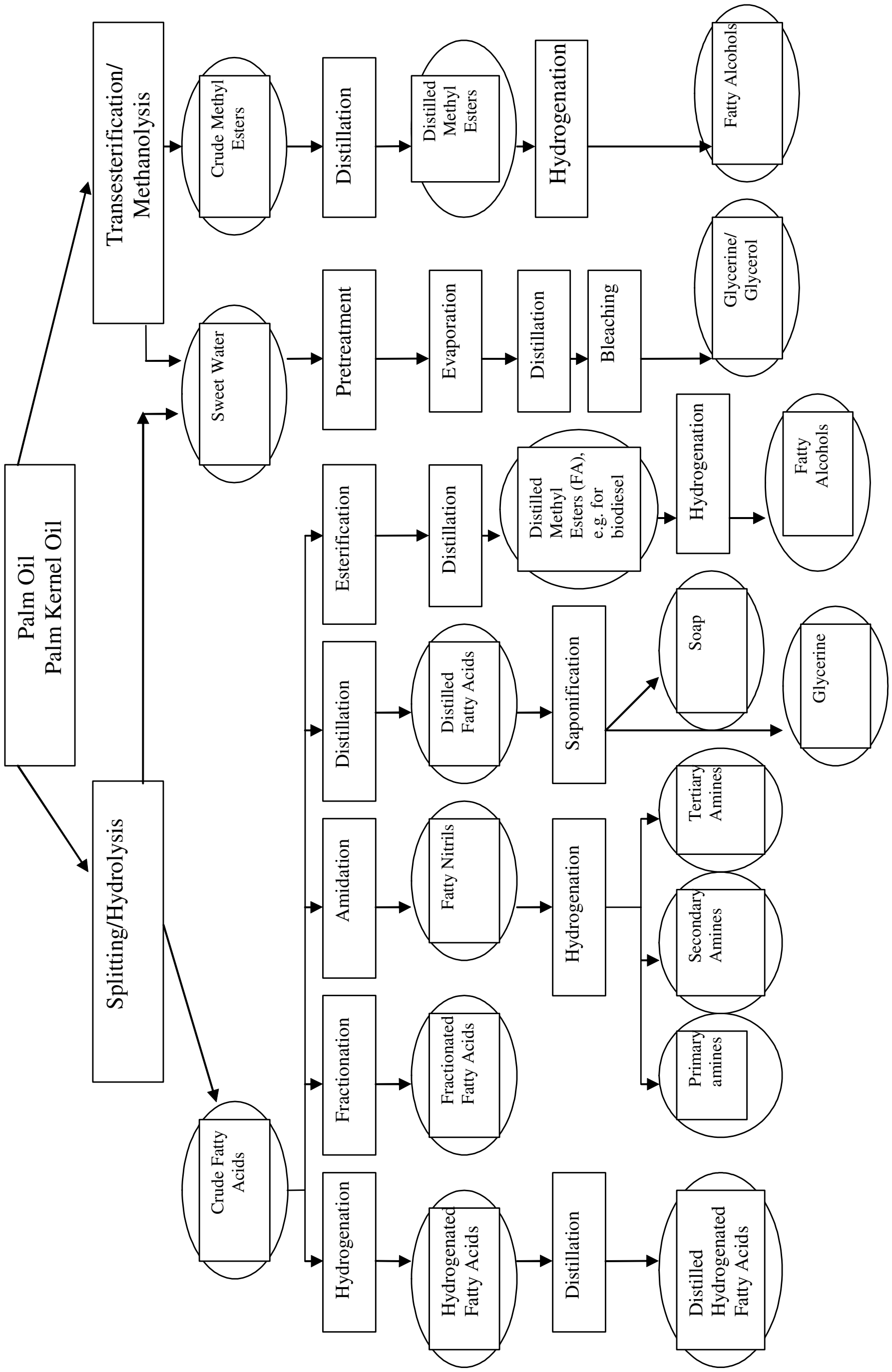


Figure 4.5 Oleochemical Manufacturing Process

4.3 The evolution of the palm oil production chain in Malaysia: Then and Now

Malaysia has undergone two phases of modern economic development. The first phase of agriculture economic development was as a result of the British colonial legacy where the then Malaya (today West Malaysia) was treated as a commodity producer state. The first major commercial crop was rubber and this was followed by oil palm and cocoa. From a mere 400 hectares in 1920, the area under oil palm cultivation has expanded to 54,638 hectares in 1960 (DOE 1999b:5), and to 3,875,327 hectares in 2004 (MPOB 2004) (See also Table 4.1). Sing Khera's analysis (1976) of the oil palm industry till 1975 indicated that there were three distinct phases.

Table 4.1 Planted Area (Hectares) for Oil Palm

Year	Hectarage	Percentage Change
1875-1910s	< 350	-
1920	400	14 (1920-10)
1930	20,600	5050 (1930-40)
1940	31,400	52 (1940-30)
1950	38,800	24 (1950-40)
1960	54,638	41 (1960-50)
1970	261,199	378 (1970-60)
1980	1,023,306	292 (1980-70)
1990	1,984,167	94 (1990-2000)
2000	3,376,664	70 (2000-1990)
2004	3,875,327	15 (2004-2000)

Source: PORLA, Palm Oil Statistics; MPOB Oil Palm Statistics, various publications; Harcharan Singh Khera, 1976

Table 4.2 Area Planted With Oil Palm In Peninsular Malaysia, Sabah and Sarawak (Hectares)

Tahun	Peninsular Malaysia	Sabah	Sarawak	Total
1925	3,200	-	-	3,200
1930	20,000	-	-	20,000
1940	31,000	-	-	31,000
1950	38,800	-	-	38,800
1960	54,638	-	-	54,638
1970	221,791	38,433	975	261,199
1980	906,590	93,967	22,749	1,023,306
1990	1,698,498	276,171	54,795	2,029,464
2000	2.045,500	1,000,777	330,387	3,376,664
2004	2,201,606	1,165,412	508,309	3,875,327

Source: 1925-1950: Moll 1987; 1960-1980: PORLA Palm Oil Statistics 1988; 1980-2000: MPOB Oil Palm Statistics 2003; 2004: MPOB Oil Palm Statistics 2004.

The first stage, known as the experimental stage, from 1875 to 1917 started with the introduction of oil palm seeds to Singapore, a state in then Malaya. This led to the Department of Agriculture importing oil palm seeds to the Batu Tiga Experimental Plantation for governmental experimentation with regard to the suitability of oil palm cultivation for commercial purposes, and to the Public Gardens in Kuala Lumpur for ornamental purposes. Selected seeds and seedlings from this experimental plantation were planted at the new Experimental Plantation at Serdang. It however remained more of an ornamental plant till 1916. The second stage, from 1917 to ending 1961, identified as the commercial planting stage, was an exciting period as can be seen in Table 4.1 with regard to positive percentage change in hectarage, signifying its increasing importance. The period of 1920-30 saw a phenomenal increase of 5050 percent or an average growth of 459% per annum. This coincided with the heavily depressed prices of rubber and the stimulation of interest in oil palm. The decade of 1930-40 saw a lower hectarage growth due to low prices of palm oil products while 1940-50 was affected by the Japanese Occupation from 1941-45. The period of post war years were focused on rehabilitation and later hectarage expansion. The post-war prices of palm oil products were four to five times higher than pre-war days and were remarkably steady, which led to further expansion in hectarage and replanting where old low yielding palms were replaced with high yielding plantlets. The declaration of 'Emergency' in June 1948 as a result of the communist threat slowed the pace of expansion in the period 1950-60.

The third stage, identified with agriculture diversification and oil palm expansion, started in the 1960s and lasted to a certain extent till today. However, prior to this, the World Bank Mission in 1955 highlighted the need for agriculture diversification. The World Bank Mission and the Ford Foundation recommended oil palm and this was abetted by the declining and pessimistic prices of rubber in the 1960s. The Malaysian Government recommended the rapid expansion of oil palm hectarage by incorporating smallholder participation on a large scale which was hitherto dominated by three large foreign plantation companies which were also involved in trading (Moll 1987). This policy was implemented mainly by government agencies such as the Federal Land Development Authority (FELDA), Federal Land Consolidation and Rehabilitation Authority (FELCRA), Rubber Industry Smallholders Development Authority (RISDA) and state government schemes for smallholders in settlement projects, as indicated in Table 4.3.

Table 4.3 Distribution of Oil Palm Planted Area (Hectares)

	1970 Hectares	%	1980 Hectares	%	1990 Hectares	%	2000 Hectares	%	2003 Hectares	%
Private Estates	214,200[a]		557,659	52.1	912,131	44.9	2,024,286	60.0	2,248,014	59.13
Government Schemes:										
FELDA	51,561[b]		316,550	29.6	608,100	30.0	598,190	17.7	630,330	16.58
FELCRA			18,851	1.8	118,512	5.8	154,357	4.6	155,937	4.10
RISDA	-		20,472	1.9	32,582	1.6	37,011	1.1	59,497	1.56
State Schemes			67,281	8.0	174,456	8.6	242,002	7.1	320,265	8.42
Smallholders			70,446	6.6	183,683	9.1	320,818	9.5	387,998	10.20
TOTAL			1,051,259	100.0	2,029,464	100.0	3,376,664	100.0	3,802,040	100.0

Source:
1970: [a]. Department of Statistics. [b]. FELDA Annual Report 1970.
1980: PORLA Palm Oil Statistical Handbook (1981 Supplement).
1990: PORLA Palm Oil Statistical Handbook 1990.
2000: Malaysian Oil Palm Statistics 2000 (20^{th} Edition).
2003: Malaysian Oil Palm Statistics 2003.

The private commercial plantation companies also concurred with this policy, in which top priority for oil palm was accorded in new planting and replanting programs. Existing rubber smallholders, who wish to replant their old rubber trees with oil palms, were given a replanting grant starting in 1962. This, together with government schemes mentioned above, set the stage for the rapid expansion in oil palm hectarage for the periods 1960-70, 1970-80, 1980-90 and 1990-2000 and also 2000-2004 as seen in Table 4.1. The 1970s also saw the rapid expansion of large scale planting in the states of Sabah and Sarawak, part of East Malaysia, which extended till today as seen in Table 4.2. As land is a limited resource, vast tracts of available, suitable land for oil palm cultivation are diminishing in Malaysia. Adding to reduced availability, the prices of land have gone upwards. Thus, in the view of this researcher, this set the stage for the fourth phase of offshore expansion of oil palm hectarage that began from around 1995 till today. The offshore expansion was focused primarily on Indonesia as Indonesia has a relatively large land mass where land and labour are relatively cheap. The islands of Sumatra and Kalimantan were the main foci of attention.

In terms of ownership, up till the early 1970s, the private estates were predominantly foreign-owned, accounting for 68% of the total acreage in West Malaysia in 1972. Of this total, British companies owned 48.26%, other foreigners mainly Danish, French and Singapore interests collectively owned 17.9% with the remaining 33.84% owned by Malaysians (Singh Khera 1976). Perbadanan Nasional Berhad (PNB) was established in March 1978 as a government investment vehicle in promoting bumiputra (indigenous) equity interest under the auspices of the New Economic Policy (NEP). PNB negotiated with foreign-domiciled plantation companies for the transfer of ownership. By 1979, Sime Darby and Harrisons and Crosfield (also including Island and Peninsular) were acquired. Harrisons and Crosfield is today known as Golden Hope. Austral's parent company also came under the control of PNB and its related unit trust funds under a smooth transition.

However, Guthrie and Co. PLC (also includes Highlands and Lowlands PLC as a subsidiary) was acquired in a lightning raid at the London Stock Exchange in 1981 under acrimonious conditions. As such, foreign ownership in private estates today is limited in nature, mainly by Danish and Singaporean interests. From the 1970s till today, the non-PNB, home-grown Malaysian plantation companies spread their wings to become major players in the oil palm and palm oil industry in Malaysia. Many have become public listed companies in the Malaysian Bourse. The major non-PNB companies are PPB Oil Berhad, Asiatic Development Berhad, IOI Corporation Berhad, Kuala Sidim Berhad which is a subsidiary of Boustead Holdings Berhad, Kulim Berhad which is a subsidiary of Johore Corporation Berhad, Kuala Lumpur Kepong Berhad (following a restructuring scheme it became a Malaysian domiciled company), and IJM Plantation Berhad.

With reference to Table 4.3 the main player for the government schemes is FELDA. FELDA was established in 1956 with the objective of socio-economic upliftment of the rural community by means of resource deployment. Subsistence agriculture would be converted into higher income generating smallholdings where each smallholder is given four hectares. The opening up of agricultural settlements, initially with rubber and later mainly with oil palm was done on primary forests and logged over forest lands. The first planting of oil palm occurred in 1961 on 8100 acres at the Tain Andak Complex in Pahang. In 1980s it expanded to Sabah (Tunku Shamsul and Lee, 1980). In the 1980s, FELDA also expanded to the development of plantations (FELDA Online 2006). As shown in Table 4.3, FELDA's hectarage expanded from 51,561 hectares in 1970 to a phenomenal 630,330 hectares in 2003, an average annual growth of 34%, and accounting for 16.58% of total oil palm planted area. However, in the period of 2000-2003, there was no significant increase in hectarage with the focus being on replanting the old palm trees with higher yielding materials. FELCRA focuses on the rehabilitation of the earlier developed low cost State Schemes and Youth Land Schemes and also opening up forest or unused land to increase the land resource of existing villages (Moll 1987). FELCRA was corporatised in 1997 with a change of name to FELCRA Berhad to reflect not only on the socio-economic objective but also the business imperative by developing upstream and downstream activities (Malaysia 1991). In 2003, FELCRA commands a 4.1% of oil palm planted hectarage. RISDA's name may sound like a misnomer as it is rubber related, but its original role of providing rubber replanting grants, was later expanded to oil palm. As at 2003, the oil palm hectarage under RISDA has expanded to 1.56%. The state schemes in Sabah and Sarawak, at this point, are predominated by FELDA and similar land schemes like FELCRA.

Collectively, the smallholders hold a sizeable percentage of 10.2% of oil palm hectarage. A smallholding is any legal holding of 100 acres (40.5 hectares) or less. In most instances, the relatively poorer crop management practices and subsequently the yields of the FFBs are lower as compared to the plantations. The FFBs produced by the smallholders are sold to nearby mills. At this juncture the smallholders have greater leverage as the FFBs are much sought after as millers try to increase plant capacity utilization to attain economies of scale and also because of higher demand for palm oil and palm kernel oil.

This phenomenal growth in hectarage was obviously accompanied by the rising production of palm oil based products. As an example, in 1960, the production of CPO was 91,793 tons (PORLA, 1991: 22), and it has expanded to 13,976,182 tons in

2004 (MPOB, 2004). This shows a remarkable volume increase of 15,126% or an average annual growth of 344% over these two periods (Refer Table 4.4). However, the growth in CPO export did not grow as phenomenally as that of CPO production. The export of CPO in 1960 was 97,568 tons and since then had expanded in volume in 1970 before experiencing a downswing in 1980 and 1990 followed by an upturn in 2000 and 2004. The downswing from 1970 to 1990 was due to the takeoff of the downstream activities which started with the first refinery by Unitata in 1974 and the first oleochemical plant by Acidchem in 1979. In the Malaysian context, the CPO produced by the millers must be sold in the local market. However if there is an inventory overhang of CPO in the domestic market, the Crude Palm Oil can be exported with special permits from the MNRE (Hanim Adnan, 2004). These special permits are given to the local large vertically integrated players with refineries overseas like the IOI Group and the Golden Hope Group. The increasing depth of utilization of CPO by the downstream sub-sectors is also reflected in the proportion of export to production of CPO where the ratio declined drastically till 1990 before a slight uptick in 2000 and 2004 due to a larger inventory overhang. In tandem, palm kernel production also experienced an upsurge from 24,053 tons in 1960 to 3,661,456 tons in 2004, an upswing of 15122% or an annual average growth of 344% over these two points in time. However, data from the Department of Statistics revealed that by 1970, as shown in Table 4.5, the production of CPKO has already begun. This is also evidenced by the statement made by Moll that the palm kernel crushing industry started in Malaysia during 1970-75 (Moll 1987). The export of palm kernel was terminated in 1972 (Moll 1987), thereby indicating the growth of the palm kernel crushing sub-sector and also evincing the development of value-added activities. The number of palm oil mills grew from 10 in the 1960s to 381 in 2004. This rapid rise in the number of mills is paralleled by the increasing hectarage as shown in Table 4.3.

Table 4.4 Production and Export of CPO, Production and Export of PK, and the Existing Number of Palm Oil Mills in Malaysia, 1950-2004

Year	Crude Palm Oil Production (CPO) (Tons)	Crude Palm Oil Export (Tons)	Proportion of Export to Production for CPO	Palm Kernel Production (PK) (Tons)	Palm Kernel Export (Tons)	Proportion of Export to Production for Palm Kernel	Existing Number of Palm Oil Mills
1950	51,000	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1960	91,793	97,568[a]	1.6	24,053	n.a.	n.a.	10[c]
1970	431,069	401,930	*0.93*	92,285	28,900[b]	0.31	50[d]
1980	2,573,173	197,659	*0.08*	557,066	-	-	149[e]
1990	6,094,622	93,949	*0.02*	1,844,737	-	-	261
2000	10,842,095	398,352	*0.04*	3,162,760	-	-	350
2004	13,976,182	1,324,478	*0.09*	3,661,456	-	-	381

Notes: n.a.: not available

[a]. *CPO export 1960 : Moll 1987: 141.*

[b]. *Palm kernel export 1970 : Moll 1987: 142.*

[c]. *Number of existing mills, 1960: It is mentioned that in the 1960s, there were 10 palm oil mills (Yusof Basiron, et al., (1998): 12).*
[d]. *Number of existing mills, 1970: Yusof Basiron and Ariffin Darus: 45.*
[e]. *Number of existing mills, 1980: Annual Report 1980 PORLA: 53.*

Source: PORLA Palm Oil Statistics, various issues; Malaysian Oil Palm Statistics, MPOB, various issues.

Table 4.5 also reveals that the production of CPKO increased dramatically from 70,865 tons in 1970 to 1,644,445 tons in 2004, an escalation of 2,221% or an annual growth rate of 65% between these two points of time. However, the export of CPKO only started in 1983 (MPOB, 2003) culminating with a volume of 297,152 tons in 1990, subsequently contracting to 20,071 tons in 2000 and later expanding to 88,920 tons in 2004. The uptick in 2004 is due to stock overhang. However, the ratio of export to production of CPKO has edged downwards from 0.36 in 1990 to 0.01 in 2000 and subsequently rising insignificantly to 0.05 in 2004. This reflects on the successful absorption of CPKO as feedstock in downstream activities of refining and specialty fats production and particularly that of oleochemical production. Likewise, the production of palm kernel cake escalated to 278,559 tons in 1980 with the genesis of the palm kernel crushing sub-sector in 1970, which subsequently expanded to 1,894,017 tons in 2004, an increase of 580% or an annual average growth of 24% between these two points in time. The exploitation of PKC for export only started in 1976 (MPOB 2003) and continued till today. However, the high ratio of export to production of PKC as disclosed in Table 4.5 indicated that PKC is primarily for the export market where the PKC is used mainly in the formulation of animal feeds. Based on existing data, the number of crushing plants has declined from 53 in 1990 to 37 in 2000 prior to a slight increase to 41 in 2004. With the exception of palm kernel crushers which are a part of a vertically integrated group, the remaining ones are independent palm kernel crushers which belong to the Small and Medium Enterprises category. The independent palm kernel crushers serve mainly independent palm oil mills and groups that have only a plantation cum milling arm. The number of palm kernel crushers has not expanded like palm oil mills over time as there is excess capacity (MPOB 2005).

Table 4.5 Production and Export of CPKO, Production and Export of PKC and the Existing Number of Palm Kernel Crushers in Malaysia, 1970-2004

Year	Crude Palm Kernel Oil Production (CPKO)	Crude Palm Kernel Oil Export (Tons)	Ratio of Export to Production for CPKO	Palm Kernel Cake (PKC) Production	Palm Kernel Cake Export (Tons)	Ratio of Export to Production for PKC	Existing Number of Crushing Factories
1970	70,865	n.a.	n.a.	n.a.	n.a.	n.a	n.a.
1980	222,285	n.a.	n.a.	278,559	259,593	0.93	n.a.
1990	827,233	297,152	0.36	1,038,221	868,591	0.84	53
2000	1,384,685	20,071	0.01	1,639,227	1,349,945	0.82	37
2004	1,644,445	88,920	0.05	1,894,017	1,795,918	0.95	41

Note: n.a.: not available
1990- Number of existing crushing factories: Review of the Malaysian Palm Oil Industry in 1990.
Source: Malaysian Oil Palm Statistics, MPOB, various publications.

As mentioned above, the refining sub-sector was kickstarted by Unitata in 1974. From that year onward, a tax incentive was granted to the local refining sub-sector. This led to the rapid growth to 45 refineries in 1980. However, the number of refineries declined to 37 in 1990 due to excess capacity which led to the cessation of operations for some. From 1990 onwards, there is a pick up in the number of refineries as the problem of excess capacity has abated paralleled with the increasing demand and export of processed palm oil and processed palm kernel oil. As highlighted earlier, the process of refining is the removal of impurities. However, at the same time refiners also carry out modifications by way of fractionation, hydrogenation and interesterification. As such, the outputs by refiners are categorized as processed palm oil or processed palm kernel oil depending on the feedstock used. Table 4.6 reveals that a high ratio of export of processed palm oil to CPO production from the 1980s onwards, points to the changing profile to the types of products exported, with the coming into being of the predominance of export of processed palm oil which is aligned to the reduction of export of CPO and to a lesser extent CPKO as CPO and CPKO are feedstocks for the production of processed palm oil and processed palm kernel oil. This phenomenon is highlighted via Tables 4.4 and 4.5 which indicate the drastic decline in the export of CPO and CPKO. This also carries the implication that the downstream refining sub-sector has gone beyond the takeoff phase and is a major export contributor. This is supported by a high ratio of export of processed palm oil to CPO production and to a certain extent the lower ratio of export of processed palm kernel oil to CPKO production which hovers in the region of 0.3 and 0.4 and also the increasing export of edible as shown in Table 4.6(ii). However, an analysis on the number of POFP manufacturers over time is not possible as available data exists only for 2004. The feedstock for POFP comes from processed palm oil and processed palm kernel oil. However feedstock data for POFP are not available. The lower ratio of export of processed palm kernel oil to CPKO production compared to the ratio of export of processed palm oil to CPO production is to be expected as CPKO is the main feedstock for oleochemical production. However it must be mentioned that both these ratios in Table 4.6(i) did not take into account the refining factor or the loss of feedstock oil in the refining process, which is a relatively small amount. However, at the same time it does not detract from the fact that the figures for CPO production and CPKO production, which are feedstocks in the refining process, are good proxies for the production of processed palm oil and processed palm kernel oil respectively. These were taken as proxies as the production outputs for both processed palm oil and processed palm kernel oil were not available.

Table 4.6(i) Production Feedstock and Export of Processed Palm Oil, Production Feedstock and Export of Processed Palm Kernel Oil, and the Existing Number of Refineries in Malaysia, 1975-2004

Year	CPO Production (Tonnes)	Export of Processed Palm Oil (Tons)	Ratio of Export of Processed Palm Oil to CPO Production	CPKO Production (Tonnes)	Export of Processed Palm Kernel Oil (Tons)	Ratio of Export of Processed Palm Kernel Oil to CPKO Production	Existing Number of Refineries
1975	1,257,573	215,515	0.17	108,260	n.a.	n.a.	n.a.
1980	2,573,173	2,073,563	0.81	222,285	n.a.	n.a.	45
1985	4,134,463	3,420,974	0.83	511,908	27,720	0.05	38
1990	6,094,622	5,633,502	0.92	827,233	392,575	0.47	37
1995	7,810,546	6,495,682	0.83	1,036,538	354,713	0.34	41
2000	10,842,095	8,683,201	0.80	1,384,685	500,208	0.36	46
2004	13,976,182	11,250,923	0.81	1,644,445	689,937	0.42	48

Note: n.a.: not available
Number of existing refineries (in operation) : 1980: Annual Report PORLA 1980: 53.
Number of existing refineries (in operation) : 1985: Palm Oil Statistics Supplement 1985: 5.

Source: Malaysian Oil Palm Statistics, MPOB, various issues.

Table 4.6(ii) Export of Edible POFP and the Number of Existing POFP Manufacturers in Malaysia, 1995-2004

Year	Export of Edible POFP (Tons)	Percentage Change	Existing Number of POFP Manufacturers
1995	98,664	n.a.	n.a.
2000	250,136	154	n.a.
2004	374,345	50	16[1]

Source: [1] MPOPC and Jora-Aki Technology 2003,
Malaysian Oil Palm Statistics, MPOB various issues.

Table 4.7, like Table 4.6 does not have data pertaining to oleochemical production in Malaysia. If it is available, the ratio of export of oleochemical products to the production of oleochemical products in Malaysia can be calculated. Therefore a proxy was developed to analyze the export orientation and the development of downstream value-added activities of the Malaysian oleochemical manufacturers. The feedstocks for oleochemical production are CPKO, processed palm oil, processed palm kernel oil and CPO in order of importance. As processed palm oil and processed palm kernel oil are derived from CPO and CPKO respectively, the proxy to be used as the feedstock for oleochemical manufacturers would be a combination of CPO and CPKO production in Malaysia and not a combination of CPO, CPKO, processed palm oil and processed palm kernel oil so as to avoid double counting. At the same time, data for the production of processed palm oil and processed palm kernel oil in Malaysia are not available. Likewise as in the case of refining, the oil lost in oleochemical manufacturing is not taken into account but this does not detract from the utility of this proxy as it is the next best alternative. The oleochemical manufacturing sub-sector started in 1979 with the establishment of an oleochemical plant by Acidchem. Table 4.7 reveals that the ratio of export of oleochemical products to the total of CPO and CPKO production is on a slow relatively marginal increase till 2004. The expansion of the number of existing oleochemicals plant from 1990 onwards is also on a slow incremental basis. This indicates that the development of the downstream oleochemical industry is not as rapid and vibrant as that of the refining sub-sector if history is taken into context. The refining sub-sector was born in 1974 whereas the oleochemical manufacturing sub-sector was 4 years later in its genesis but the difference in volume of the export of processed palm oil and processed palm kernel oil, a total of 11,940,890 for these two oils as compared to 1,766,441 tons of export for oleochemical products in 2004 indicated a wide gulf existing for these two sub-sectors in terms of export, productive capacity and the number of players.

Table 4.7 Production Feedstock, Export of Oleochemical Products and Number of Oleochemical Manufacturers, 1980-2004

Year	CPO Production	CPKO Production	Total of CPO and CPKO Production as Proxy for Feedstock for Oleochemical Manufacturers	Export of Oleochemical Products	Ratio of Export of Oleochemical Products to Total of CPO and CPKO Production	Existing Number of Oleochemical Manufacturers
1980	2,573,173	222,285	2,795,458	n.a.	n.a.	1
1985	4,134,463	511,908	4,646,371	n.a.	n.a.	1[a]
1990	6,094,622	827,233	6,921,855	129,224	0.02	13[b]
1995	7,810,546	1,036,538	8,847,084	520,564	0.06	13
2000	10,842,095	1,384,685	12,226,780	1,137,871	0.09	16
2004	13,976,182	1,644,445	15,620,627	1,766,441	0.11	17

Note: n.a.: not available
[a]: S.S. Chen and K.G. Berger 1984.
[b]: Hamirin Kifli, T.L. Ooi and Salmiah Ahmad 1990.

Source: Malaysian Oil Palm Statistics, MPOB, various issues.

4.4 The Export of the Palm Oil Production Chain in Malaysia

The major regions or markets for the export of palm oil products, which include CPO and processed palm oil, from Malaysia as indicated in Table 4.8(i) are West Asia, East Asia, Middle East and European Union in order of importance. However, the significant percentage growth in volume as at 2004 as compared to 2000 for these major markets as identified above, are East Asia and EU. Table 4.8(ii) highlights that the major regions for the export of palm kernel oil products, which comprise of CPKO and processed palm kernel oil, are North America, East Asia, Middle East, and EU. Of these markets, West Asia, Middle East and North America experience significant growth in volume. However, for PKC, the major export market is predominantly EU as revealed in Table 4.8(iii). For oleochemical products, the major export regions for Malaysia are East Asia, EU and North America as indicated in Table 4.8(iv). East Asia experiences a significant increase in volume and to a certain extent by EU and North America for oleochemical. Table 4.8(v) discloses that the Middle East, West Asia and non-EU Europe are the major export regions for Malaysia's POFP. However, the original data for POFP presented by MPOB classifies export on a country basis which in turn is classified into regions by the researcher herself. However, for the other products above, MPOB classifies export via regions and also the countries importing in a particular region. However a possible limitation in terms of the data for the POFP is that the MPOB classification for *others* may also include data for countries in the regions as delineated in Table 4.8(v). This suspicion is borne from the high export volume figures for both 2000 and 2004 for the *others* category.

The above-mentioned major export markets or regions highlighted certain common denominators for the exporters of palm oil products and palm kernel oil products from Malaysia. East Asia, West Asia, Middle East, EU and North America are major export regions or destinations for Malaysia. Export volumes are influenced by several issues. For West Asia, or particularly India, the main issues pertain to higher tariff imposed on palm oil and the quality of oil (Zaidi Isham Ismail 2003a). For East Asia, as in the case of China, the main issue is quantity which is essentially trade whereas for Japan, a high priority is accorded to quality and HACCP requirement. No major issues emanate from the Middle East. However, the major export regions of EU and North America can give rise to major environmental issues in relation to deforestation for the purpose of logging and consequently oil palm cultivation, and in the process the destruction of flora and fauna, especially the endemic ones, resulting in a damaged ecosystem. This is also exacerbated by the strong competition and competitive pricing of palm oil which has provoked adverse reactions from other vegetable oil producers in the international oils and fats market. Particularly strong is the soybean oil lobby in the USA as the USA is a major exporter of soybean oil. The soybean oil lobby has clouded competitive trade issues with health and environmental concerns. Concerted efforts were carried out to deride the quality of palm oil which the then Ministry of Primary Commodities and the now Ministry of Plantation Industries and Commodities and MPOPC, countered effectively via research not only by scientists from Malaysia but also from the developed countries. (See Section 4.5 for an elaboration of environmental impacts).

The EU has adopted a farm to fork preventive approach via the issuance of Food Hygiene Directive 93/43/EEC covering all stages of food production. In addition, a primary concern for the oil palm and palm oil chain is Regulation 178/2002 that covers the general principles and food law requirements which include traceability, being enforced from 1 January 2005 onwards (Ng Say Bock and M. R. Chandran 2004). One of the ways of fulfilling this Directive and Regulation is by means of obtaining ISO 9000 standards certification where quality parameters and the traceability element are stated. Trade with EU and North America also envelopes the requirements for other benchmarks, like the European Retailer Fresh Produce

Working Group Good Agricultural Practices (EUREPGAP) certification and HACCP certification. EUREPGAP's global standards emphasis on food safety, environmental protection and social welfare at the pre-farm gate level whereas standards are being developed for animal welfare and post-farm gate level (Hugo Hays 2004). EUREPGAP certification is an international certification where in relation to the POPC, certified food products with palm oil content can be sold by large retailers like Tesco and Carrefour (Zaidi Isham Ismail 2003b). On the other hand, HACCP is a food safety certification program that manages hazards based on seven principles, namely hazard identification, taking corrective action, monitoring, verifying and recording measures undertaken to ensure hazard removal, and keeping hazards under control, thus leading to the elimination of hazards. Another important code is the Codex Alimentarius, a series of food standards, has the aims of creating a high level of consumer protection and fair trading practices in the international trade of food and agriculture produce. The Codex Alimentarius Commission, charged with the development of Codex standards, is an intergovernmental body jointly sponsored by the United Nations bodies like the World Health Organization and Food and Agriculture Organization. Codex standards are recognized in relevant World Trade Organization agreements as having the ability to provide food safety and quality, and also not unnecessarily restricting trade. The European Union has become a member of Codex since November 2003 (Codex Online 2005). However, the adoption of Codex standards in EU is voluntary in nature. As such, compliance with EU Food Hygiene Directive 93/43/EEC and Regulation 178/2002, obtaining EUREPGAP and HACCP certifications and complying with Codex standards can also be viewed as a means of access to the EU market. The farm to fork food supply chain management, a preventive approach, can be viewed as only as strong as the weakest link. The attainment of food safety at source is a major step in eliminating hazards from entering into the food supply chain, thus overcoming and strengthening the weak link or links in a particular food supply chain (Ng Say Bock and M. R. Chandran 2004). On top of these, 100% sampling and analysis is being done on the export of Malaysian palm oil and palm kernel oil to Europe which acts as an added assurance. Good quality oil is an imperative in determining the utility and quality of downstream or finished products. These preventive measures ensure that palm oil quality is made in the fields, with milling, refining and modification, helping to maintain it (Yusof Basiron and Chan Kook Weng 2004).

Table 4. 8(i) Export Volume (Tons) of Palm Oil Products (CPO and Processed Palm Oil) by Region for the Years 2000 and 2004

Major	Export Volume of Palm Oil for 2000	% Export Volume of Palm Oil for 2000	Export Volume of Palm Oil for 2004	% Export Volume of Palm Oil for 2000	% Change of Export Volume for 2000/2004
European Union (EU)-15	1,037,994	11.4	1,942,345	15.5*	87.1
European Union (EU)-25			1,967,111	15.6	-
Non EU Europe	80,639	0.9	226,571	1.8	*181.0***
North America	187,436	2.1	353,791	2.8	88.8
Latin America	35,603	0.4	87,475	0.7	145.7
Middle East	1,256,678	13.8	1,736,130	13.8	38.2
Africa	459,155	5.1	879,060	7.0	91.5
Oceania	132,690	1.5	127,181	1.0	-4.2
East Asia	1,868,898	20.6	3,931,366	31.3	110.4
ASEAN	548,943	6.0	826,755	6.6	50.6
West Asia	3,451,763	38.0	2,346,155	18.7	-32.0
Others	21,695	0.2	93,809	0.7	332.4
Total	9,081,494	100.0	12,575,403	100.0	

Legend:

* *The percentage in italic is not summed up vertically in the table as part of the 100% as the members of the European Union have expanded from 15 to 25 members by May 2004. This figure is calculated so as to highlight the composition of export or the ratio of export based on the original 15 members.*

** *The percentage in italic calculated is not an absolutely true reflection of percentage change for non-EU Europe as 10 countries from this region became a member of the EU in May 2004. As such it is not comparing an exact like with an exact like.*

Source: Malaysian Oil Palm Statistics, MPOB 2000; Malaysian Oil Palm Statistics, MPOB 2004

Table 4.8(ii) Export Volume (Tons) of Palm Kernel Oil Products (CPKO and Processed Palm Kernel Oil) by Region for the Years 2000 and 2004

Major	Export Volume of Palm Kernel Oil for 2000	% Export Volume of Palm Kernel Oil for 2000	Export Volume of Palm Kernel Oil or 2004	% Export Volume of Palm Kernel Oil for 2000	% Change of Export Volume for 2000/2004
European Union (EU)-15	83,017	16.0	95,491	*12.3**	15.0
European Union (EU)-25			98,631	12.7	
Non EU Europe	6,613	1.3	31,027	4.0	*369.2***
North America	125,804	24.2	184,967	23.8	47.0
Latin America	22,586	4.3	32,314	4.2	43.1
Middle East	66,284	12.7	124,191	16.0	87.4
Africa	31,343	6.0	34,776	4.5	11.0
Oceania	14,403	2.8	17,416	2.2	20.9
East Asia	98,210	18.9	134,728	17.3	37.2
ASEAN	34,373	6.6	34,466	4.4	0.3
West Asia	27,739	5.3	57,845	7.4	108.5
Others	9,908	1.9	28,497	3.7	187.6
Total	520,280	100	778,858	100 (round-up)	

Legend:

* *The percentage in italic is not summed up vertically in the table as part of the 100% as the members of the European Union have expanded from 15 to 25 members by May 2004. This figure is calculated so as to highlight the composition of export or the ratio of export based on the original 15 members.*

** *The percentage in italic calculated is not an absolutely true reflection of percentage change for non-EU Europe as 10 countries from this region became a member of the EU in May 2004. As such it is not comparing an exact like with an exact like.*

Source: Malaysian Oil Palm Statistics, MPOB 2000; Malaysian Oil Palm Statistics, MPOB 2004

Table 4.8(iii) Export Volume (Tons) of PKC by Region for the Years 2000 and 2004

Major	Export Volume of PKC for 2000	% Export Volume of PKC for 2000	Export Volume of PKC for 2004	% Export Volume of PKC for 2004	% Change of Export Volume for 2000/2004
European Union (EU)-15	1,214,698	90.0	1,490,395	83*	22.7
European Union (EU)-25			1,490,395	83	-
Non-EU Europe	-	-	-	-	-
North America	-	-	-	-	-
Latin America	-	-	-	-	-
Middle East	-	-	55	negligible	-
Africa	-	-	27,983	1.6	-
Oceania	-	-	84,931	4.7	-
East Asia	119,859	8.9	147,211	8.2	22.8
ASEAN	15,215	1.1	36,732	2.1	141.4
West Asia	160	0.01	175	0.01	9.4
Others	-	-	8,435	0.5	-
Total	1,349,932	100 (round-up)	1,795,917	100 (round-up)	

Legend:

* *The percentage in italic is not summed up vertically in the table as part of the 100% as the members of the European Union have expanded from 15 to 25 members by May 2004. This figure is calculated so as to highlight the composition of export or the ratio of export based on the original 15 members.*

Source: Malaysian Oil Palm Statistics, MPOB 2000; Malaysian Oil Palm Statistics, MPOB 2004

Table 4. 8(iv) Export Volume (Tons) of Oleochemical Products by Region for the Years 2000 and 2004

Major	Export Volume of Oleochemical Products for 2000	% Export Volume of Oleochemical Products for 2000	Export Volume of Oleochemical Products for 2004	% Export Volume of Oleochemical Products for 2004	% Change of Export Volume for 2000/2004
European Union (EU)-15	379,653	33.4	498,769	28.2*	31.4
European Union (EU)-25			510,495	28.9	-
Non-EU Europe	5,302	0.5	6,174	0.4	16.4**
North America	175,926	15.5	215,181	12.2	22.3
Latin America	4,481	0.4	14,941	0.9	233.4
Middle East	52,615	4.6	75,671	4.3	43.8
Africa	25,457	2.2	39,020	2.2	53.2
Oceania	8,245	0.7	15,415	0.9	87.0
East Asia	347,999	30.6	606,864	34.4	74.4
ASEAN	64,717	5.7	127,802	7.2	97.5
West Asia	63,172	5.6	121,717	6.9	92.7
Others	10,305	0.9	33,162	1.9	221.8
Total	1,137,872	100 (round-up)	1,766,442	100 (round-up)	

Legend:

* *The percentage in italic is not summed up vertically in the table as part of the 100% as the members of the European Union have expanded from 15 to 25 members by May 2004. This figure is calculated so as to highlight the composition of export or the ratio of export based on the original 15 members.*

** *The percentage in italic calculated is not an absolutely true reflection of percentage change for non-EU Europe as 10 countries from this region became a member of the EU in May 2004. As such it is not comparing an exact like with an exact like.*

Source: Malaysian Oil Palm Statistics, MPOB 2000; Malaysian Oil Palm Statistics, MPOB 2004

Table 4. 8(v) Export Volume (Tons) of POFP by Region for the Years 2000-2004

Major	Export Volume of POFP for 2000	% Export Volume of POFP for 2000	Export Volume of POFP for 2004	% Export Volume of POFP for 2004	% Change of Export Volume for 2000/2004
European Union (EU)-15	-	-	10,113	2.7*	-
European Union (EU)-25	-	-	14,011	3.7	-
Non-EU Europe	11,000	4.4	67,392	18.0	512.7**
North America	-	-	-	-	-
Latin America	-	-	-	-	-
Middle East	113,642	45.5	111,983	29.9	-1.5
Africa	27,795	11.1	15,776	4.2	-43.2
Oceania	-	-	6,752	1.8	-
East Asia	-	-	-	-	-
ASEAN	-	-	12,795	3.4	-
West Asia	-	-	68,694	18.4	-
Others	97,210	38.9	76,941	20.6	-20.9
Total	249,647	100.0 (round-up)	374,344	100.0	

Legend:

* *The percentage in italic is not summed up vertically in the table as part of the 100% as the members of the European Union have expanded from 15 to 25 members by May 2004. This figure is calculated so as to highlight the composition of export or the ratio of export based on the original 15 members.*

** *The percentage in italic calculated is not an absolutely true reflection of percentage change for non-EU Europe as 10 countries from this region became a member of the EU in May 2004. As such it is not comparing an exact like with an exact like.*

Source: Malaysian Oil Palm Statistics, MPOB 2000; Malaysian Oil Palm Statistics, MPOB 2004

4.5 The Current Industry Structure of the POPC in Malaysia

Table 4.9 highlights a cross-section of the existing industry structure and not the population. This is due to the complexity and the limited information especially pertaining to private limited companies. However, whatever data available from the annual accounts of public listed companies and the limited data in terms of ownership provided for in the Malaysian Palm Oil Directory (MPOB, 2003(a), MPOPC and Jora-Aki Technology Sdn. Bhd.,2003), published on a bi-annual basis, the major group of players can be discerned. This is also validated by the pilot study being carried out prior to the field research proper.

The most important group of players particularly in the oil palm and generally in the palm oil industry is government agencies that have an overarching socio-economic objective of attaining a higher standard of living via land development exercises in the form of oil palm and rubber cultivation (Malaysia, 1991). These players started off as land development authorities by way of cultivating oil palm, but for some, over time have organically permeated into the POPC. A good example is Felda Holdings Berhad Group, which under its umbrella, covers all the activities with the exception of the foreign distribution chain as shown in Figure 4.1. Felda Holdings Berhad is the biggest player in the oil palm and palm oil chain. As shown in Table 4.3, Felda Holdings Berhad has the largest hectarage under palm oil. Its involvement in the palm oil production chain is through the 72 palm oil mills, six palm kernel crushers, seven refineries, 2 margarine plants and a joint venture with Proctor and Gamble in an oleochemical manufacturing plant (FELDA Online 2006). The ownership structure adopted by Felda Holdings Berhad is a group with a holding company structure, which comprises of the parent company and a host of subsidiaries which are involved in the oil palm and palm oil chain. Within this context, each mill, refinery, palm kernel crusher and oleochemical operation in the POPC is incorporated as a separate legal entity or subsidiary with equity ownership held by the parent company. This type of holding company structure is also adopted by all the other groups in the POPC. As Felda is a government agency, government policies have a pervasive influence. The Federal Government has given a strong push to the public and private sector to adopt ISO 9000 standards on quality, HACCP certification for food safety, ISO14000 standards for environmental management, and OHSAS 18000 standards for Occupational Health and Safety. This is to drive efficiency and competitiveness in both the sectors. This involvement imposes stringent quality, environment, safety and health standards on the Group. ISO certification in government ministries and departments is being implemented and by virtue of Felda Holdings Group being a government agency, the various ISO certifications are given high priority by the parent company, which in turn is pushed down throughout the entire oil palm and palm oil chain. The various ISO certifications are seen to be a competitive strategic tool for participation in the global market. If any one activity within the Felda Holdings Group production chain is not fully ISO certified, then the whole Group cannot proclaim that there is stringent quality, environment, food safety and health standards being practised as a norm within the entire group. Structural embededdness imposes these requirements as the different activities are interlinked within the entire oil palm and palm oil chain.

By June 2005, 72 millers under the Felda Palm Industries Sdn. Bhd, the milling subsidiary of the Felda Holdings Group, have attained ISO 9001 Quality Management System, ISO 14001 Environmental Management System, OHSAS 18001 Safety and Health Management System and ISO 17025 Laboratory Management System (Felda Online 2006). Amongst others, Felda Oil Products Sdn Bhd., a refining subsidiary of the Felda Group was awarded the ISO9000:1994 in year 2000 and the certification was upgraded to ISO 9000:2000 in 2003 (Felda, 2004a). Currently, the factory is in its final stages of preparation for the HACCP and ISO14000 EMS certification. The quality and safety aspects of factory operations are given top priority and the factory is able to adhere to all the required international and local quality/safety certifications. In addition, Felda Bulkers has been successfully awarded ISO 9001:2000 and prior to this, the company has already achieved ISO9002 from SGS Yardsley of UK and ISO14001 in 2001 (Felda, 2004b). The company manages five palm oil bulking terminals, one for oleochemicals and the remaining four for the various types of oils, and also one palm kernel expeller warehouse at Port Klang, Kuantan, Lahad Datu, Sahabat and Pasir Gudang (Felda, 2004c). Felda Marketing Services has obtained accreditation for Quality Management System MS ISO9001: 2000 by SIRIM International and UKAS Quality Management (Felda, 2004d).These achievements also motivated all the subsidiaries within the oil palm and palm oil chain of the Group to strive for certification. Thus, it is evident that structural embeddedness within Felda's palm oil production chain is a driving force for the various certification programs as the subsidiaries in the entire oil palm and palm oil chain are highly interlinked despite high geographical dispersion.

Felcra Holdings Berhad, on the other hand is involved in the planting of oil palm and palm oil milling and palm kernel crushing (Malaysia 1991) and has not gone downstream to the extent of FELDA. RISDA is involved only in rubber and oil palm cultivation (RISDA Online 2007). The Sabah Land Development Board, to a large extent, modeled after FELDA is involved in oil palm cultivation, palm oil milling, palm kernel crushing, and refining. Sarawak Land Consolidation and Rehabilitation Authority (SALCRA) also modeled after FELDA, is involved in oil palm cultivation, palm oil milling and palm kernel crushing. The remaining government agencies are either involved solely in oil palm cultivation or oil palm cultivation cum milling. These government agencies, likewise, are very much influenced by government policies.

From a historical perspective, a number of groups with holding company structure was foreign owned (mainly British owned), which started off via their involvement in upstream plantation activities in the early phases of commercial agriculture development in Malaysia, that is in the early half of the last century. These concerns grew into public-listed companies and had dual listing in the London Stock Exchange as well as the then Kuala Lumpur Stock Exchange (today known as the Malaysian Bourse). The big three, namely Sime Darby, Guthrie and Golden Hope (formerly known as Harrisons and Crosfield) were acquired by PNB as mentioned earlier, are known today as Government Linked Companies (GLC). As a result of government encouragement and policies related to industrial development and the deepening of resource-based industries, the Golden Hope Group is involved in nearly the entire chain of the POPC, namely palm oil milling, palm kernel crushing, refining and POFP manufacturing and oleochemical manufacturing with the exception being plam kernel crushing. The Sime Darby group via the delisted Consolidated Plantation and other subsidiaries are involved in oil palm plantation, palm oil milling, refining and palm oil based finished products manufacturing. The Guthrie group, however, has limited its activity to that of plantation and milling till today. Likewise, these PNB cum Government Linked Companies are very much influence by government policies. Government policies on quality, environmental management, food safety, and occupational health and safety are pervasive in these groups and they are translated in terms of the various certification programs like the ISO 9000 standards, ISO 14000 standards, ISO 18000 standards and ISO 22000 standards. These policies, once adopted at the parent company level, will surely be cascaded down within the entire group. Among these three giants, the Golden Hope Group is in the forefront of environmental management (Teoh Cheng Hai and Martin Abraham 1996).

The business model of close local collaboration within the group is driven mainly by the adoption of government policies. These government agencies and PNB cum Government Linked Companies have triple bottomlines in terms of profit orientation, environmental management and corporate social responsibility in terms of the overarching socio-economic objectives.

As mentioned earlier, from the 1970s onwards, the non-PNB home grown plantation companies also flex their wings and moved beyond milling to the downstream activities of palm oil production and in tandem these companies evolved into groups with a holding company structure. Groups like IOI and KLK are involved in plantation and the whole spectrum of the POPC. However groups like PPB Oil, Lam Soon and Kwantas are involved in upstream plantation and palm oil milling, and downstream palm kernel crushing and refining and POFP manufacturing for the POPC. Johore Corporation, on the other hand, is involved in upstream plantation and a combination of palm oil milling, palm kernel crushing and oleochemical (via Natural Oleochemicals Sdn. Bhd, a subsidiary of Kulim Berhad, which in turn is a subsidiary of Johore Corporation). Groups like the Far East, Kim Loong and Prosper are involved in upstream plantation and the combination of palm oil milling and palm kernel crushing. This indicates that groups with plantation have moved into the POPC with a variety of combinations. This is made possible by groups with plantation as the feedstock in terms of FFB are readily available and poses a competitive advantage as compared to independent refiners and oleochemical manufacturers. This situation is exacerbated by the coming onstream of biodiesel plants in 2007 which would make the supply of CPO more acute. These non-PNB groups with activities in upstream plantation and milling are also involved either singularly in a downstream activity in the POPC or a combination of activities in the downstream part of the POPC.

The remaining non-PNB plantation companies, which are locally owned and had started off with the early phases of commercial agriculture development or at a later stage, have either moved into palm oil milling or have remained a plantation company. Groups like Tradewind, Asiatic Development and the new kid on the block like IJM Plantation are involved in upstream plantation and palm oil milling. Generally plantation companies which have more than 4000 acres of planted oil palm crop are able to attain economies with a palm oil mill (Harcharan Singh Khera 1976). As such, the bigger plantations tend to have a mill in the midst of the plantation, which is very often near a water source, like a river. These non-PNB groups with plantation and milling are only involved in the upstream activities.

A point to note is that for the non-PNB home grown groups, local collaboration exists within a group so as to tap on group expertise or group resources synergistically. However, such local collaborative efforts are driven mainly by business or competitive reasons, especially that of market requirements.

Another group of players is the independent palm oil millers, independent palm kernel crushers, independent refiners cum POFP manufacturers, independent oleochemical manufacturers and also two activity groups without a plantation arm (lowly vertically integrated) in the POPC. The independent palm oil millers are home bred companies located at areas where oil palm is cultivated, especially in areas where there are many smallholdings and oil palm plantations so as to gain easy access to FFBs. However, the independent refiners cum POFP manufacturers, independent oleochemical manufacturers and two activity groups without a plantation arm are either home bred companies or as a result of Foreign Direct Investment (FDI) normally on a joint-venture basis. Examples of the above can be found in Table 4.9 as illustrated in the following. An independent local palm oil miller is Ban Dung; an independent local palm kernel crusher is Sehcom Industries, an independent home bred refiner cum POFP manufacturer is Carotino whereas a foreign refiner cum POFP manufacturer is Ngo Chew Hong Oils and Fats; a home bred non-plantation two activity group is the Soon Soon Group; a foreign non plantation two activity group is the Pan Century Group, which is under the Aditya Birla Group, one of the biggest conglomerates in India. The Pan Century group, at this point in time is looking for potential buyers or the possibility of having a joint-venture (Hanim Adnan 2006). The investment of the FDI is a result of government policy to encourage downstream development, especially the downstream part of the POPC. However, due to the acute supply situation which might occur when the biodiesel plants come onstream from 2007 onwards, consolidation is surfacing as a solution to resolve the conundrum of possible acute supply faced by the non-plantation independent players or non-plantation two activity groups involved in either refining cum POFP manufacturing or oleochemical manufacturing, or both.

Table 4.9 A Cross-Section of the Existing Industry Structure for the Palm Oil Production Chain

Overall Business of Group or Holding Company and	Name of Organization Group	Plantation	Palm Milling	Palm Kernel Crushing	Refining and Manu-facturing	Oleochemical Manufact-uring
Oil Palm and Palm Oil Based Government Agency-	FELDA Group	/	/	/	/	/
Oil Palm and Plam Oil Based Government Agency-	FELCRA Group	/	/	/		
Ol Palm Based Government Agency	RISDA Group	/				
Oil Palm and Palm Oil Based GLC/PNB	Golden Hope Group	/	/	/	/	/
Oil Palm and Palm Oil Based GLC/PNB	Guthrie Group	/	/			
Diversified Public Listed GLC/PNB	Consolidated Plantation under the Sime Darby Group	/	/		/	
Diversified Group with Public Listing	IOI Group	/	/	/	/	/
Diversified Group with Public Listing	KLK Group	/	/	/	/	/
Diversified Group with Public Listing	PPB Oil Palm under the PPB Group	/	/	/	/	
Diversified Group with Public Listing	Lam Soon Group	/	/		/	/
Oil Palm and Palm oil Based Group with Public Listing	UP Group	/	/		/	
Oil Palm and Palm oil Based Group with Public Listing	Tradewind	/	/			
Diversified Group with Public Listing	IJM Plantation under the IJM Group	/	/			
Diversified Group with Public Listing	Asiatic Development under the Genting Group	/	/			

Overall Business of Group or Holding Company and	Name of Organization Group	Plantation	Palm Milling	Palm Kernel Crushing	Refining and Manu-facturing	Oleochemical Manufact-uring
Diversified Public Listed Company	Keck Seng Group	/	/	/	/	
Palm Oil Public Listed Company	Carotech				/	/
Palm Oil Private Limited Company	Sehcom Industries			/		
Palm Oil Private Limited Company	Ban Dung		/			
Palm Oil Private Limited Company	Ngo Chew Hong Oils and Fats				/	
Palm Oil Private Limited Company	Carotino				/	
Palm Oil Private Limited Company	Pacific Inter-Link				/	
Palm Oil Private Limited Company	Uniqema Malaysia under the ICI Group					/
Two Activity Palm Oil Group	Soon Soon			/	/	
Two Activity Palm Oil Group	Pan Century under the Aditya Birla Group				/	/

4.6 Environmental Issues Pertaining to Production in the POPC

The upstream activities that are related to oil palm planting have adverse impacts on the environment in the initial years of development. The first phase of agriculture economic development in Malaysia, as mentioned earlier, which was primarily upstream, led to the clearing of natural forests for oil palm planting. The clearing of natural forests has a direct impact on the ecosystem health where the loss of flora and fauna, and rapid water runoffs as a consequence of a lack of natural vegetation has negative repercussions. Currently the loss of natural jungle is limited by replanting exercises, that is the old rubber trees (past its prime) are replanted with oil palm trees, and as a result the effect on the environment is limited or indirect. Land preparation in the earlier years, where either the natural forests or rubber trees were logged prior to the slash and burn phase in preparation for planting activities, had negative ecological effect, especially in terms of the loss of flora and fauna for virgin jungles and air pollution (the slash and burn phase). This gives rise to claim that the cultivation of oil palm has led to lost of vast tracts of virgin jungles, leading to the disruption of the natural ecosystem. The destruction of the virgin jungles and concurrently the loss of endemic flora and fauna have provided the foreign environmental non-governmental organizations with ammunition to discredit the oil palm and palm oil industry. The iconic use of the *orang utans*, being displaced by the destruction of their natural habitat, is the symbolic war waged against the oil palm and palm oil industry (New Sunday Times 22 December 2002a). The reveberations are still being felt today where this issue of the *orang utan* is rehashed time and again. However, if viewed in the bigger scheme of things, Malaysia's land area is 32.65 million hectares and the total area for permanent forest reserve is 19.54 million hectares, a ratio of 60%. The areas under oil palm cultivation, rubber cultivation and cocoa/coconut cultivation are 3.87 million hectares, 1.28 million hectares and 192,000 hectares respectively. Hence, the total area under permanent forest and tree crop cover is 24.88 million hectares or 76.20% of total land mass in Malaysia. This is a respectable figure and not many countries either of equal development or a more developed status can claim such a high proportion (MPOA Online 2005).

As mentioned above with regard to replanting that occurred in the later years, the old rubber trees are treated as a valuable resource for the wood-based and furniture manufacturing industry. With effective marketing efforts, these old rubber tree trunks are branded as Malaysian oak and are used mainly in the manufacturing of wooden furniture. This move is deemed to be much friendlier towards the environment instead of the slash and burn method adopted in the earlier years. If the felled trees are old palm trees, the old palm trunks are chipped and pulverized for composting purposes. The exposed land, after the felling of the trees, is affected by soil erosion, leaching and water runoffs as a result of rainfall can lead to loss of soil fertility. The nurturing of immature palm trees and the management of the fields during the harvesting cycles with the application of fertilizer, pesticide and herbicide can lead to rain runoffs that will pollute the river system (DOE, 1999b). In order to minimize environmental degradation, cover crop planting, terracing on hill slopes and constructing silt pits can be part of good agricultural practices and are carried out to a large extent by plantations. In order to reduce chemical fertilizer utilization, a cost-saving cum environmentally friendly measure, the correct placement of frond piles and the EFBs (after milling) on the fields for the purpose of mulching so as to be converted as organic fertilizer. As such Zero Burn is adopted during the replanting process (PORIM 1998). The selection of the type of clone in the replanting process is an integral component in the productivity equation. The higher yielding clones are much more expensive as compared to the lower yielding ones but the impact on productivity on a long term basis is very telling indeed. The new clones are expected to produce at a ratio of 35:25 (i.e. 35 tons FFBs per hectare per year with 25% oil extraction rate (MPOB Online 2003).

The harvesting process where a harvester using a long harvesting pole to cut the fresh fruit bunches from the palm trees is very labour intensive. The selection of ripe fresh fruit bunches will have an impact on yield as young, immature fruits will lead to lower yield and lower quality oils. For larger plantations, mechanisation in the form of a mechanical grabber is used to grab the cut FFB prior to loading on the tractor. The attendant logistics of transporting the fresh fruit bunches from the harvested area to the mill has to be as efficient as possible. The faster the FFBs are sent to the palm oil mill, the higher the yield and the higher the quality of oil that can be obtained. The MPOB has given a warning that the Oil Extraction Rate (OER) of 18% must be minimally met by all palm oil mills. If the OER, which is based on the weightage of the FFBs, for any palm oil mill falls below 18%, it means that the operating license is breached and appropriate action will be taken (New Sunday Times 22 December 2002b, MPOB Online 2006). This implies that the factories must only accept ripe fruits and reject young fruits and at the same time the production process must be up to the mark.

The fruits of labor from the fields, be it from a plantation or a smallholding, are the feedstock for the palm oil mills. As such, milling is the next step in the value chain. The prioritization of resource-based industries as mentioned earlier led to the phenomenal growth in palm oil milling which has continued unabated till today. Palm oil milling produces two main products namely crude palm oil (CPO) and palm kernels. At some palm oil mills, palm kernel crushers are available to exploit the economies of scope. Palm oil mills began to sprout in oil palm plantations for reasons of logistics, a steady source of water supply and the availability of land to construct a factory. As most of these oil palm plantations own vast tracts of land, the possibility of a river system passing through the land is very high indeed. As such, the plantation companies also own the vast majority of palm oil mills. The process of forward integration for plantations into palm oil milling is based on the *rai-son d'etre* of economics. Without a mill, the plantation will have to source for a purchaser of the FFBs which will most likely be a mill in the vicinity. As such, there are economies of scope where for example, capital expenditure for a road network linking the plantation and mill can be depreciated and apportioned to both the plantation and the mill. The palm oil mills have a steady source of feedstock and this is supplemented by smallholders who have fields in the vicinity of the palm oil mills. Transportation costs will be fairly negligible in terms of transferring the harvested FFBs to the nearby palm oil mills and this in turn will help to retain the freshness of the fruits.

The palm oil mills are located close to rivers and streams as milling requires a vast amount of water. As most of these mills are located in the interior or rural areas, the discharging of palm oil mill effluent (POME) into the receiving waterways has the potential to create adverse environmental consequences. This negative environmental impact will affect riverine communities and users of water from an economic, social and health perspective. The POME can also cause odor pollution as it is foul smelling in nature if not treated. POME is a combination of 3 principal sources of wastewaters that are generated as part of the milling process:

1. The FFBs is subjected to steam-heat treatment for the purpose of sterilization where amongst the main reasons are to prevent the formation of free fatty acids as a consequence of enzyme actions and also to facilitate the stripping of the fruits from the bunch stalks. The sterilizer condensate, which is the steam condensate being discharged as wastewater, constitutes approximately 36% of POME.
2. In crude palm oil extraction, hot water is added to the oil to enhance its flow. This crude oil slurry is fed to a clarification tank for oil separation. The water and fibrous debris are discharged as clarification wastewater where it constitutes approximately 60% of POME.

3. After the nuts are cracked, the kernels and shells need to be separated and the most popular separator is the hydrocyclone. The discharge from this process is known as hydrocyclone wastewater, which constitutes approximately 4% of POME (DOE, 1999b).

The raw POME, which has an extremely high organic content, when discharged into the waterways can lead to rapid deterioration in the ecosystem health. As such, the raw POME has to be treated by a combination of physical (the removal of sand, grit and settled solids) and biological (to treat the organic content) processes. During the infancy of the palm oil milling sub-sector in the 1960s, with only 10 mills, wastes like POME, EFB, fiber and shell were disposed in waterways or in any form which is convenience to the millers. As there were only ten mills then, the environment has the absorptive capacity. However in the 1970s and 1980s, the proliferation in the number of mills put heavy stress on the environment where the mean BOD of 25000 ppm from organic wastes is far above that as specified in the EQA as mentioned in Chapter 3. At that point in time, there was no proven technology in the palm oil milling sub-sector to treat the POME. In the late 1970s and early 1980s, some plantation firms utilized the raw POME as part of cropland application as it has high fertilizer value. DOE discourages this type of action as it can lead to groundwater contamination, surface water pollution and nuisance conditions like having a large population of flies and odor pollution. However, if raw POME is treated accordingly, the treated effluent is a rich source of nutrient where it can be used for cropland application. As a result of the high pollution load, the government and industry worked together to create and design a technology which is environmentally friendly and economically viable to treat POME. The resultant government-industry synergistic effort led to successful treatment systems for POME (Chow Mee Chin and A.N. Ma 1995). The three most common treatment systems being adopted are the ponding system, the open tank digester and extended aeration system, and the closed anaerobic digester and land application system. The most popular of these three is the ponding system. The proper application of any of these three systems enables a miller to comply with all EQA parameters as mentioned in Chapter 3. The treated POME can either be discharged into waterways or for cropland application. Treated POME for discharge into waterways has to meet the stringent BOD parameter of 100 mg/litre or less whereas for cropland application, the BOD parameter is 5000ppm. For independent millers, the treated POME is discharged into waterways whereas for millers which have plantations, the treated POME, which is still high in organic nutrient, is used for cropland application.

Biogas or methane, which emanates from the anaerobic digestion of POME can be harnessed for heat or electricity generation. According to the then PORIM (and the current MPOB), a 60 ton FFBs per hour mill operating for 20 hours can generate 20,000 cubic metres of biogas from anaerobic digestion of POME (PORIM 1998). However, this has not taken off as the capital requirement and the yield is not attractive enough.

The waste fiber and shell materials are used as solid fuel for the steam boiler. This is deemed to be environmentally friendly, as these materials are not treated as wastes and used as a form of fuel or energy. Palm oil mills, in general, are self-sufficient in energy generation as there is an abundance of such materials. However steam boilers can emit black smoke as a consequence of incomplete combustion of the solid waste material. This can lead to smoke and dust pollution. The DOE has specified that on any day of mill operation, the maximum time allowable for black smoke emission is 15 minutes. Another caveat is that for any hour selected, the maximum is 5 minutes per hour. This means that black smoke emission is only allowable for 5 minutes per hour for any 3 hours selected per day (ILBS, 2004).

The EFBs, after oil milling, are either incinerated to produce potash ash for cropland application as fertilizer or send to the fields for the superior process of mulching. DOE has discouraged the use of incineration so as to reduce air pollution (DOE 1999b). However, for the older or independent palm oil mills, the incineration of EFBs is allowed to continue. Once these long established mills are closed and replaced with modern milling plants, the incineration of empty fruit bunches is not allowed to continue.

The palm kernels are sent to the palm kernel crushers where the process of crushing will help to extract the crude palm kernel oil and PKC. Further downstream activities mean that the palm kernel meal will be blended to make animal feed. Palm kernel crushing, either by mechanical extraction or solvent extraction, can be deemed to be very environmentally friendly as 100% of the kernel is used. For solvent extraction, the solvent is recovered and reused. Effluent comes in the form of wastewater, which is generated when the crushing facilities are cleansed by means of water and chemicals for housekeeping purposes and also for incidences when oil spillage or pipe leakage occurs. This wastewater is fed to the oil/fat trap to enable oil recovery and oil loss minimization before the wastewater reaches the storm drains. This wastewater stream is miniscule as compared to that of POME.

The millers, refineries, specialty fats or palm oil finished products manufacturers and oleochemical manufacturers also face the same problem of oil spillage or leakage as palm kernel crushers. Cleaning, as a consequence of oil spillage or leakage, or as part of good housekeeping practices, utilizes water and chemicals. And likewise, this wastewater is fed to the oil/fat trap to enable oil recovery and oil loss minimization before this stream of wastewater, besides the other wastewater streams, reaches the treatment plant. Palm kernel crushers would be an exception as there is no need for a treatment plant as the manufacturing process is very efficient with minimal waste and can be deemed to be environmentally friendly. Other wastewater streams like palm oil refinery effluent from refining or oleochemical industrial effluent from oleochemical manufacturing are also channeled to the treatment plant for collective treatment. Once the wastewater is treated, the recycled water is used for in-house facilities. However, some of the existing and longer established palm kernel crushers and refineries do not have oil/fat trap to enable oil recovery. The wastewater is channeled to the storm drains and is a source of pollution outside the factory premises.

For all the activities in the POPC, be it milling, crushing, refining, POFP manufacturing and oleochemical manufacturing, storage tanks are required for feedstocks and production outputs. As oil is highly combustible and if in acid form, it can be highly dangerous. As such the construction of bunds is a means of containing spillage. However, some players in the POPC do not have this safety feature in their set-up.

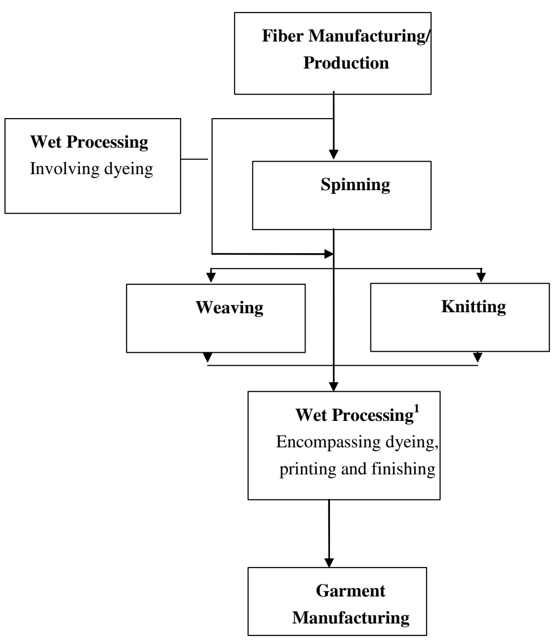
CHAPTER 5
The Textile and Apparel Production Chain in Malaysia

5.1 Introduction

This chapter starts off with a general overview of the production processes of the TAPC in Malaysia. This helps to delineate the types of pollutants associated with the TAPC. This is followed by the development of the TAPC in Malaysia which spans the period 1957-2004. Subsequently, the current industry structure of the TAPC was demarcated in terms of the types of players. This chapter closes with the environmental issues in relation to the Malaysian TAPC. The above sections provide the groundwork for the operationalization of the hypotheses as discussed in Chapter 6.

5.2 The Production Processes of the Textile and Apparel Production Chain

In its broadest sense, the TAPC in Malaysia is a very diverse sector in terms of feedstock utilization, production processes, products and capital intensity. This is partially explained in Figure 5.1. Due to its diversity, the main production processes are ascertained, accompanied by a general overview of the main production processes for the TAPC in Malaysia.



[1] *If wet processing is done either for fibers or yarns/thread at an earlier stage, the following processes are printing and/or finishing.*

Figure 5.1 General Overview of The Production Processes

The TAPC in Malaysia starts with polymerization in the production of synthetic polyester fiber. This is followed by spinning using either natural fiber feedstock or man-made fiber feedstock to produce yarns or threads. Yarns are converted into unfinished fabrics or greige goods by either weaving or knitting. Spinning, weaving and knitting are categorized as dry processing despite the fact that water is utilized in the weaving process. The unfinished fabrics or greige goods undergo the process of dyeing, printing and finishing to produce finished fabrics. Dyeing, printing and finishing are categorized as wet processing, the most polluting sub-sector in the TAPC. Finished fabrics, the main feedstock, are cut and sewn in fabrication or garment making up process to produce apparels.

(i) Fiber Manufacturing/Production

There are two main types of fibers, namely natural and man-made fiber. Natural fibers harvested from animals and plants, like wool and cotton, can be converted into yarn by grouping and twisting in the spinning process (DOE 2000, http://www.e4s.org.uk/textilesonline/index.htm 2006). However, in the Malaysian context, natural fibers are not produced commercially. Man-made fibers include rayon and acetate, both cellulosic fibers created via chemical reaction with wood pulp, and synthetic fibers like acrylic, nylon, polyester and elastane are mainly derived from oil products. In Malaysia, there are two synthetic fiber manufacturing plants involved in polyester production. Figure 5.2 illustrates the processes in polyester production. The main feedstocks in the production of polyester are ethylene alcohol and terephthalic acid required in the esterification process. These two feedstocks are derived from petroleum. Terephthalic acid is derived from para-xylene, a distillate of petroleum, which has undergone high purification. These two raw materials are combined in an Esterifier, a reactor, at elevated temperature with nitrogen blanketing to produce Ethylene Terephthalate, an ester, and water. The Ethylene Terephthalate undergoes polycondensation at high temperature and high vacuum, aided by catalysts in a polymerization vessel. A monitoring system measures the growth of the polymer chain by sensing the level of resistance. Polymerization is completed once the desired level of Ester Unit is attained, that is 100, 120 or 150. The molten polymer is forcefully extruded, thereby forming a ribbon after being cooled down. The cooled ribbon is cut into chips and transferred to the chip silo (DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org).

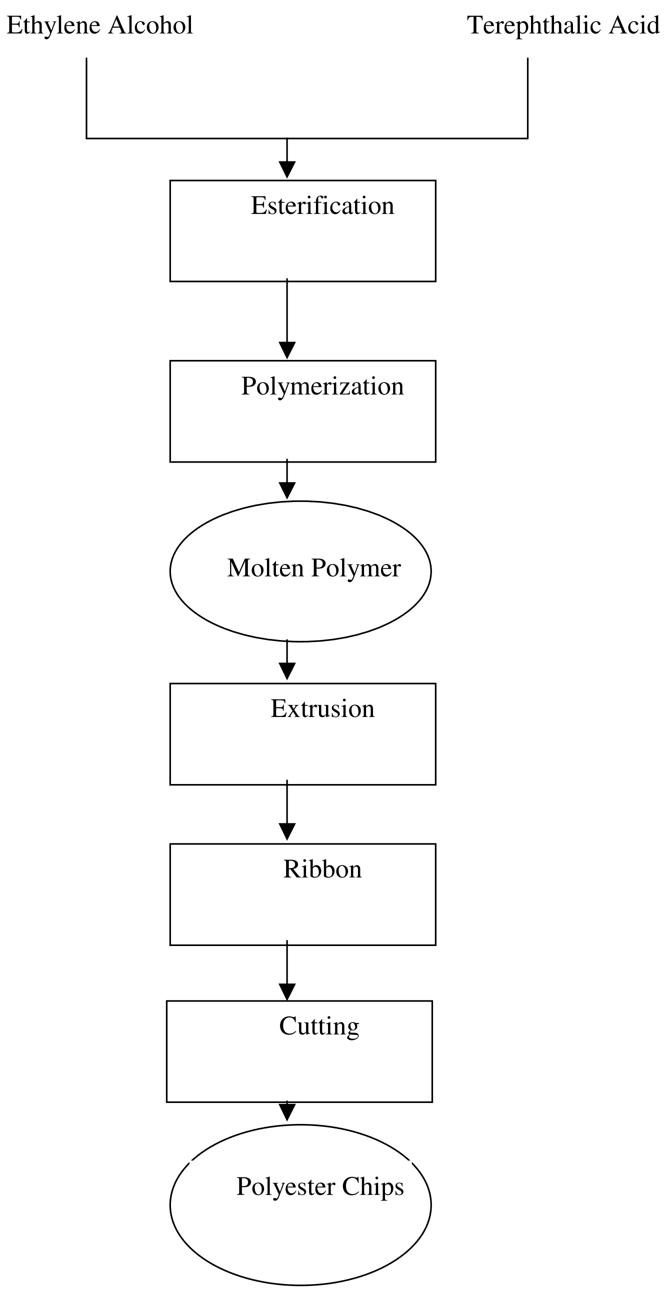


Figure 5.2 Production Processes For Polyester
Source: Adapted from DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org).

(ii) Spinning

The main feedstock for spinning can be broadly classified into two, namely man-made fibers and natural fibers. The discussion below will start with the man-made fibers (continuing from the above discussion) and will subsequently be followed by natural fibers. Figure 5.3 shows the processes involved in man-made fiber spinning operation. The chips in the spinning process are conveyed to the crystallizer to be heated above the glass point of crystallation and subsequently fed to the dryer. The dryer removes the intermolecular moisture from the chips. The chips are subsequently fed to the extruder. The high pressure action of the screw and electrical heating zones surrounding the cylinder melt the chips and a thick viscous liquid is formed. This molten liquid is pumped into the spin packs. Each spin pack is a heavy metal container containing a filter media and a spinnerette. The spinnerette has a specific number of holes depending on the required denier or fiber titre (fineness of fiber). The molten polymer is forced through each hole of the spinnerette. The quenching process starts with the extruded molten polymer being rapidly air-cooled to facilitate solidification. The solidified fibers or filaments are gathered at the bottom of the spin shift in a single tow (in the form of a ribbon). The single tows from the spinnerettes are mixed to form a combine spin tow. The spin tow is coated with finishing liquid in a bath and coiled in a can. The spin finish aids in the later mechanical processing as it contains anti-static and lubricating chemicals. This material is known as undrawn tow and has no textile characteristics.

The next step is the drawing process in which undrawn tows from several cans are combined to form a sheet. This passes through a hot water trough of 70 degrees Celsius, that is the glass transition temperature, which allows for drawing or stretching. Drawing or stretching takes place in a steam chamber or in a hot water trough to facilitate the drawing process. After the drawing process, each filament has the required crystalline structure and denier, resulting in a stronger product. The next process is annealing or heat setting under tension to set the strength for the filaments. The tows are conveyed under tension on steam heated cylinders. After the completion of tension setting, the tows are washed under tension in a washing bath to remove spin-finish emulsion and subsequently vigorously squeezed to provide a good washing effect.

The perfectly smooth surfaced polyester fiber is not conducive to textile processing like natural fibers which have a textured surface. Crimps, a series of small, zigzag kinks, are attained via the crimping or texturing process which serrates the fiber under heated pressure in a crimper or stuffer box. Textile spin finish is applied either before or after crimping with the type of oil dependent on fiber and subsequent textile processing. The next step is the drying process, based on the conveyor belt principle with the tow laid on a lattice that moves through a hot air chamber. The dried continuous tow is delivered by the stretchline to be cut to the desired staple length at the end of the line. The cut fiber falls by gravity into a chute and conveyed to be bale-pressed.

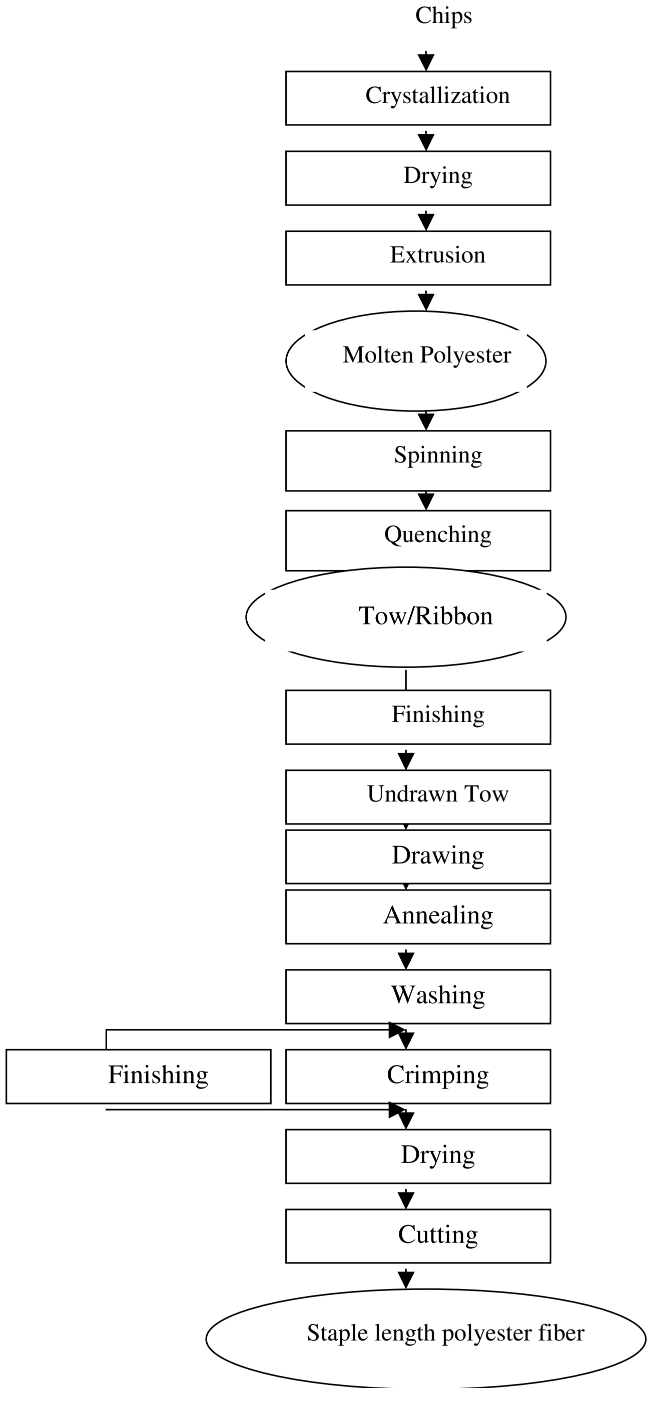


Figure 5.3 Production Processes For Spinning Utilizing Man-made Fiber Feedstock

Figure 5.4 shows a step by step process in natural fiber spinning operation. For natural fibers, like cotton and wool, the first step is opening the compressed fiber to remove impurities like dirt, twigs and leaves and subsequently a lap or sheet of fiber is produced. The clean fibers from different bales are blended to improve fiber mix consistency. The lap and in some modern systems the fiber tufts are conveyed to the carding machine which teases out and aligns the fibers via brushes and needles into thin, parallel sheets and in the process removes more impurities. The sheet of carded fibers is condensed into a card sliver.

The next step is combing. Combing is similar to carding, with the exception being the utilization of finer and closely spaced brushes and needles. Combing, although optional, depending on yarn end-use, is to remove short fibers and remaining impurities. Several combed slivers are combined into a continuous rope-like strand and fed to the drawing frame, a machine that has several sets of rollers rotating at successfully faster speeds. The strand passes through the drawing frame and is drawn and lengthened five to six times the original length. Slivers of different fibers like cotton and polyester may be blended in the drawing process. A drawn sliver is known as a roving in ring spinning. The next process is drafting, which uses a frame to stretch the yarn, and in the process a slight twist is added prior to winding it onto a rotating spindle. The rovings, after drafting, may be blended with other fibers to produce woven or knitted textiles.

The final step is spinning in which the fibers are spun into either spun yarns or filament yarns. Spun yarns consist of overlapping staple (short) length fibers, which are bound together by a twisting operation. Filament yarns are produced from continuous man-made fibers strands. The two spinning methods are ring spinning and open-end spinning. For ring spinning, the delivery rollers will feed the roving via a traveler or wire loop located on a ring. A twist is added to the yarn through the rotating spindle around the ring, The yarn is wound and collected via a bobbin. For open-end spinning, the sliver is delivered by rollers into a rotating funnel shaped rotor. A twist is formed via the sliver hitting the rotor inside and rebounding to the rotor's left side. Open-end yarns possess higher uniformity, lower strength, higher extensibility, bulkier, higher abrasive resistance and higher absorbent characteristics. However, not all the characteristics are beneficial and as such open-end yarns will not substitute ring spun yarns but are a complementary product (DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org).

The two major commercial methods in fabric production are weaving and knitting. Figure 5.5 illustrates the fabric production process for flat fabrics that are used in apparel manufacturing (DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org).

(iii) Weaving

Although weaving or yarn interlacing is the most common fabric production process, in Malaysia, commercial weaving is carried out only by large corporations with deep pocket as heavy capital investment is required. This research covers only broad-woven mills as the outputs are used in apparel manufacturing. Narrow-woven and non-woven mills are excluded as the outputs are primarily used for industrial application.

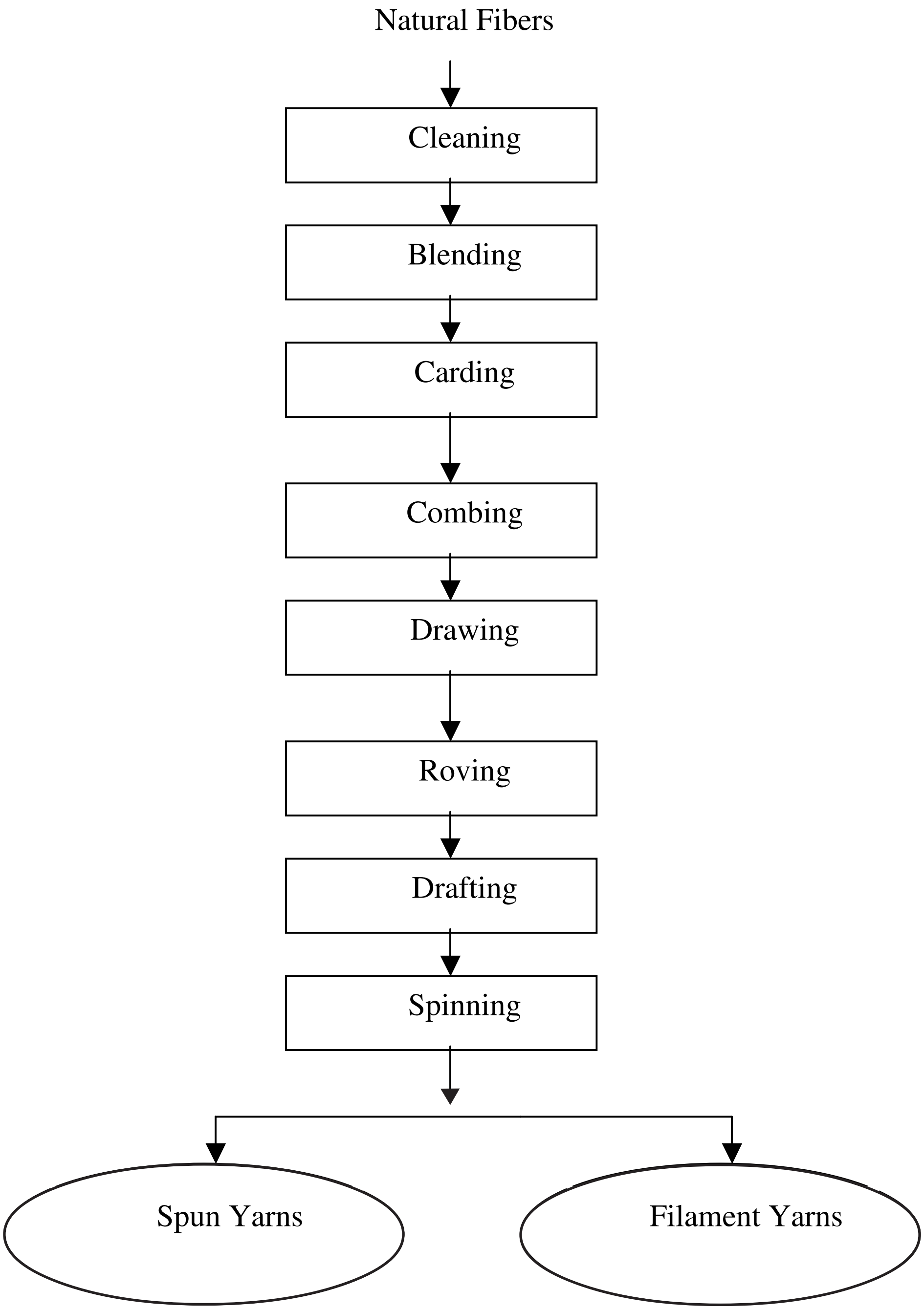


Figure 5.4 Production Processes For Spinning Utilizing Natural Fiber Feedstocks
Source: Adapted from DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org.

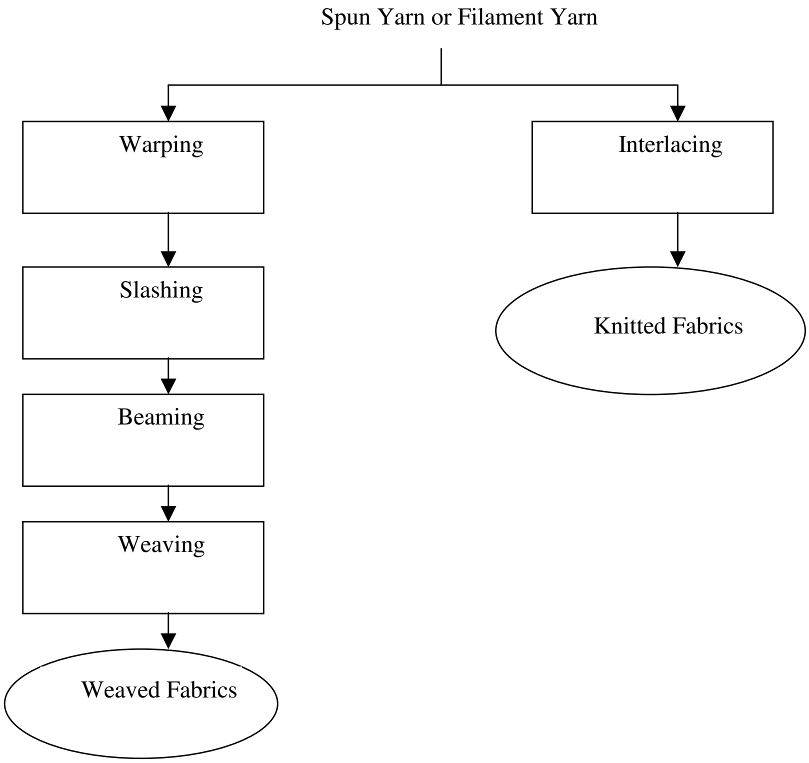


Figure 5.5 Weaving/Knitting
Source: Adapted from DOE 2000, UNEP Online 2005,
http://www.e4s.org.uk, http://www.cotton.org

In weaving, the length-wise or longitudinal yarns form the basic fabric structure known as warp. The crosswise or transverse yarns are known as filling and referred to as wefts. In the weaving process, the weft yarns undergo little strain whereas the warp yarns undergo heavy strain and as such must be prepared to withstand the strain. Prior to weaving, warp yarns are wound on large spools or cones and placed on a creel, a rack. The warp yarns are unwound and undergo slashing, that is the application of size to the warp yarn by a slasher. The size solution forms a coating on the warp yarns to protect against snagging or abrasion during the weaving process. After the completion of size application, the warp yarns are wound on a warp beam in the beaming process. This is followed by mounting the wound beam in a loom. Traditionally, shuttle looms were used, but have rapidly being replaced by shuttleless looms. The common shuttle looms include water-jet looms, air-jet looms, rapier looms and projective looms. A major problem with shuttle looms is that yarns can splinter and catch in the shuttle whereas for shuttleless looms, weaving is carried out at high speeds but with reduced noise levels. Basically, in the weaving process, one set of yarns (warp) is interlaced with another set oriented clockwise (weft). The warp are held parallel and taut by the loom. The weft are woven alternately over and under the warp to produce unfinished fabrics or greige goods. (DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org).

(iv) Knitting

Knitted fabrics are produced by the interlacing loops of yarns with hooked needles. In Malaysia, knitting is the most common method in fabric production. Enterprises involved in knitting range from large corporations with deeper pockets to small and medium scale enterprises with shallower pockets. The two methods of knitting are warp knitting and weft knitting (DOE 2000). Warp knitting is the most rapid method in fabric production in which successive loops of yarn run along the fabric length. In warp knitting, each needle loops its own thread with the yarns running vertically while the connections are diagonal, which interlocked in a zigzag pattern. For weft knitting, one yarn, under needles, is carried back and forth with the yarn running horizontally with horizontal connections occurring between loops.

(v) Wet Processing

The next step for the unfinished fabrics is wet processing, also collectively known as finishing. The purpose of wet processing is to enhance the fabric appearance, durability and serviceability (DOE 2000). Figure 5.6 illustrates the typical wet processing processes for fabrics. Prior to dyeing, printing, or finishing, most fabrics with the exception of denim and certain knit styles, undergo fabric preparation. In fabric preparation, natural impurities or processing chemicals that impair dyeing, printing and finishing are removed. Typical preparation treatments as illustrated in Figure 5.6 include desizing, scouring and bleaching (for 100% synthetic, cotton and cotton blends). However, preparation treatments can also include singeing and mercerizing, which are dependent on the fabric type, finished product specification and later processing treatments (will be discussed later). If there are no contaminants in the unfinished fabrics, preparation processes are not required.

The first preparation process, if required, is singeing. Singeing, a dry process, removes the protruding surface fibers by flame or heated copper plates to produce a smooth finish. Singeing improves the surface appearance of woven unfinished fabrics and is useful for fabric printing. Desizing is only necessary for woven fabrics to remove starch-based size that is applied prior to weaving. This is done via an enzyme or diluted acid treatment and followed by a simple washing off procedure. The next treatment is scouring, a cleaning process, which removes impurities from fibers, yarns or unfinished fabrics by washing with alkaline solutions like sodium hydroxide, and in some cases solvent solution in the scouring bath. This is followed by bleaching, a chemical process, which eliminates unwanted colors from fibers, yarns or unfinished fabrics. The common bleaching agents used are hydrogen peroxide, sodium hypochlorite, sodium chlorite and sulphur dioxide gas. The bleaching process involves saturating the fibers, yarns or unfinished fabrics with the bleaching agent, activator, stabilizer and auxiliary chemicals at raised temperature held for the completion of bleaching. The fibers, yarns or unfinished fabrics, are then thoroughly washed and dried.

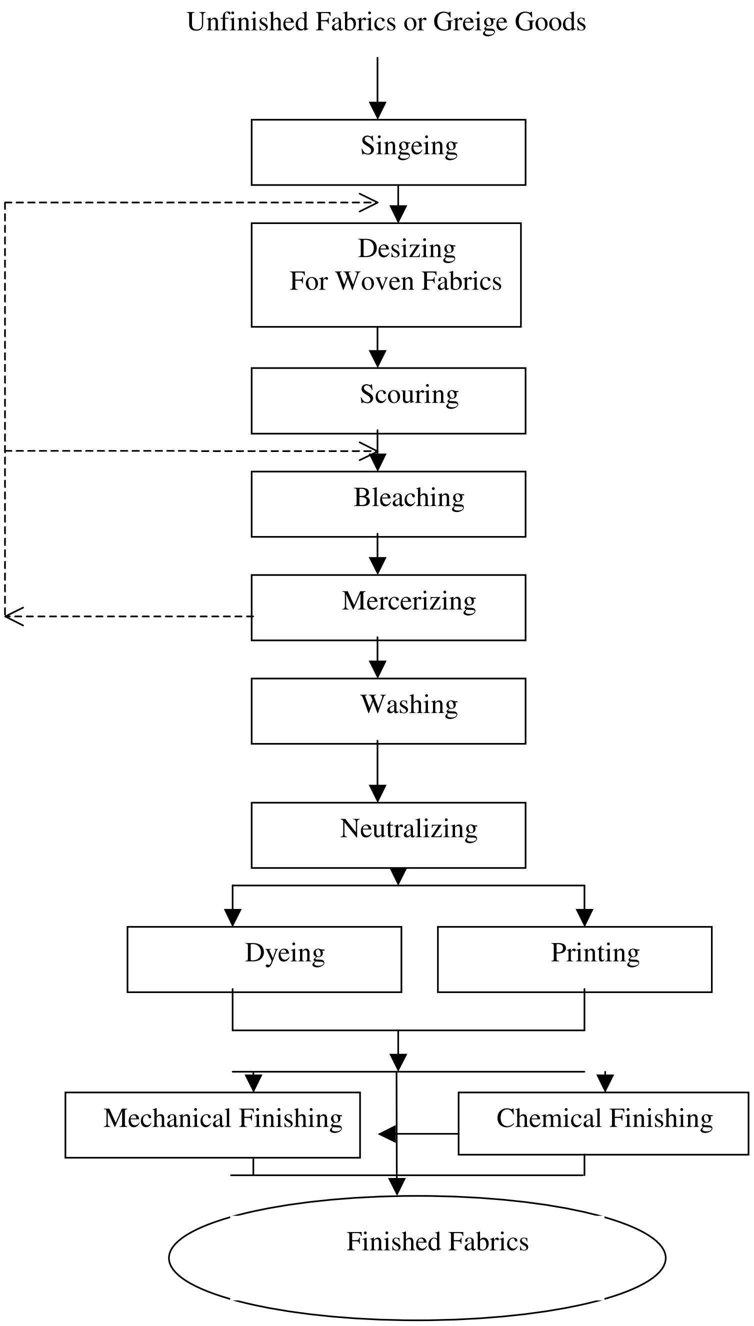


Figure 5.6 Production Processes For Wet Processing
Source: Adapted from DOE 2000, UNEP Online 2005,
http://www.e4s.org.uk, http://www.cotton.org

The next process is mercerizing, a continuous chemical process which is applied for cotton and cotton-polyester blends to increase dye affinity, luster, handle and appearance. Mercerizing treatment can also take place following singeing and preceding bleaching. In mercerizing, the fabric moves through a cold caustic soda solution and subsequently stretched-out on a tenter frame. Hot water sprays are applied to remove most of the caustic soda solution. This is followed by several washes under tension for further caustic soda removal. The caustic soda remnants are then neutralized with a cold acid treatment followed by several rinsing for acid removal (DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org, Winitex, Johore).

Textile dyeing utilizes a wide range of dyestuffs, techniques and equipment, which is dependent on application and end-use. Dyeing can take place batch or continuous wise. For batch dyeing, textile substrates, ranging from 100 to 1,000 kilograms, are loaded into a dyeing machine. For continuous dyeing, textiles are fed continuously at speeds ranging from 50 to 250 meters per minute in a dye range. Both processes undergo dye application, dye fixation aided by chemicals or heat, and washing to remove unfixed dyes and chemicals. With reference to Figure 5.6, the dyeing process can take place at varying stages in the textile manufacturing process, namely at the fiber, tow, yarn and unfinished fabric stage. Fiber is dyed via stock dyeing using perforated tubes or perforated cage. Tow is dyed via machines which pad the tows with dye liquor and subsequently passes through a tunnel for dye fixation and washing. Yarn-dyeing is utilized to create attractive patterns via different colored yarns in the weaving process. In yarn package dyeing, yarn spools are stacked on perforated tubes and immersed in a tank. In skein yarn dyeing, yarn is coiled on a reel and immersed in a dye bath.

Most unfinished fabrics are piece-dyed as piece dyeing provides maximum inventory flexibility in meeting color demands as a result of fashion changes. The piece dyeing methods are beck or winch dyeing, jig dyeing, jet or rapid dyeing and pad dyeing. In beck dyeing or winch dyeing, a continuous process, fabric of around 900 kg is passed in rope form through the dyebath. Jig dyeing is similar to beck dyeing but the difference is that the fabric is held at full width on rollers which passes through the dyebath. In jet or rapid dyeing, fabric of around 500 kg is put in a heated tube or column in which jets of dye solution at high pressure are forced through. The dye continually recirculates as the fabric passes through the tube (DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org).

The aim of printing is to provide colors and patterns on fabrics. Approximately 75-85% of printing operations use pigments and do not require washing. As pigments are typically insoluble and have no fiber affinity, resin binders are used to attach pigments. Solvents are utilized to transport the pigment and resin mixture to the textile substrates. The solvents will eventually evaporate and leave a hard opague coating.

There are five printing techniques, namely rotary screen printing, flat screen printing, direct printing, discharge printing, resist printing, ink-jet printing and heat-transfer printing (DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org).

- Rotary screen printing utilizes the rotating seamless cylindrical screens under which the fabric passes through. Each rotary screen has a squeegee which forces the paste on the moving fabric. The printed fabric is then oven-dried.

- Flat screen printing utilizes a screen in which parts of the screen is masked out to form a pattern. Color is then passed through the screen on to the cloth. Each color used requires a different screen.
- Direct printing utilizes a large cylindrical roller to pick up the fabric, and the color and pattern from the smaller rollers are printed on the fabric.
- Discharge printing is utilized for piece-dyed fabrics. Patterns are created on fabric via color removal using discharge pastes.
- Resist printing includes several hand and volume methods in which pattern application is done by preventing color penetration (for example the utilization of wax in batik printing) in certain areas. Examples in the Malaysian context is batik printing and screen printing.
- Ink-jet printing, a non-contact printing method, propels colorant solution droplets at the desired spot on a textile substrate.
- Heat transfer printing utilizes a special paper substrate for the pattern to be printed on with volatile dyes. The paper is positioned against the fabric with heat and pressure application. Sublimation takes place in which the dyes are transferred to the fabric.

Finishing comprises of mechanical and chemical finishing applied to fiber, yarn or fabric to enhance appearance, texture or performance. The various treatment techniques and related purpose or purposes for mechanical finishing are listed below:

- Heat-setting, a dry process, is used for the purpose of stabilizing and imparting textual properties to synthetic fabric and high synthetic concentration fabric. Stabilization helps to maintain shape and size for subsequent finishing operations. Imparting textural properties include effects on durable surface like pleating, creasing, puckering and embossing.
- Brushing and napping by the use of wires or brushes to roughen the fiber surface and to change texture feel for the purpose of decreasing fabric luster.
- Softening is to reduce surface friction and to increase the sheen.
- Optical finishing is to smoothen the surfaces under pressure to add luster to yarn.
- Shearing is to remove surface fibers to smoothen the texture.
- Compacting is to compress fabric structure to reduce fabric stress. The sanforizing process in compacting is to reduce residual shrinkage after repeated laundering.

The various treatment techniques and related purpose or purposes for chemical finishing are listed below:

- Optical finishing is either to brighten or deluster the textile.
- Absorbent and soil release finishing is to alter surface tension to increase water absorbency and improve soil release.
- Softening and abrasion-resistant finishing is to improve feel and to increase textile ability for abrasion and tearing resistance.

- Physical stabilization and grease-resistant finishing is to stabilize cellulosic fibers to attain permanent press properties to reduce shrinkage and crease after laundering. These finishes may also include formaldehyde-based resin finishes.

Mechanical finishing is often done in conjunction with chemical finishing. The completion of chemical finishing is followed by drying, curing and cooling.

(vi) Apparel Manufacturing

Figure 5.7 shows the final production process known as the fabrication process. The fabrication process involves the conversion of finished fabrics into a variety of apparels like shirts, blouses, trousers and dresses (DOE 2000). The steps undertaken are cutting, sewing, checking for quality control, ironing and delivering. In cutting, the finished fabrics are laid out in layers and automatically cut by a computer controlled system that has the capability of organizing patterns to minimize fabric loss. For smaller operations, the finished fabrics are hand-cut and lesser skilled employees involved in cutting can contribute to higher fabric loss. The cut sections are sewn either via automation or hand. Likewise, less skilled employees can contribute to higher wastage or rejects. The final products or finished goods will be sent for quality control checking. Final products meeting product specification standards are sent for ironing. The rejects are either sold at discount stores or discount warehouse sales, or destroyed as required by certain brand owners. The finished goods are then sent for pressing or ironing, and then to packing prior to final delivery. However, some finished goods have to pass through a garment finishing oven, prior to packing for delivery (DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org, Winitex, Johore).

5.3 The Development of the TAPC In Malaysia

The first weaving company producing grey cotton fabrics was established in Johore Bahru in 1957 and with the support of a small number of tailoring shops set out to meet local demand for garments. This was the genesis of the textile and apparel industry in Malaysia. In 1961, a Singapore-based establishment started the first knitting mill in Batu Pahat, Johore, followed by a Phillipine-based knitting mill in Butterworth, Penang (MKMA 1995). This marked the beginning of the knitting sub-sector, a new milestone in the TAPC. At the same time, imported knitted products from China flooded the local market and resulted in financial difficulties for the two knitting mills. With the introduction of the import substitution strategy by the Malaysian government and in tandem the protection of the local industry, the imposition of a ban on imported Chinese knitted products was implemented in 1963. This then led to the recovery of the two knitting firms. With attractive import substitution incentives, the local family owned or cottage businesses grew rapidly into larger textile and apparel manufacturing firms. The main focus of these local firms was to meet the demand of the growing domestic market and whatever remaining capacity was channelled towards the export market.

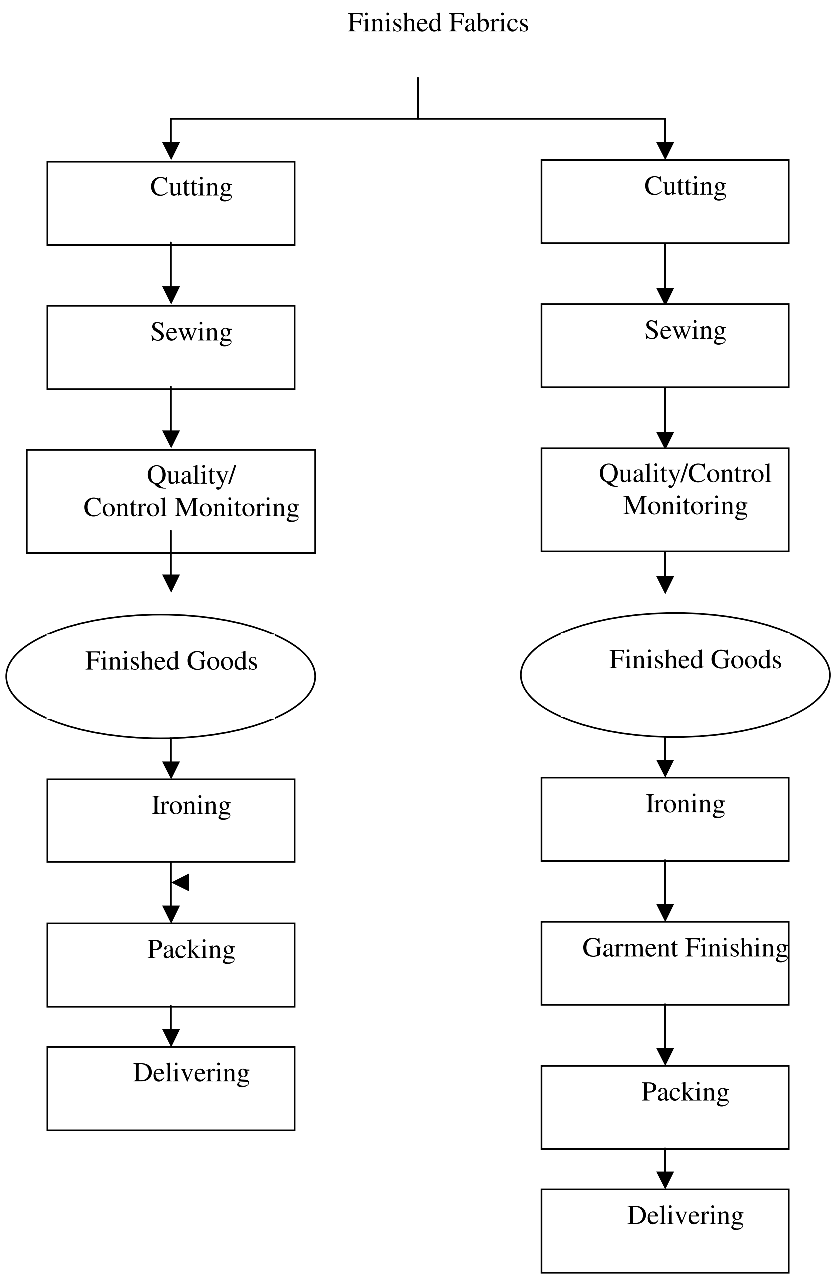


Figure 5.7 Fabrication Processes For Garment Making-Up
Source: Adapted from DOE 2000, UNEP Online 2005, http://www.e4s.org.uk, http://www.cotton.org

The 1960s also saw political unrest in Hong Kong. Hong Kong-based manufacturers began to source for locations that offer political stability and attractive potential development. Two well-known Hong Kong-based knitting establishments began to relocate their operations with their expertise and technology in Petaling Jaya, a part of the Klang Valley in central Peninsular or West Malaysia. Following suit, knitting mills began to gradually grow in number in Penang (north of West Malaysia), Klang Valley (central West Malaysia) and Batu Pahat (south of West Malaysia). This is reflected in Table 5.1 which shows that 48 establishments were recorded for textile manufacturing in 1967 (the first time that statistics in relation to textile manufacturing were recorded by the Department of Statistics).

Table 5.1 Number of Textile Manufacturing Establishments, 1967-1970

Year	Number of Establishments	Gross Value of Sales of Own-Manufactured Products (ex-factory)
1967	48[(a)]	51,219[(a)]
1970	75[(a)]	97,529[(a)]

Note:
[(a)] *: Statistics covered only Peninsular/West Malaysia.*
[(b)] *: Rounding-up to a thousand*

Source: Annual Bulletin of Statistics 1969, 1970, 1972.

Tables 5.2 to 5.6 will be individually and subsequently, collectively analysed with regards to the development of the TAPC in Malaysia. However, some covenants need to be taken into consideration when reviewing statistics produced by the Department of Statistics over a particular timeline. Statistics produced prior to 1995 were truncated in nature due to changing codes and especially changing classification of activities. Besides that, statistics for the TAPC prior to 1995 are for the entire population whereas from 1995 onwards, the coverage is for establishments with a minimum number of workers as can be seen in the notes for Table 5.2 to Table 5.6. Thus, this excludes the small-scaled enterprises and to a certain extent the medium scaled enterprises in the statistical count if comparison were to be made with membership in trade associations. The truncated nature of statistics for the TAPC from the early years till today do not allow for accurate trend analysis but a general overview can be depicted. At the same time, sales values are consistently provided from 1995 onwards but in most cases, statistics on production volume are absent. A limitation in comparing sales value over time is that the time value of money is not taken into account.

Table 5.2 shows that the spinning of cotton yarn increased in production volume from 1980 till 2000 (even though statistics from 1995 onwards cover establishments with more than 100 employees). However, a drastic drop was recorded for the period 2000-2004. The weaving of cotton cloth in production volume displayed a yo-yo pattern. The production volume of cotton cloth dropped sharply in 1990 as compared to 1985, prior to rebounding strongly in 1995, and before gradually declining in 2000 and 2004. The sales value and the number of establishments for the spinning, weaving and finishing of textiles also show a decline for the period 1995-2004. As cotton is not produced at all in Malaysia, and is solely imported as feedstock, cotton producing countries like China, a dominant global player in the textile and apparel industry, have cost advantages. This has impacted negatively on spinners and weavers which utilize cotton as the main feedstock as reflected in the decline in production volume, sales value and the number of establishments.

Table 5.2 Production, Sales Value and Number of Establishments for Spinning, Weaving and Finishing of Textiles, 1975-2004

Year	Production			
	Cotton Yarn (pure and mixed)	Cotton Cloth ('000 metres)	Sales Value of Own-Manufactured Products (ex-factory) (RM'000)	Number of Establishments
1975	n.a	n.a.	201,768	16
1980	16,118[(a)]	218,749[(a)]	220,320[(a)]	n.a.[(a)]
1985	25,165	180,746	603,698	26
1990	37,727	120,273	n.a.	n.a.
1995	71,307	222,739	954,922[(b)]	17 [(b)]
2000	90,110	187,489	769,472 [(b)]	12 [(b)]
2004	30,596	175,771	342,586[(b)]	11[(b)]

Note:
n.a. = Not Available
[(a)]: *These statistics covered only Peninsular/West Malaysia. However, the number of existing establishments was not available..*
[(b)]: *These statistics covered establishments of more than 100 employees.*
Source: 1975: Annual Statistical Bulletin, Malaysia, 1979: 21.
1980: Monthly Statistical Bulletin Peninsular Malaysia, December 1981: 52.
1985: Monthly Statistical Bulletin of Peninsular Malaysia, December 1986: 44 and Malaysia: Industrial Surveys 1985: 70.
1990: Malaysia: Monthly Statistical Bulletin, December 1991: 42.
1995: Malaysia: Monthly Statistical Bulletin, December 1996: 38;
2000: Malaysia: Monthly Statistical Bulletin, December 1991: 50.
1995, 2000, 2004: Malaysia: Monthly Manufacturing Statistics, October 2005: 25.

As highlighted in Table 5.3, synthetic textile mills which are involved in the singular production of either fibers, yarns or fabrics or any combination of the afore-mentioned, showed a remarkable 55 fold increase in sales value for the year 2000 as compared to 1975 (even though statistics from 1995 onwards cover establishments with more than 100 employees only). The growth in this sector is mainly driven by FDI, beginning in the 1970s as mentioned earlier. However, the production volume by the synthetic textile mills which would allow a more meaningful comparison is not provided by the DOS. On the other hand, the number of such establishments gradually decline to stabilize at seven. The decline in sales value and the number of existing establishments are due to a highly competitive global trade in textile. The main feedstocks for synthetic textile mills are petroleum related and with the escalation in petroleum price, synthetic textiles face huge cost competitive pressures from natural fiber-based manufacturers.

Table 5.3 Sales Value of Fibers, Yarns, and Fabrics By Synthetic Textile Mills, 1975-2004

Year	Sales Value of Own Manufactured Products (ex-factory) (RM'000)	Number of Establishments
1975	59,709	10
1980	n.a.	n.a.
1985	104,499	13
1990	n.a.	n.a.
1995	1,694,198[(a)]	8[(a)]
2000	3,295,793[(a)]	7[(a)]
2004	2,959,659[(a)]	7.[(a)]

Note:
n.a. = Not Available.
[(a)]: Data only covered establishments of more than 100 employees.

Source: 1975: Annual Statistical Bulletin, Malaysia, 1979: 21.
1980: Monthly Statistical Bulletin Peninsular Malaysia, December 1981.
1985: Malaysia: Industrial Surveys 1985: 71.
1995, 2000, 2004: Malaysia: Monthly Manufacturing Statistics, October 2005: 26.

Table 5.4 illustrates the rapid 24 fold increase in sales value of knitted fabrics and knitted clothing for the period 1975-2000 (even though statistics from 1990 onwards cover establishments with more than 20 employees). The sales value peaked in 2000 and subsequently declined by 14 percent in 2004. Like in the above table, statistics on production volume were not available for most of the years. The number of establishments peaked at 49 in 1995 and gradually decline to 41 and fairly sharply to 37 in 2000 and 2004 respectively. However, the number of establishments as reported by the Department of Statistics is not a true reflection of the actual situation as the statistics only cover establishments of more than 20 employees from the year 1990 onwards. Thus, small-scaled enterprises, which form a large majority of the knitting mills, are excluded. Anecdotal evidences from the pilot study and the survey field work indicated the proliferation of small-scaled knitting mills in Batu Pahat, Klang Valley and Penang in the 1980s to mid 1990s. However, anecdotal evidences also evinced that a large number of such small scaled knitting mills are suffering a margin squeeze in the face of competition from China. If this were to continue, many such enterprises will be in dire straits as reflected in the ten closures via 2000-2004 statistics.

Table 5.4 Sales Values of Fabrics And Knitted Clothing Of Wearing Apparel By Knitting Mills, 1975-2004

Year	Sales Value of Own Manufactured Products (ex-factory) (RM'000)	Number of Establishments
1975	50,124	42
1980	n.a.	n.a.
1985	190,096	60
1990	613,340[(a)]	41[(a)]
1995	1,045,542[(a)]	49[(a)]
2000	1,197,150[(a)]	47[(a)]
2004	1,033,766[(a)]	37[(a)]

Notes:
n.a. = Not Available
[(a)]: Statistics only covered establishments of more than 20 employees.

Source: 1975: Annual Statistical Bulletin, Malaysia, 1979: 21.
1980: Monthly Statistical Bulletin Peninsular Malaysia, December 1981.
1985: Industrial Surveys 1985: 72.
1990: Malaysia: Monthly Manufacturing Statistics, April 1991: 9.
1995, 2000, 2004: Malaysia: Monthly Manufacturing Statistics, October 2005: 26.

Likewise, the sales value of dyeing, bleaching, printing and finishing of yarns and fabrics, except batik, as shown in Table 5.5, demonstrates a slightly more than six fold increase in 2000 as compared to 1975 (even though statistics from 1995 onwards cover establishments with more than 100 employees). For the period 2000-2004, sales value declined by 22 percent However, statistics on production volume were not available at all. On the other hand, the number of such establishments for the period 1995-2004 has stabilized to 11. The decline in sales value also reflects on the tough competitive business climate facing the textile and apparel industry in Malaysia. The wet processing sub-sector is primarily domestic oriented with minor commission works coming from Singapore due to the proximity of Batu Pahat, Johore. The decline in sales as mentioned above also carries the implication that the amount of wet processing works also have declined during the same period.

Table 5.5 Sales of Services in Relation To Dyeing, Bleaching, Printing and Finishing of Yarns and Fabrics, except Batik, 1975-2004

Year	Sales Value of Own Manufactured Products (ex-factory) (RM'000)	Number of Establishments
1975	166,686	23
1980	n.a.	n.a.
1985	176,799	10
1990	n.a.	n.a.
1995	686,022 [(a)]	11[(a)]
2000	1,061,308[(a)]	12[(a)]
2004	832,054[(a)]	11[(a)]

Notes:
[(a)] : Statistics only covered establishments of more than 100 employees.

Source: 1975: Annual Statistical Bulletin, Malaysia, 1979: 21.
1980: Monthly Statistical Bulletin, Peninsular Malaysia, December 1981.
1985: Malaysia: Industrial Surveys 1985: 70.
1995, 2000, 2004: Malaysia: Monthly Manufacturing Statistics, October 2005: 26.

The sales value of specific garments by clothing factories, which do not include knitted and fur apparels, demonstrated an approximately striking 28 fold increase for the period 1975-2000 as illustrated in Table 5.6 (even though statistics from 1995 onwards cover establishments with more than 50 employees). The increase in sales value is also in tandem with the increase in production volume for male trousers, shirts, blouses and dresses for that particular period with the exception of a slight aberration for dresses in the period 1995-2000. However for the period 2000-2004, the sales value of specific garments saw a drop of 12 percent. The number of clothing factories also saw a drop from 153 to 125 for the period 1995-2004. The decline in sales value and the number of clothing factories reflect on the cost competitive pressure as the clothing factories are mainly labor intensive in Malaysia. The increasing labor cost, juxtaposed against low wage labor in developing economies like China, Pakistan and India, pushes the low value added garment or clothing factories to eventual closure. The cost conundrum, in turn, forces the clothing factories to move up the value chain via faster cycle time in terms of design, sourcing of feedstock and garment making-up.

Table 5.6 Sales Value And Production Of Specific Garments by Clothing Factories, 1975-2004

Year	Sales Value Own Manufactured Products (ex-factory) (RM'000)[h]	Production of Trousers-Male ('000)	Production of shirts ('000)	Production of Blouses ('000)	Production of Dresses ('000)	Number of Establishments
1975	130,687	n.a.	n.a.	n.a.	n.a.	116
1980	n.a.	5,330	23,962	5,357	2,820	n.a.
1985	668,182	9,174[a]	21,381[a]	13,975[a]	2,577[a]	168[c]
1990	1,663,851	13,948	27,110	22,746	5,518	131
1995	2,302,782[c]	12,544[b]	33,726[b]	19,057[b]	7,456[b]	153[b]
2000	3,610,905[c]	15,709[b]	39,739[b]	25,549[b]	7,418[b]	138[b]
2004	3,192,844[c]	12,221[b]	20,102[b]	17,686[b]	2,097[b]	125[b]

Notes:
n.a. = Not Available
[a] *: Statistics covered only Peninsular Malaysia/West Malaysia.*
[b] *Statistics only covered establishments of more than 50 employees*
[c] *Statistics only covered establishments of more than 30 employees*

Source: 1975: Annual Statistical Bulletin, Malaysia, 1979: 22.
1980: Monthly Statistical Bulletin Peninsular Malaysia, December 1981:54-55.
1985: Yearbook of Statistics, Malaysia, 1986 and Malaysia: Industrial Surveys 1985:3.
1990: Monthly Manufacturing Statistics, Malaysia, April 1991: 9, 31, 32.
1995, 2000, 2004: Malaysia: Monthly Manufacturing Statistics, October 2005: 27, 58

In terms of collective analysis with regard to Tables 5.2 to 5.6, the growth of the global textile industry against the backdrop of the voluminous cum cheaper exports emanating from developing countries to developed countries, led to the orchestration of the Multi-Fibre Agreement (MFA), which was signed and implemented in 1974. The MFA, an industry cartel in which membership was derived from more than 40 exporting and importing countries, was renewed four times by 1986 since its inception. The MFA was subsequently incorporated in 1994 into the Uruguay Round of General Agreement on Tariffs and Trade (GATT) where it was later renamed in 1995 as the World Trade Organization. The MFA was completely phased out beginning January 1, 2005 (Lim Ai Leen and Mary Ann Tan 2004) so as to be in tandem with the principles of global free trade.

The imposition of export quotas with the inception of the MFA in 1974 has benefited Malaysia as Malaysia has not fully utilized its quota. This led to 'quota hopping' where foreign investors, having fully utilized the export quotas of their home countries, seized upon the opportunity that avails in the unutilized portion of Malaysia's export quota. In the 70s, the textile industry was given another boost with regards to the inflow of FDI, due in part to the structural changes in the home countries of the FDI and also the generous incentives provided by the Malaysian Government. FDI in the form of wholly owned subsidiaries or joint-ventures with local partners provided the impetus to growth. The knock-on effect is that it also acts as a catalyst for the growth of the locally-owned textile and apparel manufacturers. Tables 5.2 to 5.6 reveal that the collective number of primary textile manufacturers, comprising of cotton-based spinners, weavers and finishers, synthetic textile mills, knitting mills, and wet processors with the exception of batik, is 89 as compared to 116 apparel manufacturers in the year 1975. This highlights the point that the entire spectrum of the TAPC was already in existence in Malaysia by the year 1975.

Aided by political and economic stability together with a good infrastructural network, the inflow of FDI continued into the 1980s. The inflow of FDI led to the deepening of the TAPC with a wider variety of products. Taiwan recorded the highest in investment value whereas Singapore had the largest number of projects (Angeline Tay and Sieh Lee Mei Ling, 2000). The Taiwanese had the largest investment value as they brought in modern production methods and technologies. Generally FDI have better production methods and technologies as compared to the locally owned enterprises. The 1980s and 1990s were also assisted by contract or licensed manufacturing awarded by global brand owners and retail chains. The global brand owners and retail chains play the role of coordinators by linking the designers, logistic suppliers, contract or licensed manufacturers and buyers. These global brand owners and retail chains also go to the extent of planning the production schedules, the sourcing and purchasing of feedstocks and supplies, and also the provision of logistics to meet buyer specifications and expectations. The growth in the eighties and nineties are reflected in Tables 5.2 to 5.6 and the accompanying individual analysis as mentioned above.

Post-2000 offers a different scenario. Global textile and apparel competition, especially from China, has altered the business climate by imposing a margin squeeze. The cost conundrum faced by the Malaysian TAPC as a result of higher labour cost and a high reliant on imports for feedstocks, has weeded out the less competitive ones. This cost conundrum forces the Malaysian TAPC to move up the value chain to survive. Under such circumstances, a lack of deep pocket can be detrimental not only to survival but also to environmental management as funds would be lacking.

Tables 5.7 to 5.10 do not take into account re-exports, in the form of re-packing, sorting or grading, which are not included as part of the transformation process. As such, the exports of textile and apparels emanate from the production or transformation process. Tables 5.7 (i), (ii) and (iii) reveal that Malaysia is a net importer of textile fibers. Cotton, one of the major feedstocks, is not produced locally and is wholly imported. The import of cotton is a major contributory reason for being a net importer of fibers. Petroleum-related feedstocks, which are used in synthetic fiber production, are readily available in Malaysia as Malaysia is a net exporter of petroleum-related products. This also explains the trend of increasing exports of synthetic polyester fibers for the period 1985-2004. At the same time, Malaysia also imports a substantial amount of synthetic fibers other than polyester fibers for the downstream activities.

Table 5.7 (i) Export of Textile Fibers For Apparel Production, 1985-2004

Fiber Types	Year (RM'000) 1985	1990	1995	2000	2004
Silk	-	55	1,603	3,310	137
Cotton	3,676	5,883	29,092	22,500	24,675
Synthetic fibres suitable for spinning	62,317	73,990	131,051	186,305	230,385
Other man-made fibres and waste	496	1,372	4,329	8,833	12,474
TOTAL	66,489	81,300	166,075	220,948	267,671

Source: 1985: Malaysia: Annual Statistics of External Trade, Vol. I, Part I (Tables and Summaries): 3
1990: External Trade Statistics: Tables and Summaries, 1990: 35.
1995: Malaysia: External Trade Summary, December 1996: 6.
2000: Malaysia: External Trade Statistics: Tables and Summaries 2001: 10.
2004: Monthly External Trade Statistics, December 2005 :10.

Table 5.7(ii) Import of Textile Fibers For Apparel Production, 1985-2004

Fiber Types	(RM'000) 1985	1990	1995	2000	2004
Silk	11	-	2,320	2,727	470
Cotton	92,236	191,601	314,823	420,435	367,315
Synthetic fibers suitable for spinning	39,125	75,082	221,727	17,510	200,493
Other man-made fibers and waste	6,643	31,882	32,103	53	62,895
TOTAL	138,015	298,565	570,973	440,725	631,173

Source: 1985: Malaysia: Annual Statistics of External Trade, Vol. I, Part I (Tables and Summaries): 3
1990: External Trade Statistics: Tables and Summaries, 1990: 35
1995: Malaysia: External Trade Summary, December 1996: 6.
2000: Malaysia: External Trade Statistics: Tables and Summaries 2001: 10.
2004: Monthly External Trade Statistics, December 2005 :10.

Table 5.7(iii) Net Exporter /Net Importer Of Textile Fibers For Apparel Production, 1985-2004

	1985	1990	1995	2000	2004
Total Export	66,489	81,300	166,075	220,948	267,671
Total Import	138,015	298,565	570,973	440,725	631,173
Net Exporter/ (Net Importer)	(71,526)	(217,265)	(404,898)	(219,777)	(363,502)

Tables 5.8 (i), (ii) and (iii) highlight the reversing trend of being a net importer to that of an increasing net exporter of yarns, fabrics and clothing accessories for the period 1985-2004. This demonstrates the deepening and success of downstream

activities which has the capacity in not only reversing the trend of being a net importer but also being a major net exporter of such intermediate products. At the same time, it provides an insight into the capacity of such enterprises of not only being a provider of intermediate products to the local downstream garment manufacturers but also having an increasingly important export orientation focus. This also reflects on the deepening and success of downstream activities in the TAPC in Malaysia.

Table 5.8 (i) Export of Yarns, Fabrics And Clothing Accessories, 1985-2004

	Year (RM'000)				
Products Types	1985	1990	1995	2000	2004
Textile Yarn	118,191	162,745	1,232,234	2,166,588	2,129.218
Cotton Fabrics, Woven (Not including narrow or special fabrics)	103,695	209,616	336,327	442,102	440,513
Fabrics, Woven of man-made textile, materials (not including narrow or special fabrics)	168,403	251,778	665,049	1,350,320	1,007,936
Textile fabrics, cotton	59	755	2,539	3,126	10,298
Knitted or crocheted fabrics (including tubular knit, pile and open-work fabrics)	16,394	178,105	365,232	495,957	390,383
Tulles, lace, embroidery, ribbons, trimmings and other small wares	392	7,787	20,162	34,000	42,317
TOTAL	407,134	810,786	2,621,543	4,492,093	4,020,665

Source: 1985: Malaysia: Annual Statistics of External Trade, Vol. I, Part I (Tables and Summaries): 4-5.
1990: External Trade Statistics: Tables and Summaries, 1990:36-37.
1995: Malaysia: External Trade Summary, December 1996: 9.
2000: Malaysia: External Trade Statistics: Tables and Summaries 2001: 14.
2004: Monthly External Trade Statistics, December 2005 :14.

Table 5.8 (ii) Import of Yarns, Fabrics And Clothing Accessories, 1985-2004

Products Types	Year (RM'000) 1985	1990	1995	2000	2004
Textile Yarn	82,326	454,598	1,026,485	1,010,255	918,435
Cotton Fabrics, Woven (Not including narrow or special fabrics)	167,027	524,799	630,399	590,572	419,906
Fabrics, Woven of man-made textile, materials (not including narrow or special fabrics)	283,208	678,423	793,489	908,289	709,032
Textile fabrics, cotton	8,492	44,954	257,889	103,752	88,113
Knitted or crocheted fabrics (including tubular knit, pile and open-work fabrics)	88,665	496,066	571,488	919,798	642,759
Tulles, lace, embroidery, ribbons, trimmings and other small wares	12,079	52,247	77,144	105,474	91,144
TOTAL	641,797	2,251,087	3,356,894	3,638,140	2,869,389

Source: 1985: Malaysia: Annual Statistics of External Trade, Vol. I, Part I (Tables and Summaries): 4-5.
1990: External Trade Statistics: Tables and Summaries, 1990:36-37.
1995: Malaysia: External Trade Summary, December 1996: 9.
2000: Malaysia: External Trade Statistics: Tables and Summaries 2001: 14.
2004: Monthly External Trade Statistics, December 2005 :14.

Table 5.8(iii) Net Exporter /Net Importer Of Yarns, Fabrics and Clothing Accessories, 1985-2004

	(RM'000) 1985	1990	1995	2000	2004
Total Export	407,134	810,786	2,621,543	4,492,093	4,020,665
Total Import	641,797	2,251,087	3,356,894	3,638,140	2,869,389
Net Exporter/ (Net Importer)	(234,663)	(1,440,301)	(735,351)	853,953	1,151,276

Malaysia is a net exporter of apparels as indicated in Tables 5.9 (i), (ii) and (iii). The period 1990-2000 highlights the increasing trend of being a net exporter of apparels. However, the period 2000-2004 buckled the trend in the face of stiff global competition. This once again demonstrates the deepening and the success of downstream activities in the export orientation push. The deepening and success of downstream activities and the export linkage reflect on the collaborative efforts in the form of vertical integration, be it backward or forward integration, and especially overseas contract or licensed manufacturing, acting as a collaborative leverage to the export markets.

Table 5.9 (i) Export of Apparel, 1985-2004

Products Types	Year (RM'000) 1985	1990	1995	2000	2004
Men's or boy's coats, capes, jackets, suits, blazers, trousers, underwear etc. of textile fabrics, not knitted or crocheted.	n.a [(a)]	685,312	920,612	1,257,090	749,083
Women's or girls' coats, capes, jackets, suits, blazers, trousers, shorts and similar articles of textile fabrics, not knitted or crocheted.	n.a [(a)]	575,551	503,921	679,624	682,477
Men's or boys' coats, capes, jackets, suits, blazers, trousers, shorts and similar articles of textile fabrics, knitted or crocheted.	n.a [(a)]	280,566	407,314	671,270	664,906
Women's or girls' coats, capes, jackets, suits, blazers, trousers, shorts and similar articles of textile fabrics, knitted or crocheted.	n.a [(a)]	445,285	526,328	845,534	825,408
Articles of apparel, of textile fabrics, whether or not knitted or crocheted	n.a [(a)]	551,489	742,537	1,246,819	1,235,769
Clothing accessories of textile fabrics, whether or not knitted or crocheted	n.a [(a)]	90,296	199,836	363,720	421,260
TOTAL	n.a [(a)]	2,628,499	3,300,548	5,064,057	4,578,903

Notes:
n.a [(a)]: Not Available
(Statistics for these product types have a different grouping and classification of activities as compared to the year 1990 onwards).

Source: 1985: Malaysia: Annual Statistics of External Trade, Vol I Part I (Tables and Summaries): 7.
1990: Malaysia: External Trade Statistics: Tables and Summaries 1990:39.
1995: Malaysia: External Trade Summary, December 1996:11-12 .
2000: Malaysia: External Trade Statistics: Tables and Summaries 2001:20.
2004: Monthly External Trade Statistics, December 2005 :20.

Table 5.9(ii) Import of Apparel, 1985-2004

	Year (RM'000)				
Products Types	1985	1990	1995	2000	2004
Men's or boy's coats, capes, jackets, suits, blazers, trousers, underwear etc. of textile fabrics, not knitted or crocheted.	n.a [(a)]	21,127	53,276	113,982	107,230
Women's or girls' coats, capes, jackets, suits, blazers, trousers, shorts and similar articles of textile fabrics, not knitted or crocheted.	n.a [(a)]	24,449	66,482	55,852	189,988
Men's or boys' coats, capes, jackets, suits, blazers, trousers, shorts and similar articles of textile fabrics, knitted or crocheted.	n.a [(a)]	7,901	19,494	22,444	43,015
Women's or girls' coats, capes, jackets, suits, blazers, trousers, shorts and similar articles of textile fabrics, knitted or crocheted.	n.a [(a)]	4,913	11,720	20,748	64,489
Articles of apparel, of textile fabrics, whether or not knitted or crocheted	n.a [(a)]	74,243	118,843	103,950	174,584
Clothing accessories of textile fabrics, whether or not knitted or crocheted	n.a [(a)]	50,125	84,334	183,357	250,950
TOTAL	n.a [(a)]	182,758	354,149	500,333	830,256

Notes:
n.a [(a)]: Not Available
(Statistics for these product types have a different grouping and classification of activities as compared to the year 1990 onwards).

Source: 1985: Malaysia: Annual Statistics of External Trade, Vol I Part I (Tables and Summaries): 7.
1990: Malaysia: External Trade Statistics: Tables and Summaries 1990:39.
1995: Malaysia: External Trade Summary, December 1996:11-12 .
2000: Malaysia: External Trade Statistics: Tables and Summaries 2001:20.
2004: Monthly External Trade Statistics, December 2005 :20.

Table 5.9(iii) Net Exporter /Net Importer Of Apparel, 1985-2004

	(RM'000)				
	1985	1990	1995	2000	2004
Total Export	n.a [(a)]	2,628,499	3,300,548	5,064,057	4,578,903
Total Import	n.a [(a)]	182,758	354,149	500,333	830,256
Net Exporter/ (Net Importer)	n.a [(a)]	2,144,741	2,946,399	4,563,724	3,748,647

Notes:
n.a [(a)]: Not Available

A review of Table 5.10 highlights two major markets for Malaysian garment manufacturers. The period 1990-2003 (latest available statistics) illustrates the importance of the USA market and the collective EU markets as major market destinations (38% for 1990; 31% for 1995; 26.5% for 2000 and 25.8% for 2003). These two major market destinations are developed economies with high GDP per capita income. For the USA market, the American Apparel and Footwear Association, the largest and most representative trade association for sewn products with over 700 members selling 85 percent of sewn products at wholesale, gave birth to Worldwide Responsible Apparel Production (WRAP) certification. WRAP certification focuses primarily on human rights with accompanying principles on health and safety, and compliance with rules, regulations and standards in relation to the environment as well as environmentally conscious practices (WRAP Online 2005). In the MKMA Directory 2003-2005 (MKMA), many garment manufacturers have obtained such a certification.

A number of importers from the EU markets, especially Germany, would require garment manufacturers to have Oeko-Tex Standard 100 certification. Oeko-Tex Standard 100 certification focuses primarily on "human ecology" (Oekotex Standard 100 Online 2005) by evaluating and screening for harmful substances in processed textiles that will come into contact with users. This standard also addresses production ecology by offering manufacturers the development of measurable and controllable production processes that are environmentally friendly through an auditing process. It not only encompasses finished textile goods but also associated accessories and grey products like fibers, yarns and buttons. This standard defines relevant harmful substances and accompanying limiting values. The tests are carried out by recognized institutes appointed by the Oeko-Tex Association to award the Oeko-Tex Standard 100. The Oeko-Tex Standard 100 has similarities in terms of environmental performance improvement like the ISO14000 standards (Welcome at Oeko-Tex_com. 29 November 2005). Likewise, in the MKMA Directory many garment manufacturers have also obtained Oeko-Tex Standard 100 certification.

Besides certifications, global brands like Nike, Adidas, Lotto and such likes have a sourcing policy or sourcing requirements in contractual form with the vendors or contract or licensed manufacturers pertaining to human rights, health and safety, and environmental requirements. As such, exporting to these two major markets impose environmental requirements directly on the garment manufacturers and indirectly on the other players in the upper vertical production chain as these environmental requirements have to be relayed and imposed by the garment manufacturers.

Table 5.10 Export of Apparel and Clothing Accessories By Major Countries, 1990-2004

Countries	Year (RM'000)/% 1990	%	1995	%	2000	%	2003	%
Argentina	-	-	-	-	-	-	13,956	0.2
Australia	39,667	1.1	57,223	1.0	113,692	1.3	102,180	1.3
Austria	21,908	0.6	22,353	0.4	14,181	0.2	-	-
Belgium	47,653	1.3	164,127	2.9	202,382	2.4	163,498	2.1
Canada	143,033	4.0	161,171	2.8	264,240	3.1	199,743	2.6
Denmark	30,933	0.9	38,688	0.7	45,213	0.5	33,781	0.4
Finland	-	-	7,874	0.1	8,379	0.1	-	-
France	218,042	6.1	234,754	4.1	256,095	3.0	244,254	3.1
Fed. Rep. of Germany	333,806	9.4	393,056	6.9	386,875	4.5	342,153	4.4
Greece	-	-	10,035	0.2	14,261	0.2	-	-
Hong Kong	38,157	1.1	64,697	1.1	70,803	0.8	70,016	0.9
Ireland	-	-	24,798	0.4	51,076	0.6	32,777	0.4
Italy	127,591	3.6	167,940	3.0	209,601	2.4	218,487	2.8
Japan	98,465	2.8	283,027	5.0	477,524	5.6	433,602	5.5
Netherlands	135,451	3.8	106,719	1.9	168,473	2.0	162,457	2.1
Norway	-	-	15,173	0.3	10,808	0.1	-	-
Phillipines	-	-	19,427	0.3	16,964	0.2	19,760	0.3
Singapore	212,138	6.0	328,549	5.8	281,002	3.3	260,243	3.3
Spain	44,664	1.3	44,048	0.8	77,878	0.9	109,290	1.4
Sweden	43,202	1.2	22,669	0.4	11,856	0.1	-	-
Switzerland	25,669	0.7	28,759	0.5	37,189	0.4	20,625	0.3
Thailand	-	-	15,459	0.3	26,676	0.3	45,526	0.6
United Arab Emirates	-	-	3,927	0.1	10,268	0.1	-	-
United Kingdom	347,571	9.8	521,662	9.2	820,732	9.6	712,151	9.1
U.S.A.	1,498,801	42.3	2,766,530	48.7	4,566,878	53.3	4,014,592	51.4
Korea	-	-	-	-	-	-	32,387	0.4
Mexico	-	-	-	-	-	-	35,713	0.5
Taiwan	-	-	-	-	-	-	33,972	0.4
Turkey	-	-	-	-	-	-	30,418	0.4
Rest of the World	140,024	3.9	179,345	3.2	431,612	5.0	483,467	6.2
TOTAL	3,546,775	100.0	5,682,011	100.0	8,574,659	100.0	7,815,049	100.0

Source: 1990: Malaysia: External Trade Summary, December 1990: 46.
1995: Malaysia: External Trade Summary, December 1996:53.
2000: Malaysia: External Trade Statistics: Tables and Summaries 2001:65.
2003: Malaysia: External Trade Statistics: Tables and Summaries 2004: 65

5.4 Current Industry Structure Of The TAPC In Malaysia

Based on the production processes as mentioned in Section 5.2, the sub-sectors in the TAPC are fiber production, spinning, weaving/knitting in the production of fabric, wet processing and garment manufacturing/making-up. Figure 5.1, as earlier illustrated, provides a general overview of the production processes. This sub-sectoral classification is not in accordance to SITC classification adopted by the DOS, as the SITC classification differentiates between synthetic-related textile production and natural fiber-related textile production. For the purpose of this research, sub-sectoral classification according to production processes is adopted as environmental issues and the types of pollutants can be clearly delineated. Fiber production, spinning, weaving/knitting and garment manufacturing are low-pollutant generators whereas wet processing is diametrically opposite, a high-pollutant generator. Issues pertaining to pollution will be discussed in the later Section 5.5.

Table 5.11 below highlights a cross-section of existing industry players in the TAPC. The organizational structure for the involvement in the various activities/ levels in the TAPC is unlike that of the POPC. For the POPC, the involvement in a downstream activity is incorporated in the form of a subsidiary. However, for the TAPC, the involvement in an upstream or downstream activity may not be in the form of a subsidiary. In the majority of cases, upstream or downstream expansion or backward or forward integration means expansion of facilities for the new activity in the existing factory site. This new activity will be integrated into the existing organization and not in the form of a subsidiary. However, forward integration in the form of garment manufacturing, a downstream activity, is the exception. The garment factory would be incorporated as a subsidiary and in most cases, is located nearby.

A quantitative review of the population in the TAPC in terms of the number of vertically integrated groups and standalones is not possible due to the limitation of existing available data. However, existing data drawn mainly from the MTMA Textile Directory 2002-2003 and MKMA Members Directory 2003-2005, and supplemented and complemented by the pilot study and the survey field-work, a general overview of the industry structure can be constructed. The most important group of players in the TAPC is the highly vertically-integrated groups. These players started off in any one of the following levels, namely fiber production, spinning, knitting or weaving and gradually over time via organic growth or acquisitions, move either upstream or downstream, or a combination of upstream and downstream, to grow to a four or five level involvement in the TAPC. During this period of growth, which happened during the heydays of the 1970s and especially the 1980s and 1990s, involvement in wet processing is essential to complement and supplement the delivery cycle time and meeting product specification like the utilization of dyestuffs that meets human ecological requirements. At this juncture, there are only two vertically-integrated groups that are involved in synthetic fiber production. Based on Department of Statistics classification, both are known as synthetic textile mills and the product lines encompass polyester fibers, yarns, and fabrics. Both are FDIs with the Pen-Group originating from Japan and Hualon from Taiwan. The remaining highly vertically-integrated groups are home grown, with the likes of Ramatex and MWE, both public listed. The locally owned highly vertically integrated groups are gradually phasing out or already have opted out of weaving due to cost competitive pressures. The home grown highly vertically-integrated groups are not at all involved in synthetic fiber production as it is highly capital and technology-intensive.

Another rung below is a group of players which have a level less involvement in the TAPC. A large majority of these players is involved in knitting, wet processing and garment manufacturing. Like in the above group, these players started off with a singular activity and over time, especially during the heydays of the 1980s and 1990s, moved either upstream or downstream, or a combination of both, to the existing three level involvement.

Likewise, another rung below is a group of players which are involved in two levels in the TAPC. A large majority of such players are involved in the combined activities of knitting and garment manufacturing. However, only a very small number is involved in the combined activities of wet processing and knitting, wet processing and garment manufacturing, and wet processing and spinning. These players with the exception of spinners with wet processing facilities are mainly small-scaled enterprises (SSEs) and medium-scaled enterprises (MSEs), with the majority located in the District of Batu Pahat, other areas in Johore, Klang Valley and Penang. However, spinners with wet processing facilities are FDIs with the likes of Coats Thread and American & Efird, which are capital and technology-intensive.

For the above players, local collaboration exists within the group or organization that is minimally involved in two levels in the TAPC. Local collaboration in the form of technological expertise and resources, and also as a result of group policy and strategy, are driven by competitive pressures especially that of market requirements. These collaborative efforts also encompass human ecological requirements like the utilization of azo free dyestuffs. Vertically-integrated groups or organizations have to ensure that all operations meet the "human ecological" product specifications.

The last group of players is independents. The independents are involved in one of the activities, namely spinning, knitting wet processing or garment manufacturing. Independent spinners are very small in number. Independent yarn spinners (without wet processing facilities) are large concerns, for example CNLT, which produces a wide variety of products and is capital and technology-intensive whereas independent thread spinners (without wet processing facilities) are either small-scaled enterprises or medium-scaled enterprises. All the independent knitters and wet processors is either small-scaled enterprises or medium-scaled enterprises. However, a large number of independent garment manufacturers is either small or medium-scaled enterprises with the exceptions of large garment manufacturers like Pen Apparel and Sinwah Industries who act as contract manufacturers for global branded marketers and retail chains.

Most of the export-based players in the TAPC have possess from a range of one to three certifications in the form of Oko-tex Standard 100 certification, ISO 9001 certification and WRAP certification. A larger number is observed to have Oeko-Tex 100 Standard certification as compared to ISO 9001 certification (MKMA 2003). This carries the implication that human ecology is placed on a higher priority as compared to quality. For US-based exports, the majority of players have WRAP certification for market access purposes.

Table 5.11 also reveals that all the groups and organizations involved in the TAPC are truly business concerns. They are neither government agencies nor government-linked companies (GLCs). This is in contrast to that of the POPC in which the majority of the main players are either government agencies or GLCs. As such, the impact of government policies should be more discernible in the POPC as compared to the TAPC.

Table 5.11: A Cross-Section of the Existing Industry Structure for the Textile and Apparel Production Chain

		Type of Activity					
Overall Business Focus of Group or Holding Company and Organisational Type	Name of Organisation/ Group	Fiber Production	Spinning	Knitting	Weaving	Wet Proces-sing	Apparel Manu-facturing
Plastic, Chemical and Textile Based Japanese MNC	Toray or Pen-Group	/	/	/	/	/	/
Textile Based Taiwanese Group	Hualon	/	/	/	/	/	
Textile and Apparel Based Group with Public Listing	Ramatex Group		/	/		/	/
Diversified Group with Public Listing	MWE		/	/	/	/	/
Diversified Group with Public Listing	Arab Malaysian Development Textile Division			/	/	/	
Textile and Apparel Based Private Limited Company	Winitex		/	/	/	/	/
Textile and Apparel Based Private Limited Company	Baneng Industries			/		/	/
Textile and Apparel Based Private Limited Company	Choon Giap Knitting Industries			/		/	/
Textile and Apparel Based Group with Public Listing	Hing Yiap Knitting Industries			/		/	/
Textile Based American MNC	American & Efird		/			/	
Textile Based UK MNC	Coats Thread		/			/	

		Type of Activity					
Overall Business Focus of Group or Holding Company and Organisational Type	Name of Organisation/ Group	Fiber Production	Spinning	Knitting	Weaving	Wet Proces-sing	Apparel Manu-facturing
Textile Based Private Limited Company	Jangdah Garment Industries			/		/	
Textile Based Private Limited Company	Eng Seen Bleaching and Dyeing					/	
Textile Based Private Limited Company	Samtex Industries					/	
Textile Based Private Limited Company	JV Silk Screen Enterprise					/	
Textile and Apparel Based Private Limited Company	Maple Tricot Industries			/			/
Textile and Apparel Based Group with Public Listing	Hytex Integrated			/			/
Textile and Apparel Based Private Limited Company	Chung Kai Knitting Factory			/			/
Textile Based Private Limited Company	Capital Island Green		/				
Apparel Based Private Limited Company	Bin Bin Knitwear Manufacturer						/
Apparel Based Hong Kong Group	Pen Apparel						/
Textile Based Private Limited Company	Hautex Industry			/			
Textile Based Private Limited Company	Firstex Knitting			/			

5.5 Environmental Issues Pertaining To The TAPC In Malaysia

The TAPC generates a variety of waste streams with the main ones being wastewater effluents, air emissions in the form of chemical mist and vapour, dust from the main feedstocks and solid wastes. However, the nature of waste is dependent on the application of production processes and technologies and the types of fibers, fabrics and chemicals utilized.

Effluents

The largest waste stream in the TAPC is the combined factory effluents. The amount of water used to process 1 kilogram of textile is on the average 165 litres of water (DOE 2000). The sizing process in weaving generates effluent in the form of residual sizing liquor. In wet processing, desizing, scouring, bleaching and mercerizing processes in fabric preparation are major sources of water pollution. The desizing process generates large quantity of discarded water soluble sizes. The discarded size can be in the form of starch (for natural fibers) or starch blends that contain synthetic sizes (for coating natural and synthetic yarns). Synthetic sizes may be in the form of pure polyvinyl alcohol (PVA) or PVA blends and may also contain acrylic and acrylic copolymer compounds and also carboxymethyl cellulose (MC). Besides sizing agents, the desizing wastewater may also contain oils, waxes and other additives used to increase yarn softness and pliability.

The scouring wastewater stream contains impurities which are removed from fibres, yarns or unfinished fabrics through washing. The impurities may contain disinfectants and insecticide (wool scouring) residues, dirt and other natural materials, caustic soda, water-soluble sizes, antistatic agents, residual tints for yarn identification, detergents, fats, oils, pectin, wax, knitting lubricants, spin finishes and spent solvents.

Wastewater from the bleaching process typically consists of hydrogen peroxide, sodium silicate or organic stabilizer and residues of oxidizing agents. The bleaching wastewater has a high pH value. However, peroxide bleaching pollution is not a major problem.

Wastewater from mercerizing contains caustic soda which is used for dyeability, lustre and appearance. Typically mercerizing wastewater contains a substantive amount of high pH alkali.

The dyeing process generates a large volume of effluent which comes mainly from the spent dye-baths and wash waters. Dyeing effluent contains residual dye liquor and dye colours and may also contain salts (mainly sodium chloride and sodium sulphate) which are used as raw materials or produced as by-products, metals in the form of chromium nickel, zinc and cobalt found in dyes and also by-products like mercury generated during the dyeing process, surfactants and spent solvents. The dyeing effluent can either have an acidic or alkaline pH value.

Printing effluent in the form of colors comes from washing down in which after each printing run, the rollers, squeegees screens and print paste containers are thoroughly cleaned for the next print run. Cleaning is via using water spray guns and tub cleaning machines. Cleaning, however, consumes a lot of water in which a screen or a squeegee requires approximately 100 litres and on the average, 250 litres of water is required to process one kilogram of printed textile with the exception of transfer printing (www.cotton.org).

The wastewater generated in the finishing process typically contains natural and synthetic polymers, toxins, suspended solids and spent solvents.

The various effluent streams from the TAPC can be typically treated by a combination of physical processes and chemical or biological treatment processes which would comprise of the followings:

- Screening
- Equalization
- Chemical treatment/dissolved air flotation/ultrafiltration
- Primary clarification
- Biological treatment via one of the following systems: Activated Sludge Process, Sequencing Batch Reactor (SBR), Oxidation Ditch System, Up-Flow Anaerobic Sludge Blanket (UASB) Reactor.
- Secondary Clarification
- Sludge Treatment and Disposal

(DOE 2000).

If the appropriate treatment technologies are employed efficiently, pollution abatement can be handled effectively. These treatment technologies were developed and tested and operationalized over a number of years in tandem with the enforcement of the EQA 1974. As a result, these treatment technologies can comply with the parameter limits of Standards A and B which were applied to the manufacturing industry, inclusive of the TAPC as shown in Table 3.2 in Chapter 3. Standard A as compared to Standard B has stricter parameter limits as the factory location is within an upstream water-supply catchment area of a public water-supply intake point (Environmental Quality (Sewage and Industrial Effluents Regulations, 1979).

Air Emissions

Air pollutants emitted by the TAPC is relatively minor as compared with other industries in Malaysia. However, due to the wide variety of air emissions, exposure to them on a long-term basis carries the risk of occupational hazard, health and safety. All the major processes in the TAPC give rise to air emissions in the form of airborne dust and lint for pure cotton and cotton blended fibres, yarns and unfinished fabrics, oil and acid mists and solvent vapours.

Airborne dust and lint is found in natural fiber preparation prior to spinning, knitting, weaving, singeing (a dry process in fabric preparation prior to dyeing or printing) and garment making-up. This airborne dust and lint occurs around the operating machines and their immediate surrounding for each of the above processes. Cotton dust from pure cotton and cotton blended fibers, yarns and unfinished fabrics can lead to byssinosis or ‘brown lung’, a disabling lung disease caused by inhalation. In 1971, approximately 30% of workers in United States cotton factories had byssinosis. This was also a common disease in European textile mills (Hricko and Brunt 1976). Another study revealed that the rate of byssinosis as a result of inhaling cotton dust for workers who have worked for up to 5 years is 7% whereas for those who have worked for more than 25 years, the rate is 18% (Science Today, February 1978 edition quoted in Ramachandran, 1986).

In synthetic fiber production, heat-setting processes can lead to emissions of oil and acid mists as a result of volatilisation of spin finish agents. In desizing, a preparatory step prior to dyeing, volatile organic compounds (VOCs) from glycol ethers are emitted. In scouring, another preparatory step prior to dyeing, volatile organic compounds (VOCs) from glycol ethers and solvent vapours consisting of toxic compounds like acetaldehyde, choloroflourocarbons, p-dichlorobenzene, ethyl acetate and others, are emitted. Carriers and solvents used in dyeing may also lead to air emissions. Carriers applied in batch dyeing may lead to volatilisation of aqueous chemical emulsions during heat setting. In drying and curing in the finishing process, volatilisation of organic compounds may take place and process chemicals like methyl naphthalene or cholorotolueno may be emitted. Acetic acid and formaldehyde are two major emissions in wet processing.

In garment making-up or product fabrication, formaldehyde maybe found in cutting and sewing rooms if resin treated cotton or polyester/cotton blended fabrics are used. This is especially pronounced in garment finishing ovens.

As the TAPC uses a wide variety of chemicals, exposure to chemicals on a long-term basis can lead to serious health problems. The likely routes for chemical entry into the human body are via inhalation, skin absorption and digestion.

Preventive measures that can be taken to eradicate or minimise the threats posed by airborne dust and lint, oil and acid mists, and solvent vapours are proper exhaust devices or ventilators, filters, appropriate respirators or face masks and scrubbers. The TAPC is subjected to the air emissions standards as specified in the Environmental Quality (Clean Air) Regulations, 1978 as shown in Section 3.2.1 in Chapter 3. Regulation 25(s) of the Factories and Machinery (Safety, Health and Welfare) Regulations 1970 and pursuant to paragraph (c) (ii) of Section 22(1) of the Act specifies air ventilation in terms of the number of air changes. If little or no heat, smoke or fume is generated, the number of air changes is not less than ten. If heat, smoke or fume is generated, the number of air changes is not less than 20. However, if any fume is likely to cause bodily injury, the number of air changes should not be less than 30. In addition, Part 1(e) of the Third Schedule, Section 32 of the Factories and Machinery Act, 1967 (Laws of Malaysia 2004) indicates that any patient suffering from any diseases contracted in a factory as listed in the Third Schedule, which also includes byssinosis, should notify the Chief Inspector of the Factories and Machinery Department. However, ineffective implementation for both the Acts has always hampered in safeguarding the health of workers (Ramachandran 1986).

Noise pollution

Noise nuisance, as a result of spinning, knitting, weaving and garment fabrication, can lead to hearing impairment if workers are exposed to high levels of noise for prolonged periods. The noise levels for the above processes are higher than the accepted danger threshold. Prolonged exposure to 85-90 dBA noise level can result in permanent hearing loss. A study carried out by the Penang Youth Scientists group and the Consumer Association of Penang (CAP) discovered the noise levels for the various sections in a textile factory are as shown in Table 5.12. At these noise levels, the duration of exposure permitted per day is specified in the Factories and Machinery (Noise Exposure) Regulations 1989 First Schedule in Part II Section 5 as mentioned in Chapter 3.

Table 5.12 Noise Levels

Section	High Value	Low Value	Average Value
Ring Spinning	94 dBA	93 dBA	93 dBA
Pirn Winding	90 dBA	88 dBA	89 dBA
Weaving	104 dBA	102 dBA	103 dBA

Source: Booklet "Noise Pollution – An Awareness Problem in Penang" published by Consumer Association of Penang) in Ramachandran 1986: 96.

Regulation 32 d(i) of the Factories and Machinery (Safety, Health and Welfare) Regulations 1970 specifies that employees working in intensive prolonged noise environment shall be supplied with appropriate ear-plugs or ear-muffs that are to be cleaned daily with the exception that they are discarded after each use. However, most employees do not use the ear plugs and the blame is shifted to the employees by management, citing discomforting and ear infection as the reasons for workers' refusal (Ramachandran 1986).

CHAPTER 6
Research Methodology

6.1 Introduction

This chapter starts with the postulation and operationalization of the five hypotheses in the G-I linkage. The succeeding section covers the postulation and operationalization of the four hypotheses in the I-I linkage. These two sections cover how each of the hypothesis is operationalized into an independent variable, encompassing also how the independent variable is measured. The following section covers the Environmental Performance Indicators (EPIs) as the dependent variables. The five categories of EPIs and the individual EPIs within each are outlined and discussed together with the point allocation and the assigned weightage for each EPI. This section ends with the scoring system for the EPIs. The next section covers the research tools used, the determination of sample size and the selection of disproportionate stratified sampling for both the POPC and the TAPC. The final section covers the rationality of using a non-parametric test in the form of the Kendall's tau-b and ends with the test for hypothesis for the correlation coefficient, that allows for comparative analysis. The test results will be discussed in Chapter 7 and Chapter 8.

6.2 Postulation And Operationalization Of Hypothesis In The Government-Industry (G-I) Linkage

The transformational role of the state as highlighted in the EMT is the overarching central premise in the G-I linkage. The transformation of the role of the nation state claim is operationalized via the interdependencies between the government and the industry or the G-I linkage. This linkage will be used to analyze the actors, factors, mechanisms and dynamics in shaping environmental management for the two selected sectors in Malaysia.

As postulated by the EMT the state's involvement in environmental policy is irrefutable, but the way the state relates to the industrial polluters makes a difference with respect to successful environmental reforms. This section covers the postulation and operationalization of the hypotheses in the G-I linkage by empirically analyzing the interactions and institutional arrangements between the Malaysian governmental institutions and the two industrial sectors (the palm oil production sector and the textile and apparel production sector) in shaping environmental management. In order to test the extent to which the transformation in the role of nation state thesis can be transplanted into empirical evidence, five hypotheses were postulated, indicated by H1 to H5. The hypotheses are operationalized below.

H1: The more the industry is involved in policy formulation process, the better the environmental performance.

As mentioned above, one of the central premises of EMT is the transformation in the role of the nation state. Janicke and Weidner (1995) have depicted the more cooperative, consensus-oriented relationship between the state and private actors in environmental policies as political modernization. Negotiated environmental policies and the creation of favorable conditions can lead to environmental reform. The first hypothesis is to test this assertion.

This hypothesis is operationalized via (i) the activeness of industry representatives in national councils/committees (dependent on the number of such councils/committees) in the aggregate and individual policy formulation process for a particular sector. (ii) the influence of industry representatives in national councils/ committees (dependent on the number of such councils/committees) in the aggregate and individual policy formulation process for a particular sector. This analysis is anchored on policies that have environmental management as a central concern.

For (i) and (ii), the summated rating Likert scale (Cooper and Schindler 1998) is used. For (i), the Likert scales of Very Active, Active, Moderately Active, Inactive and Not Active At All are used. Likewise, for (ii), the Likert scales of Very Influential, Influential, Moderately Influential, Little Influential and Not Influential At All are used.

H2: The better the cooperation between government and industry in technological development and technological transfer, the better the environmental performance.

One of the core themes of EMT is the role of science and technology as principal institutions in environmental reform via the generation of solutions. As Malaysia is a developing country, the technological base of the market actors is not sufficiently advanced enough to generate solutions, especially for the more preventive technology. However, Weale (1992) has suggested the exploration of alternative and innovative approaches to environmental policy. One of the prescriptions advocated by Weale (1992) in relation to the government-led program of action is government action or intervention in innovation, invention and diffusion of new technologies in industrial processes. This hypothesis is a test of this prescription and its relation to environmental performance in the Malaysian context.

The cooperation between G-I in technological development and technological transfer is operationalized via (i) the adoption of technologies offered by MPOB for the POPC and the participation in technical courses offered by MATAC for the TAPC; (ii) the participation in technological development programs offered by the various government agencies; (iii) the enjoyment of governmental incentives in the form of tax incentives offered by MIDA and MOF for investing in direct or indirect environment-related projects and technologies.

The measurement used is a simple category scale of a dichotomous yes or no response (Cooper and Schindler 1998).

H3: The more the (government) regulatory efforts emphasize on environmental issues, the better the environmental performance.

Mol (1995) has drawn attention to the fact that the environment has shifted from the periphery to the centre in the decision-making process. Regulating institutions have undergone modernization and can be interpreted as reflexive (institutional) reorganization. Murphy and Gouldson (2000) indicated that regulations can enhance capacity building. In addition, they assert that regulations help companies to overcome barriers to innovation and move beyond control technology to clean technology. This carries the implication that effective regulations are the precursor to more preventive technology. This hypothesis is to test the relationship between regulatory efforts emphasizing on environmental issues and environmental performance.

This hypothesis is operationalized via (i) the stringency of the DOE in the inspection of factory operations with regard to the EQA and related regulations; (ii) the stringency of the local authority in the inspection of factory operations with regard to local by-laws and related regulations; (iii) the stringency of the DOSH in the inspection of factory operations with regard to the OSHA and the FMA; (iv) the intensity of the DOE in the enforcement of the EQA and related regulations in terms of compliance; (v) the intensity of the local authority in the enforcement of the local by-laws and related regulations in terms of compliance; (vi) the intensity of the DOSH in the enforcement of the OSHA and the FMA in terms of compliance.

The measurement of stringency is on a bipolar intensity basis. The scales are as follow: (a) intense scrutiny; (b) close scrutiny; (c) scrutiny plus self-regulation; (d) lack scrutiny and self-regulation; and (e) no scrutiny and self-regulation. However, the measurement of intensity is based on the Likert scales of Very Highly, Highly, Moderately, Weakly and Not At All.

H4: The more preventive the approach advocated by the various government agencies, the better the environmental performance.

The transformation in the role of the state has led to the diversification of policy instruments that signal the move towards more preventive options. The move towards the preventive options also embraces the active involvement of the economic actors who are also the polluters themselves. Mol (1995) posits that the transfer of responsibilities, incentives and tasks from the state to the market can occur. Angel and Rock (2003) indicated that close cooperation between the agencies of economic development and firms include improvements in technological and managerial capability and a wider range of resources and policy tools that can enhance economic growth and environmental performance. The critical role that can be played by the state is to provide the necessary conditions to stimulate social self-regulation. Self regulation can be in the form of preventive approaches like ISO9001, ISO 14001, OHSAS18001 and HACCP certifications. This hypothesis is to test the relationship between preventive approaches adopted by government agencies and environmental performance.

This hypothesis is operationalized via (i) the aggregate preventive approaches advocated by the various government ministries and government agencies; (ii) the advocacy by the various government ministries and government agencies of ISO 9000 standards; (iii) the advocacy by the various government ministries and government agencies of ISO 14000 standards; (iv) the advocacy by the various government ministries and government agencies of OHSAS 18000 standards; (v) the advocacy by the various government ministries and government agencies of HACCP standards.

The aggregate (i) is a constitution of (ii), (iii), (iv) and (v) for the POPC and (ii), (iii), and (iv) for the TAPC. The Likert scale is used for (i) to (v). The scales for all are Very Highly Advocated, Highly Advocated, Moderately Advocated, Weakly Advocated and Not Advocated At All.

H5: The higher the local communities' involvement via the institutional structure in environmental monitoring, the better the environmental performance.

Public acts from the perspective of EMT can motivate improvement in environmental performance. O' Rourke (2002) has indicated that close cooperation among local communities and the relevant authorities has impacted on the environmental performances of industries in Vietnam. Local communities' involvement with government bodies can complement and supplement state functions and actions. The monitoring and enforcement of regulations can be facilitated by the long-standing relationships with important actors in the private sector (Rock 2002). Public pressure in the form of environmental monitoring can strengthen the bargaining hand of government regulators. In the Malaysian context, the local institutional structure (belonging to the state) where the local communities can be involved with is already in existence. This hypothesis is to test the relationship between local communities' involvement with local institutional structure in environmental reporting and environmental performance.

This hypothesis is operationalized via the existence of institutional relations, be it formal or informal, between the local communities namely the resident associations, village committees and interested individuals, and government authorities like the DOE, local authorities and DOSH. Formal institutional relations are in the form of seminars, workshops, dialogues and official channel of communication between both parties. Informal relations are in the form of phone calls, office visits and letters by the representatives of the local communities and interested individuals to air environmental violations.

The measurement is based on the simple category scale of a dichotomous yes or no response (Cooper and Schindler 1998).

6.3 Hypothesis Postulation and The Operationalization Of The Industry-Industry (I-I) linkage

The increasing importance of market dynamics and economic agents in the context of globalization is the overarching central premise in the I-I linkage. The increasing importance of the role of markets and market actors in the context of globalization, is operationalized via interdependencies between firms: the I-I linkage. This linkage will take into account the relations and interactions between firms from the global supply chain and the local supply chain as well as within the local supply chain in Malaysia.

This section covers the postulation and opeartionalization of the hypotheses in the I-I linkage by empirically analyzing the interactions between firms in the I-I linkage for the POPC and the TAPC in terms of environmental reform. The extent to which the increasing importance of market dynamics and economic agents in the context of globalization thesis can be transplanted into empirical evidence is tested via four postulated hypotheses. The four postulated hypotheses are H6 to H9 and are discussed below.

H6: The higher the exposure to international trade, the better the environmental performance.

Mol (2002) affirmed that economic actors like the transnational industrial companies, global markets and trade are playing a dynamic role in environmental reform. In addition Mol said that the developing regions are more affected by global markets and economic actors than supranational political institutions even though variation exists in terms of the degree of integration of each country. Van de Woerd et al., (2000) also claimed that market pressure is an important driver in the adoption of environmentally friendly strategies. By virtue of the fact that the firm is exporting, it pushes the firm to adopt environmental standards, quality standards, consumer health standards, consumer safety standards, tracing mechanism and human rights standards. Mol (2001) has succinctly stated that the increasing need to adopt ISO 14000 standards in order to gain access to certain international markets has triggered a drive towards environmental harmonization. By the same token, this leads to global harmonization of environmental practices.

The question that arises is can export alone be the driver for better environmental performance. All export regions or markets have certain market requirements but these requirements vary on the issue of stringency. As different markets have different requirements, harmonization of environmental practices may be globally uneven.

This hypothesis is operationalized via (i) the exportation of products; and (ii) the imposition of environmental standards for market access to the export market/ s. This hypothesis is further operationalized via the three main export markets in terms of importance as listed in the following: (iii) export to EU markets; (iv) export to non-EU Europe markets; (v) export to North American markets; (vi) export to Latin American markets; (vii) export to Middle Eastern markets; (viii) export to African markets; (ix) export to Oceanic markets; (x) export to East Asian markets; (xi) export to ASEAN markets; (xii) export to West Asian markets; (xiii) export to other markets. This hypothesis is further extended to export market/s that have environmental standards or regulations for market access in terms of regions as listed in the following; (xiv) export to EU markets; (xv) export to non-EU Europe markets; (xvi) export to North American markets; (xvii) export to Latin American markets; (xviii) export to Middle Eastern markets; (xix) export to African markets; (xx) export to Oceanic markets; (xxi) export to East Asian markets; (xxii) export to ASEAN markets; (xxiii) export to West Asian markets; (xxiv) export to other markets.

The measurement for (i) and (ii) is based on the simple category scale of a dichotomous yes or no response (Cooper and Schindler 1998). Further to that, the respondent has to choose the three main export markets and ranked them in order of importance. The ranking for Most Important, Second Most Important and Third Most Important is 3, 2. and 1 respectively for (iv) to (xiii). In addition, if environmental standards or regulations are imposed by the export market/s, the respondent has to apply the simple category scale of a dichotomous yes or no response for (xiv) to (xxiv).

H7: The higher the level of vertical integration, the better the environmental performance.

An important dimension of EMT is globalization and the role played by the global supply chain in environmental reform. Corbett (2002) indicated that downstream customers from OECD countries exert pressure through the global supply chain on firms or suppliers in developing countries. Downstream customers in the form of retailers and brand owners can exert substantial control over how, when, and where manufacturing will take place (Gereffi, 2002: 4). The impact of this should be felt more by vertically integrated groups. If any of the activity is adversely affected, especially by environmental problems, the reputational capital (Angel and Rock, 2005) of the group can be tarnished or eroded quickly. Some of these local vertically integrated groups, especially from the POPC, are transnational corporations with a strong industrial presence in Western Europe. Therefore, the higher the vertical integration, the greater the adverse impact would be felt. For environmentally conscious vertically integrated groups, the strongest point is in strengthening the weakest link in their vertically integrated structure. This is to ensure that the problem of the weakest link would not engulf the entire group.

This hypothesis is operationalized via (i) the involvement in the number of activities or levels for the firm or the group in the oil palm and palm oil vertical chain (refer to Figure 4.1) and the textile and apparel vertical chain (refer to Figure 5.1). If the firm belongs to a group (as mentioned in Chapters 4 and 5), the activities of the group are taken collectively.

The measurement for vertical integration is as shown in Table 6.1. Table 6.1 highlights the denotation for standalone and lowly vertically integrated (collectively), moderately vertically integrated, and highly vertically integrated. The oil palm and the palm oil chain consists of the following activities: nursery, plantation, integrated farming, palm oil milling, palm kernel crushing, biomass-based products, biomass power plants, biofuel plant, refining and palm oil finished product manufacturing, oleochemical manufacturing, chemical recycling plant, bulking terminal, palm oil-based finished food product manufacturing, palm oil-based finished non-food product manufacturing, local distribution, exporting, and foreign distribution. The focus of this research is the POPC, namely activities associated with palm oil milling, palm kernel crushing, refining and palm oil finished product manufacturing, and oleochemical manufacturing. However, for the purpose of denoting the level of integration, the whole oil palm and the palm oil chain is taken into consideration. A caveat used is that the respondent must be involved in an activity in the POPC (the basis of selecting the respondent).

For plantations, a natural extension of their business is the involvement in milling. The pilot survey and fieldwork reveal that the involvement in plantation and milling are considered as upstream activities and are categorized as lowly vertically integrated. Thus, the involvement in two activities is used as the proxy to denote lowly vertically integrated groups. This proxy is also extended to the oil palm and palm oil chain but with the caveat that the respondent must be involved in an activity in the POPC. Standalones are also categorized collectively with lowly vertically integrated groups as their activity involvement is also low. Progressively over time, the integrated plantation cum milling groups, with the encouragement of the government, moved downstream into refining and palm oil finished product manufacturing due to lower capital and technological requirement as opposed to oleochemical manufacturing. This gives rise to the basis for the selection of a proxy for a moderately vertically integrated group which would consist of a combination of three levels in the oil palm and palm oil chain with the same caveat being applied. For the matured integrated plantation cum milling cum refining and palm oil finished product manufacturing groups, the latest frontier would be oleochemical production. As mentioned above, the capital and technological intensive requirements meant that firms with deep pockets only have the means of being involved in it. This is the basis for the selection of a proxy for a highly vertically integrated group that consists of a combination of four activities or more in the oil palm and palm oil chain with the same caveat being applied.

Likewise, the measurement to determine the level of vertical integration has to be formulated for the TAPC. The TAPC in Malaysia consists of the following activities associated with manmade fiber production, spinning, knitting, weaving, wet processing, garment fabrication, local distribution, exporting, and foreign distribution. Like in the above, the focus of this research is on the TAPC, namely activities associated with manmade fiber production, spinning, knitting or weaving, wet processing, and garment fabrication. However, for the purpose of denoting the level of integration, the whole TAPC is taken into consideration. A caveat used is that the respondent must be involved in an activity in the TAPC (the basis of selecting the respondent).

The standalones and the lowly vertically integrated are collectively grouped together due to their low activity involvement in the textile and apparel chain. The standalones are mainly but not exclusively from the small and medium scale enterprises where capital requirement is not intensive in nature. The exceptions being large and medium scale garment manufacturers, and capital cum technologically intensive spinning firms. The lowly vertically integrated firm or group elaborated in greater detail later in this chapter is categorized as having a combination of two levels within the textile and apparel chain but with the application of the said caveat above. An involvement of two levels has only a proportion of two out of nine activities in the textile and apparel chain and is considered low. Progressively over time, the lowly vertically integrated firms or groups expanded upstream or downstream or a combination of upstream and downstream during the heydays of the phenomenal growth in the 1980s and 1990s into three or more activities. The involvement in three and four or more activities in the TAPC is categorized as moderately vertically integrated firms or groups and highly vertically integrated firms or groups respectively. This is supported by the views of the actors in the TAPC, the MKMA membership directory (2003-2005), the MTMA membership directory (2003-2005), the promotional brochures from MKMA (MKMA Online) and MTMA (MTMA Online), and annual reports which generally state that vertically integrated groups consist of activities in spinning, knitting or weaving, wet processing and garment manufacturing. The implication is that the involvement in these four activities signifies that the firm or group is highly vertically integrated. Thus the proxy of a combination of four or more activities in the textile and apparel chain with the same caveat being applied is used to denote highly vertically integrated firms or groups. Taking this in due consideration, moderately vertically integrated firms or groups would have one less activity than the minimum four, namely three activities. Therefore, a combination of three activities in the textile and apparel chain with the same caveat being applied would be categorized as moderately integrated firms or groups. The involvement in three or four out of nine activities, even though not relatively high, has to take into consideration that the involvement in manmade fiber production and foreign distribution has remained largely the domains of deep pocket transnationals or high reputational brand owners. At present there is only one manmade fiber producer (a large Japanese multinational) and very few local groups involved in foreign distribution (those that are involved in are distributing to very limited foreign market/s nearby to Malaysia). If these two activities were taken out, three and a minimum of four out of seven activities would remain a reasonable proportion for moderately and highly vertically integrated firms or groups respectively. For highly vertically integrated firms or groups, a minimum of four out of seven activities is a majority involvement in the chain.

Table 6.1: Categorization of Vertical Integration for the POPC and TAPC

Codes	Degree of Vertical Integration	Oil Palm and Palm Oil Chain	Textile and Apparel Chain
1	Standalone and Lowly vertically integrated	• Standalone milling • Standalone palm kernel crushing • Standalone refining and specialty fats production • Standalone oleochemical production • A combination of two activities in the oil palm and palm oil chain for the group inclusive of the caveat of an activity involvement by the respondent in the POPC	• Standalone fiber production (non-existent in Malaysia) • Standalone spinning • Standalone knitting • Standalone weaving (non-existent in Malaysia) • Standalone dyeing and/or printing cum finishing • Standalone garment fabrication. • A combination of two activities in the textile and apparel chain for the group inclusive of the caveat of an activity involvement by the respondent in the TAPC
2	Moderately vertically integrated	• A combination of three activities in the oil palm and palm oil chain for the group inclusive of the caveat of an activity involvement by the respondent in the POPC.	• A combination of three activities in the textile and apparel chain inclusive of the caveat of an activity involvement by the respondent in the TAPC.
3	Highly vertically-integrated	• A combination of four activities or more in the oil palm and palm oil chain for the group inclusive of the caveat of an activity involvement by the respondent in the POPC.	• A combination of four activities or more in the textile and apparel chain inclusive of the caveat of an activity involvement by the respondent in the TAPC.

H8: The more intensive the international relationship, the better the environmental performance.

A very influential market actor in the global supply chain from the perspective of EMT is transnational corporations or multinationals. Mol (2001) has stated that the transnational enterprises can impose their environmental requirements which act as a catalyst in triggering environmental reform in the supplier and client companies via their centrally powerful position as spiders in the economic web. Another dimension as raised by Angel and Rock (2005) is the firm-based global environmental standards. These standards are a uniform set of process and product environmental performance requirements that have to be adhered to by the global production network. A key characteristic is the vigorous engagement of global sourcing and global supplier qualification. As both the POPC and the TAPC are highly export-oriented, the actors within are exposed to this type of international relationship. This hypothesis is to test the intensity of international relationship and environmental performance.

This hypothesis is operationalized via (i) the aggregate activities on collaboration shared by the overseas parent company or head office of the client; (ii) sharing updates on environmental regulations by the overseas parent company or head office of the client; (iii) sharing the development of minimum environmental requirements for products by the overseas parent company or head office of the client; (iv) the development and audit of product safety and quality by the overseas parent company or head office of the client; (v) the aggregate activities on collaboration shared by the client; (vi) sharing updates on environmental regulations by the client; (vii) sharing the development of minimum environmental requirements for products by the client; (viii) the development and audit of product safety and quality by the client.

The aggregate activities in (i) is the constitution of (ii), (iii) and (iv). For (ii), (iii) and (iv), the simple category scale of a dichotomous yes or no response is applied. Likewise, the aggregate activities in (v) is the constitution of (vi), (vii) and (viii). For (vi), (vii) and (viii), the simple category scale of a dichotomous yes or no response.

H9: The more intensive the local collaboration, the better the environmental performance.

Globalization, an important dimension of EMT is felt at the local level. Dickens (1998) has mentioned that in a globalizing world, economic activities are geographically localized. The localization of economic activities and interactions are moulded by extra-economic logics. Localization in the form of a distinct corporate philosophy or culture has a pervasive effect. This under-developed theme in the EMT would be explored in this hypothesis. The corporate culture of the GLCs in the POPC is very much influenced by government policy as they have to toe the government line. This is juxtaposed against the actors in the TAPC which are very much influenced by the affairs of a laissez faire market. A strong corporate philosophy or culture would ensure that all activities in the vertical chain capture the essence of the ideologue by way of collaboration. Collaboration can be within the vertically integrated groups or with client companies.

This hypothesis is operationalized via (i) the aggregate activities on collaboration shared by the (local) parent company or head office of the client; (ii) sharing updates on environmental regulations by the parent company or head office of the client; (iii) sharing the development of minimum environmental requirements for products by the parent company or head office of the client; (iv) the development and audit of product safety and quality by the parent company or head office of the client; (v) the aggregate activities on collaboration shared by the client; (vi) sharing updates on environmental regulations by the client; (vii) sharing the development of minimum environmental requirements for products by the client; (viii) the development and audit of product safety and quality by the client.

The aggregate activities in (i) is the constitution of (ii), (iii) and (iv). For (ii), (iii) and (iv), the simple category scale of a dichotomous yes or no response is applied. Likewise, the aggregate activities in (v) is the constitution of (vi), (vii) and (viii). For (vi), (vii) and (viii), the simple category scale of a dichotomous yes or no response.

6.4 The Operationalization Of The Environmental Performance Indicators

The theoretical best data would be the environmental parameters as stated in the EQA and the FMA, acting as dependent variables. The parameter requirements are listed in Section 3.2.1.1 for MNRE in Chapter 3. The scheduler quarterly DOE reports and the scheduler Factories and Machinery reports, if fully accessible, would allow for trend analysis in terms of compliance and environmental performance. However, there is variability in terms of the existence and periodicity of such reports. There are instances where the firm at the start of operation, after having sent an initial environmental report to DOE and has been categorized as being not problematic in terms of pollution, is not required to submit further reports if and unless required by DOE. My fieldwork also has indicated that a number of companies in the POPC and the TAPC has not submitted any report whatsoever to DOE from the start of operation. There are also occasions that the manufacturing firms in the POPC and the TAPC have to submit DOE reports on an ad-hoc basis. This is also compounded by the problem that some respondent companies do not want to divulge their DOE reports and Factories and Machinery reports to the researcher. As a result of this circumstance and at times paucity of quantitative data from some respondent companies, five categories are developed and operationalized as Environmental Performance Indicators (EPIs).

Prior to the discussion on the five categories of EPIs, point allocation and assigned weightage, a universal pre-requisite for point allocation has to be outlined. The point allocation has been standardized or normalized for all Y variables or dependent variables with a range of 0 to1. This range is based on either the nominal scale or the ordinal scale. If the responses for a particular Y variable are either a Yes or No dichotomous response, which is based on the nominal scale (Aaker, Kumar, Day,1998), a Yes response is allocated 1 point whereas a No response is allocated 0 point. For responses for a particular Y variable where responses are ranked or arranged in an order with a common variable or denominator, the highest rank response is allocated 1 point with the second highest rank having a point allocation of less than 1 but higher than that of the third highest rank. This is illustrated by the following example:

Comply fully=1; Comply Mostly=0.75; Comply Partially=0.5; Comply Some Of The Time=0.25; Comply Just Now and Then=0.

Following suit will have three sub-sections. The first sub-section will cover the five categories of EPIs as dependent variables, point allocation and assigned weightage for each individual EPI for all five categories as shown in Tables 6.2(i) to 6.2(v). The second sub-section will cover the scoring system and the derivation of the total score per respondent for all the EPIs. This will be followed by the last sub-section which covers the derivation of the average score per respondent for the EPIs.

6.4.1 Categories Of EPIs, Point Allocation And Assigned Weightage

This sub-section will discuss the number of EPIs for each category, the point allocation and assigned weightage for each EPI in each category. They are as follow:-

1. First Category: Common quantitative parameters in relation to compliance with standards as stated in the Environmental Quality Act.

The common quantitative parameters are:-

a. Compliance with water quality based on BOD concentration not exceeding 100 mg/l for discharge of treated effluent into waterways and 5000 mg/l for field application for palm oil milling; 20 mg/l for Standard A and 50 mg/l for Standard B for other manufacturing activities as per the EQA.
b. Compliance with permissible limits of concentration of air impurities not exceeding Standard A: 0.6, Standard B: 0.5 and Standard C: 0.4 g/Nm^3 dust or solid particles as per the Environmental Quality Act (EQA).

These two common quantitative parameters are the first and second EPI in this category as shown in Table 6.2i. These two common compliance parameters are required in the DOE report if and when requested by the DOE even though the downstream manufacturing sub-sector in the POPC and the entire activities of the POPC are subjected to more parametric requirements for treated effluent in the EQA as discussed in Chapters 4 and 5.

The third and fourth EPI are the willingness to disclose the level of BOD concentration discharge into waterways and the willingness to disclose the concentration of air impurities respectively. The researcher's request for the DOE's scheduler environmental reports from respondent companies for the past three years would also take into consideration the willingness of the respondent companies to disclose of such information. Such disclosure reflects on the openness and the transparency of the respondent companies, especially in cases if they have nothing to hide.

As mentioned above, there is variability in terms of the availability and accessibility to DOE reports. As a result of this variability, the point allocation for this category of EPIs has taken cognizance of these differentials and they are as follow:-

(i) Compliance With EQA parameters:-

- The point allocation below is based on the availability of data of up to a maximum of three years for compliance with either the BOD concentration or the concentration of air impurities. This means that the factory has been in operation for three years or more.
  Full Compliance for 3 Year Data = 1;
  Partial Compliance of 2 Years for 3 Year Data = 0.67;
  Partial Compliance of 1 Year for 3 Year Data = 0.33;
  Non-Compliance for 3 Year Data = 0.

- The point allocation below is based on the availability of data of up to a maximum of two years for compliance with either the BOD concentration or the concentration of air impurities. This means that the factory has been in operation for a maximum of two years.
  Full Compliance for 2 Year Data =1;
  Partial Compliance for 2 Year Data = 0.5;
  Non-Compliance for 2 Year Data= 0.

- The point allocation below is based on the availability of data of up to a maximum of one year for compliance with either the BOD concentration or the concentration of air impurities. This means that the factory has been in operation for a maximum of a year.
  Compliance for 1 Year Data=1;
  Non Compliance for 1 Year Data = 0.

(ii) Willingness to disclose information

- The point allocation below is based on the availability of data of up to a maximum of three years for the willingness to disclose information for either the BOD concentration or the concentration of air impurities. This means that the factory has been in operation for three years or more.
  Full Disclosure for 3 Year Data = 1;
  Partial disclosure of 2 Years for 3 Year Data = 0.67;
  Partial disclosure of 1 Year for 3 Year Data = 0.33;
  Non-disclosure for 3 Year Data = 0.

- The point allocation below is based on the availability of data of up to a maximum of two years for the disclosure of information of either the BOD concentration or the concentration of air impurities. This means that the factory has been in operation for a maximum of two years.
  Full disclosure of 2 year data =1;
  Partial disclosure of 1 year with 2 year data availability =0.5;
  Not willing to provide any data = 0.

- The point allocation below is based on the availability of data of up to a maximum of one year for the disclosure of information of either the BOD concentration or the concentration of air impurities. This means that the factory has been in operation for a maximum of a year.

Full disclosure of 1 year data availability= 1;

Not willing to provide any data = 0.

In terms of data accuracy, the concentration of air impurities is highly accurate and reliable. This is due to the fact that the recordings taken from the chimney via air stack analysis are collected by a third party independent laboratory. This work has been outsourced as the task of climbing up the chimney can be dangerous. Thus, a third party independent laboratory collecting the recordings ensures data accuracy and reliability tampering and suspicion is eradicated. However, there is some ambivalence in relation to the data for BOD concentration. The reading for the BOD concentration may lack accuracy or transparency as the samples are supplied by the manufacturing firms and not independently taken by the third party laboratories. The source of sample, if not taken by the third party laboratories themselves, is acknowledged in the report. The third party independent laboratories only carry out testing on the effluent samples. For samples that are provided by the manufacturing firms, the possibility of abuse is always present.

The possibility of variability in accuracy means that different weights have to be assigned to the first two EPIs. The basis of different weights is as follows:-

- A weight of one is given to data which has ambivalent or low accuracy.
- A weight of two is given to data which has high accuracy.

Based on this weight differentiation, the first EPI which is related to BOD concentration has an ambivalent possibility and as such is assigned a weight of one. On the other hand, the second EPI which is related to the concentration of air impurities is highly accurate and as such is assigned a weight of two.

The assigning of weights for the disclosure of information to reflect openness and transparency is based on the following:-

- A weight of one is given to the mere act of disclosure of information.
- A weight of two is given to the disclosure of substantive information which can determine the causes and effects for a particular environmental parameter.

The third and fourth EPIs are merely the disclosure of information and as such are assigned a weight of one.

2 Second Category: Environmentally friendly resource utilization

The adoption of environmentally friendly resource utilization focuses on:-

1. recycling or reusing treated effluent for either manufacturing or housekeeping activities, or for field application.
2. the use of biomass as a form of renewable energy.

The above two are the EPIs for this category as illustrated in Table 6.2ii. These resources, if utilized, tend to reflect on the environmental friendliness of the firm even though such actions may solely be due to pecuniary interest. The palm oil millers, the refiners and specialty fats manufacturers and the oleochemical manufacturers in the POPC are large consumers of water and if recycling or reusing of water were to take place, it would be a positive effort in good resource and environmental conservation. However, for the TAPC, the wet processors are a huge water consumer and likewise if there is water recycling and reusing, the benefits accrued to the environment would be similar. Biomass is produced in humongous quantity by the palm oil millers and other biomass wastes, like sawdust, even though not produced by the POPC and the TAPC, offer the potential of being a source of fuel feedstock in the form of renewable energy. Topglove Berhad, a public-listed company in the Malaysia Bourse and also Malaysia's largest glove manufacturer, has a plant which utilizes oil palm biomass in power generation and it is found that the plant is cost efficient in this area concerned (New Straits Times 18 February 2003).

Like as in the above category, the limitation is the existence of quantitative data. Record keeping for this second category of EPIs is voluntary and unlike the first category of EPI can be mandatory if required by DOE. Some of the firms in the POPC and the TAPC may adopt the utilization of environmentally friendly resources but variability would exist in terms of record keeping. Some manufacturing firms in the POPC and the TAPC may record the utilization of such resources to keep count on cost efficiency whereas others may adopt such measures but record keeping is on an ad-hoc basis or not in existence at all.

The large variability in terms of data availability means that meaningful trend analysis cannot be carried out. Thus, point allocation is based on the utilization or non-utilization of such environmentally friendly resources. As such, point allocation is based on the following:-

- One point is allocated for the recycling or reusing treated effluent or for using biomass.
- Zero point is allocated for not recycling or reusing treated effluent, or for not using biomass.

The basis of weight assignment for the utilization of environmentally friendly resources is as follow:-

- A weight of one is assigned for the utilization of resource that has an indirect contribution to environmental performance.
- A weight of two is assigned for the utilization of resource that has a direct contribution to environmental performance.

The two EPIs in this category have a weight of two as both resources are environmentally friendly resources and the utilization of such environmentally friendly resources have a direct contribution to environmental performance.

3 Third Category: Qualitative assessment

Qualitative assessment for three consecutive years for compliance with the parameter limits for:-

1. BOD concentration not exceeding 100 mg/l for discharge of treated effluent into waterways and 5000 mg/l for field application for palm oil milling; 20 mg/l for

Standard A and 50 mg/l for Standard B for other manufacturing activities as per the EQA.

2. concentration of air impurities not exceeding Standard A: 0.3, Standard B: 0.25 and Standard C: 0.2 g/Nm^3 dust or solid particles as per the Environmental Quality Act (EQA).
3. noise level in terms of the maximum permissible exposure limit not exceeding equivalent continuous sound level of 90 dBA or not exceeding the limits specified in the First Schedule (refer to Section 3.2.1.1 for MNRE and DOSH in Chapter 3) within the factory premises as specified in the FMA and the maximum 60 dBA during daytime from 7am-10pm and 50 dBA during night-time from 10pm-7am at the perimeter fence of the factory as specified by the EQA.

The qualitative assessment for three consecutive years in terms of compliance with the above three parameters forms the basis of the three EPIs for this category as shown in Table 6.2iii. This qualitative assessment for three consecutive years of all working days is a longitudinal assessment. This longitudinal assessment of all workings days for three consecutive years is a much more stringent assessment as compared to the requirements of DOE for environmental reports. The pilot survey and the field research undertaken indicate that the respondents are willing to divulge true information if no quantitative data were required to be furnished. Their assessment is highly accurate as they can recall the period or periods of violation, if any, with regard to specific parameters, especially the compliance parameter for the BOD concentration, and their causes. Moreover, this type of information is less sensitive and as a result they are more willing to tell the truth. This type of qualitative assessment is an accurate proxy for periodic quantitative parametric compliance data despite its limitation of a lack of 'hard' quantitative evidence. This type of information is only gathered when the researcher is interviewing the respondent on a face-to-face basis without the presence of any third party and also with the researcher assuring that this information is for research purposes and the name of the respondent company will be kept confidential.

The point allocation for all three EPIs takes into consideration the lack of 'hard' quantitative evidence and is as follow:

Comply fully= 1
Comply mostly= 0.75
Comply partially = 0.5
Comply some of the time = 0.25
Comply just now and then = 0.

The basis of assigning weight for qualitative assessment of the three EPIs is based on the following:-

- a weight of 1 is for accuracy that ranges from unsatisfactory to less than unsatisfactory;
- a weight of 2 is for accuracy that ranges from satisfactory to more than satisfactory;
- a weight of 3 is for accuracy that ranges from moderate to more than moderate;

- a weight of 4 is for accuracy that ranges from slightly high to high.

Based on the above weightage, the relatively high accuracy for qualitative assessment of the three EPIs warrants a weight of 4.

4 Fourth Category: Environmental initiatives undertaken

The list of environmental initiatives that can be undertaken by a factory are listed below:-

a) Obtaining and maintaining ISO 9001 certification or at the implementation process prior to obtaining ISO 9001 certification.
b) Obtaining and maintaining OHSAS 18001 certification or at the implementation process prior to obtaining OHSAS 18001 certification.
c) Obtaining and maintaining HACCP certification or at the implementation process prior to obtaining HACCP certification (only for the POPC).
d) Obtaining and maintaining Oeko-Tex Standard 100 certification or at the implementation process prior to obtaining Oeko-Tex Standard 100 certification (only for the TAPC).
e) Obtaining and maintaining ISO 14001 certification or at the implementation process prior to obtaining ISO 14001 certification.
f) Having a corporate environmental policy.
g) Implementation of Corporate Environmental Auditing and Reporting in Annual Report or other forms.
h) Existing facilities for the treatment and disposal of POME/PORE/SFIE /OIE/ Industrial Effluents.
i) Existing facilities for the storage and disposal of other industrial wastes
j) Bunds for oil tanks (only for the POPC).
k) Systematic monitoring for BOD level for discharge into the waterway and for field application.
l) Systematic monitoring for air impurities or dust content.

Each of the environmental initiatives above is an individual EPI for this category as indicated in Table 6.2iv. The number of environmental initiatives undertaken carries the interpretation that the more such initiatives are being part of the corporate strategy and company practices, the more environmentally friendly the firm is. Therefore, the firm should have better environmental performance. The environmental initiatives listed from ***a*** to ***l*** are a combination of preventive and curative environmental policies. At the same time they can be classified as either direct or indirect environmental initiatives. The preventive and indirect environmental initiatives are from ***a*** to ***c*** whereas the preventive and direct environmental initiatives are ***d, e, f*** and ***j.*** The ***a*** to ***e*** initiatives are process driven and ***f*** and ***g*** are part of corporate philosophy or culture. The ***j*** initiative is basically preventive in nature taking into account accidental spillage and industrial accident that can have a major environmental impact for the surrounding area. The curative and direct environmental initiatives are ***g, h, i, k*** and ***l.*** The ***h*** and ***i*** environmental initiatives must be undertaken and complied with as they come under the purview of the EQA. The ***k*** and ***l*** environmental initiatives can either be voluntary or mandatory in nature. If the DOE were to classify the firm as requiring monitoring, the firm has to supply the mandated quarterly scheduler environmental reports. However, after initial monitoring during the start of operation, and if the firm is classified as being not problematic in terms of pollution, there is no requirement to send quarterly scheduler reports. Under this circumstance, if the firm were to keep on monitoring BOD level for discharge and air impurities, it is voluntary in nature.

If a firm has undertaken a higher number of such environmental initiatives, the environmental dimension has a higher level of cognizance in the corporate psyche. If this is ingrained in the corporate psyche, it will lead to less resistance towards environmental initiatives and the adoption of more environmental programs as many of these programs have a double dividend yield, namely benefiting the company in terms of cost efficiency and at the same time benefiting the environment.

As no 'hard' quantitative data is gathered for the EPIs in this category, this consideration is taken into account in the formulation of point allocation. The point allocation is based on the adoption of the environmental initiatives (also EPIs) as listed above. The point allocation is tailored towards the specific environmental initiatives and is as follow:-

Point allocation for environmental initiatives *a* to *e*:-
Obtained and maintaining certification = 1;
Implementing prior to obtaining certification = 0.5;
Have no intention of obtaining or implementing certification at all = 0.

Point allocation for environmental initiative *f*
Have an environmental policy = 1;
Do not have an environmental policy = 0.

Point allocation for environmental initiative *g*
Implementation of corporate environmental auditing and reporting in Annual Report = 1;
Do not implement corporate environmental auditing and reporting in Annual Report =0.

Point allocation for environmental initiative *h*
Have existing facilities for the treatment and disposal of POME/PORE/OIE/industrial effluents = 1;
Do not have existing facilities for the treatment and disposal of POME/PORE/OIE/industrial effluents = 0.

Point allocation for environmental initiative *i*
Have existing facilities for the storage and disposal of other industrial wastes= 1;
Do not have existing facilities for the storage and disposal of other industrial wastes = 0.

Point allocation for environmental initiative *j*
Have bunds for tanks = 1;
Do not have bunds for tanks = 0.

Point allocation for environmental initiatives *k* and *l*

Have systematic monitoring for the BOD concentration for discharge into waterways or the concentration of air impurities =1;

Do not have systematic monitoring for the BOD concentration for discharge into waterways or the concentration of air impurities = 0.

The basis of weight assignment for the environmental initiatives undertaken is as follows:-

- A weight of one is assigned for an environmental initiative which is indirect in nature or possesses a certain amount of ambivalence in terms of direct contribution to positive environmental management or a program of action which does not directly result in positive environmental management.
- A weight of two is assigned for an environmental initiative which contributes directly to positive environmental management.

Environmental initiatives ***a*** to ***c*** are indirect in nature and are assigned a weight of one. Environmental initiatives ***d***, ***e***, ***h***, ***i***, ***j***, and ***l*** contribute directly to positive environmental management and are assigned a weight of two. Environmental initiative ***f***, even though direct in nature, has a certain amount of ambivalence as firms may use this as a form of public relations exercise or may only talk the walk but not walk the talk. Environmental initiatives ***g***, ***k***, and ***l*** are related to either environmental auditing cum reporting, or environmental monitoring, which do not directly result in positive environmental management and as such are assigned a weight of one.

5 Fifth Category: Personal observation

Personal observation is based on the following:-

1. Housekeeping.
2. Discharge into waterways or for field application.
3. Dark smoke emission and ambient air in the factory premises.

The above three are individual EPIs for this category as indicated in Table 6.2v. The researcher and research assistant undertakes personal observation which is primarily based on sensory perception without taking any samples for testing. Housekeeping is evaluated from the general cleanliness of the surrounding within and outside the plant. Leakages of pipes and the drainage system in terms of the general cleanliness and the availability of oil traps and its functionality will be taken into account. If there are pipe leakages and the drainage system is clogged, the factory floor will be oily especially for the POPC whereas for the wet processors, the floor will be wet and colorful because of the dyes being used.

For treated effluent which is discharged into waterways (drains and rivers) outside the factory perimeter, the discharge is evaluated on clarity/turbidity/color and temperature immediately outside the perimeters of the factory. The temperature of the discharge is evaluated based on the sensory perception of heat emanated and felt by the researchers. For discharge of treated effluent for field application, the treatment ponds and the pipes used for channeling the treated effluent for field application are observed, wherever possible for leakages.

Dark smoke is evaluated in terms of the length of time for the emission of black smoke. Under the EQA, a firm cannot emit more than five minutes of black smoke in an hour and for a working day, the total cannot be more than 15 minutes per day. An observation with time keeping will be made on the length of time for black smoke emission to assess compliance. Besides dark smoke, the ambient air quality in the factory premises would also be observed especially for the TAPC. Ambient air quality, especially in the TAPC, is observed via airborne dust, lint, particulates, chemical mist and vapor near surrounding machinery and equipment, smelly odor and poor ventilation accompanied by felt stuffiness via sensory perception. These pollutants can cause occupational hazards for employees working inside the factory premises. Airborne dust and lint and odors can be eliminated by the effective use of factory ventilation and local exhaust ventilation for equipment that emit gases or vapors (DOE 2000: 57).

These observations are made possible as the principal researcher has a research assistant. While the principal researcher is conducting the interview which generally requires an average of three hours, the research assistant will observe the treated effluent discharged into waterways outside the factory perimeter fence and also the treatment ponds and pipes leading to the fields, house keeping outside the factory premises but within the compound of the factory and also dark smoke emission. The researcher, myself, after the interview, would request for a factory visit and I will be observing housekeeping and ambient air quality within the factory premises. If in cases of doubt with regard to the accuracy of observation, the researchers will repay a visit by observing from the outside perimeter fence of the factory.

The accuracy of personal observation is high but a limitation is that there is no testing done on effluent and air samples. However, it does not detract from its 'relatively' high accuracy due to the utility of sensory perception.

The sensory perception of the researchers is taken into consideration when formulating the point allocation for each individual EPI in this category. The following is the point allocation for the three EPIs:-

- **Point allocation for housekeeping:**
  Good housekeeping = 1;
  Poor housekeeping = 0.

- **Point allocation for discharge of treated effluent into waterways outside the factory perimeter fence or for field application:**
  Clean and low thermal discharge into waterways or no leakages in ponds and pipes =1;
  Dirty or high thermal discharge into waterways or leakages in ponds and pipes = 0.

- **Point allocation for air quality in terms of dark smoke emission and ambient air:**
  Complying with smoke emission requirement and good ambient air within the factory premises = 1;
  Not complying with smoke emission requirement or poor ambient air within the factory premises = 0.

The weight assigned to this fifth category based on personal observations is on the criterion of accuracy. The basis for assigning weights is as follows:-

- A weight of one is given to observation which has ambivalent or low accuracy.
- A weight of two is given to observation which has high accuracy.

As all the EPIs in this category have high accuracy, a weight of two is given for all the EPIs.

6.4.2 The Scoring And The Derivation Of The Total Score

The dependent variables (Ys) in the form of EPIs for all the five categories, the scored point, the weightage and total score are as shown in Table 6.2(i)-6.2(v). An example would be used to illustrate how the scoring is done for a particular EPI. The first step starts with the selection of a particular EPI. As in this case, a First category EPI with regard to compliance with water quality via BOD level is selected for this purpose. The second step is to determine the point score from the point allocation illustrated above. If the respondent company has complied with the BOD level for two out of three years, the point scored is 0.67. The scored point of 0.67 is multiplied with the assigned weight of one to obtain the score of 0.67 for this particular EPI. The same goes for all the other EPIs. The total score is obtained via the summation of the individual scores for all the respective EPIs. The formula for the total score is as illustrated below:-

$$\boxed{Total\ Score\ Per Respondent = \sum (Po\,\mathrm{int}\ Allocated\ \ X\ Weightage\ )\ per\ \mathrm{var}\,iable}$$

TABLE 6.2i Compliance With Air Quality and Water Quality Parameters Under The EQA

Category	DOE Quantitative Parameters	Scored Point	Weightage	Total Score
First	Compliance with BOD concentration	One of the following scores:- 3 year data: 1or 0.67 or 0.33 or 0. 2 year data: 1or 0.5 or 0. 1 year data: 1 or 0.	1	
	Compliance with permissible limits of concentration of air impurities	One of the following scores:- 3 year data: 1or 0.67 or 0.33 or 0. 2 year data: 1or 0.5 or 0. or 0.1 year data: 1 or 0.	2	
	Willingness to disclose information for BOD	One of the following scores:- 3 year data: 1or 0.67 or 0.33 or 0. 2 year data: 1or 0.5 or 0. 1 year data: 1 or 0.	1	
	Willingness to disclose information for permissible limits of concentration of air impurities	One of the following scores:- 3 year data: 1or 0.67 or 0.33 or 0. 2 year data: 1or 0.5 or 0. 1 year data: 1 or 0.	1	

TABLE 6.2ii Adoption of Environmentally Friendly Resource Utilization

Category	Resource Utilization Parameters	Scored Point	Weightage Total Score
Second	Recycling or reusing treated effluent	Either 1 or 0.	2
	Use of biomass as a form of renewable energy	Either 1 or 0.	2

TABLE 6.2iii Qualitative Assessment On Compliance With Air Quality, Water Quality and Noise Level Under The EQA

Category	Qualitative Assesment on Compliance with a Particular EQA Parameter for Consecutive year or from The Start of Operation if less than 3 years	Scored Point	Weightage Total Score
Third	Qualitative assessment on compliance with BOD concentration	One of the following scores:- 1or 0.75 or 0.5 or 0.25 or 0.	4
	Qualitative assessment on compliance with permissible limits of concentration of air impurities	One of the following scores:- 1or 0.75 or 0.5 or 0.25 or 0.	4
	Qualitative assessment on compliance with noise level	One of the following scores:- 1or 0.75 or 0.5 or 0.25 or 0.	4

TABLE 6.2iv Environmental Initiatives Undertaken

Category	Resource Initiatives Undertaken	Scored Point	Weightage	Total Score
Fourth	Stages of attainment of ISO9001 certification	One of the following scores:- 1 or 0.5 or 0.	1	
	Stages of attainment of OHSAS 18001 certification	One of the following scores:- 1 or 0.5 or 0.	1	
	Stages of attainment of HACCP certification (only for the POPC)	One of the following scores:- 1 or 0.5 or 0.	1	
	Stages of attainment of OekoTex-Standard 100 (only for the TAPC)	One of the following scores:- 1 or 0.5 or 0.	2	
	Stages of attainment of ISO14001 certification	One of the following scores:- 1 or 0.5 or 0.	2	
	Corporate environmental policy	1 or 0.	1	
	Implementation of corporate environmental auditing and reporting in annual report or other forms of reporting	1 or 0.	2	
	Existing facilities for the treatment and disposal of POME/ PORE/OIE/Industrial Effluents	1 or 0.	2	
	Existing facilities for the storage and disposal of other industrial wastes	1 or 0.	2	
	Bunds for oil tanks (only for the POPC).	1 or 0.	2	
	Systematic monitoring of BOD concentration or discharge into waterways and field application	1 or 0.	1	
	Systematic monitoring for permissible limits of concentration of air impurities	1 or 0.	1	

TABLE 6.2v Personal Observation

Category	Personal Observations	Scored Point	Weightage Total Score
Fifth	Housekeeping	1 or 0	2
	Discharge of treated effluent into waterways outside the factory perimeter fence or field application	1 or 0	2
	Dark smoke emission and ambient air in the factory premises	1 or 0	2

6.4.3 Average Score Per Respondent For The Environmental Performance Indicators

The average score per respondent company for the environmental performance indicators is obtained via the division of the total score of a respondent by the total maximum score or the total weightage.

$$\text{Average Score Per RespondentCompany} = \frac{\text{Total Score Per Respondent Company}}{\text{Total Maximum Score or Total Weightage}}$$

The average score per respondent company calculated, which is on an ordinal scale, can be ranked vis-a-vis the other respondent companies. The higher the average score, the friendlier is the respondent towards environmental management.

6.5 Research Methods

6.5.1 Research Tool

The research tools used were three questionnaires. The first and second questionnaire were directed at the respondent companies of the two sectors studied, namely the POPC and TAPC respectively (Appendix 3 and Appendix 4 respectively). Two questionnaires were required as the peculiarities of each sector have to be taken into account. The third questionnaire was targeted at the government ministries, departments cum agencies, and representatives of sector related industry associations (Appendix 5). The purpose of the third questionnaire is to obtain a strategic overview of the two sectors studied, and more importantly, to verify and complement the primary data gathered from the respondent companies of the said sectors.

Face-to-face interview would be conducted via the questionnaires above. The purpose of conducting face-to-face interview is the allowance for in-depth probing so that pertinent issues can be understood with clarity. Face-to-face interview, as compared to postal or internet interview, has a higher rate of response. In addition the complementation of a site visit when conducting the interview aids in the evaluation of the environmental performance of the respondent company.

6.5.2 Sample Size

The minimum sample size of 30 respondents (Bailey 1978:84) has been used as the benchmark for statistical accuracy. For others, the arbitrary percentage rule of thumb for sample size is at least 5 percent of the population (Burns and Bush 2003: 387). The population of the POPC and the TAPC are 330 firms and 375 firms respectively. If the arbitrary percentage rule of thumb of at least 5 percent is applied, the number of respondents for the POPC and the TAPC are at least 17 respondents and 19 respondents respectively. However, the minimum sample size of 30 respondents has to be abided to satisfy statistical accuracy. The general rule is that a sample which exceeds 5% of the population size is considered a small population. As such, both sectors can be considered to have small populations in view of the low number of respondents required based on the five percentage rule of thumb vis-à-vis the minimum sample size of 30 respondents. However, for a higher level of accuracy, a statistical method for determining sample size will be used. Based on this argument, the formula for computing the sample size for small population is as shown below:

Small population sample size=

$$n = \frac{z^2(pq)}{e^2} \text{ x } \sqrt{\frac{N-n}{N-1}}$$

where n = the sample size z= standard error associated with the chosen level of confidence (1.96) p = estimated percent in the population q = 100 – p e = acceptable sample error (Burns and Bush 2003 : 380).

This $\frac{z^2(pq)}{e^2}$ is known as sample size formula and $\sqrt{\frac{N-n}{N-1}}$ is known as the finite multiplier. If the population is small, the sample size formula needs to be adjusted by the finite multiplier (Burns and Bush 2003: 391).

The z value chosen to determine the level of confidence is 1.96 as this z value pertains to 95 percent confidence intervals. Researchers typically use either 95 percent or 99 percent confidence intervals but the most commonly used is 95 percent confidence intervals with z value of 1.96 (Burns and Bush 2003: 382). For the determination of sample size for both the sectors, z value of 1.96 is used. The multiplication of pq is to determine variability. p is the estimated percent of the population whereas q is the remaining percent of the population. There are two ways in estimating the variability of the population. One is to estimate the variability by the usage of census data, secondary data from chamber of commerce, government agencies, information or data from past researches and a host of other similar institutions. However, thus far, there is no such quantitative research pertaining to the environment for both sectors in Malaysia. As such, the second alternative has to be adopted, that is the worst case or most variability alternative. The worst case alternative is 50 percent/50 percent, the most conservative assumption, as this would result in the calculation of the largest possible sample size (50 x 50=2500). If an estimate is made, for example 60 percent/40 percent, the estimated variability is lesser and therefore it will result in a smaller sample size (60 x 40=2400).

e, the accepted sample error or the amount of desired sample error is determined via the prerequisite that the sample size must be minimally 30 for both the sectors. The reason is that the smaller the sample size, the less accurate the results are. This is also in keeping with the benchmark that a sample size must have at least 30 respondents as mentioned earlier. Ideally if the number of respondents is much higher than around 30, there would be higher accuracy but it must be weigh against time consideration as this research covers two sectors and in tandem two samples. Table 6.3 shows the calculation of the sample size for a hypothetical situation and for both the POPC and the TAPC. Column A in the table shows a hypothetical scenario pertaining to the calculation of sample size for the TAPC. The number of respondents required based on the acceptable sample error of 10 percent is 83 respondents. This number of respondents would be better in terms of accuracy but proves too daunting and a very heavy burden in terms of time and resource consideration if two sectors were covered, thereby requiring two samples of fairly equivalent size. The experience of the researcher in the pilot study reveals that on an average 3 to 5 days are required for a respondent. Column B and C illustrated that the acceptable sample error has been increased to 16 percent for both the sectors. The minimum sample size for the POPC and the TAPC are 35 and 36 respondents respectively. These sample sizes are above 30 and within the means of the researcher, taking into account time and resource consideration (Burns and Bush, 2003).

Table 6.3 Calculation of Sample Size for the POPC and the TAPC

Column A. Hypothetical Scenario for the TAPC	Column B. Small population sample size for POPC	Column C. Small population sample size for TAPC
$n = \frac{z^2(pq)}{e^2}$	$n = \frac{z^2(pq)}{e^2}$	$n = \frac{z^2(pq)}{e^2}$
$= \frac{1.96^2(50x50)}{10^2}$	$= \frac{1.96^2(50x50)}{16^2}$	$= \frac{1.96^2(50x50)}{16^2}$
$= \frac{3.84(2500)}{100}$.	$= \frac{3.84(2500)}{256}$.	$= \frac{3.84(2500)}{256}$.
$= \frac{9600}{100}$	$= \frac{9600}{100}$	$= \frac{9600}{100}$
= 96	= 37.5	= 37.5
Now applying the finite multiplier:	Now applying the finite multiplier:	Now applying the finite multiplier:
$n = 96x\sqrt{\frac{375-96}{375-1}}$	$n = 37.5x\sqrt{\frac{330-37.5}{330-1}}$	$n = 37.5x\sqrt{\frac{375-37.5}{375-1}}$
$= 96x\sqrt{\frac{279}{374}}$	$= 37.5x\sqrt{\frac{292.5}{329}}$	$= 37.5x\sqrt{\frac{337.5}{374}}$
$= 96X0.8637$	$= 37.5x0.9429$	$= 37.5x0.9499$
$= 82.9$	$= 35.3$	$= 35.6$
$\approx 83\,respondents$	$\approx 35respondents$	$\approx 36respondents$

Notes:
n = the sample size
z= standard error associated with the chosen level of confidence (1.96)
p= estimated percent in the population
q= 100 - p
e= acceptable sample error
Source: Burns and Bush 2003: 380.

6.5.2.1 Selection Of Stratified Random Sampling Method

A discussion of the rationale and utility of stratified random sampling would be carried out first prior to the adoption of disproportionate stratified random sampling for this research. Stratified random sampling was utilized in the selection of respondents for this research. Stratified sampling is to ensure that each sub-sector in the POPC and the TAPC is given due attention. Stratified random sampling divides the respective population into separate mutually exclusive or non-overlapping groups (Bailey1978:78) known as strata, and followed by the selection of respondents via random sampling for each stratum (Agresti & Finlay 1997: 26). Stratified random sampling is useful where the groups or strata are studied for comparative purposes as in the case of sub-sectoral variations. Besides that, stratification is much more efficient statistically as compared to simple random sampling and in the worst scenario, equal to it (Cooper & Schindler 1998: 238). Thus, generalizations can be drawn from the sub-sectors as well as the population for both the POPC and the TAPC which allow for comparative analysis to determine sectoral variations. Stratified Random Sampling has two sub-methods, namely proportionate stratified random sampling and disproportionate stratified random sampling. For the purpose of this research, disproportionate stratified random sampling is adopted for both the POPC and the TAPC and the rationale for doing so is discussed below.

Disproportionate Stratified Random Sampling For The POPC

The sampling frame and the elements within it will be discussed first as they are the necessary pre-requisites for the adoption of disproportionate stratified random sampling for the POPC. The choice of stratified random sampling is abetted by the availability of data in the construction of the sampling frame. The Malaysian Palm Oil Directory, which is published by the Malaysian Palm Oil Promotion Council on a biannual basis, is used as the basis for the sampling frame. The bi-annual Malaysian Palm Oil Directory lists all the players in the POPC according to activities, and within each activity the names of the companies are listed in an alphabetical order. Every player in the POPC is accounted for and as such the sampling frame is complete in nature. As such the strata are mutually exclusive and the elements in each stratum can be selected randomly without any problem.

The elements or cases for each stratum or activity comprises of the following:-

1. The vertically integrated groups have a holding company structure where participation at any level or activity in the chain is represented in the form of a subsidiary or subsidiaries. For a highly vertically integrated holding company, it would have cases present for all the strata in the POPC. A good example is Felda Holding Group where it is involved in all the activities or levels in the POPC. To highlight this nuance, this group has 72 mill subsidiaries as each mill is incorporated as a private limited company. As such, the Felda Holding Group has 72 cases in the palm oil milling activity besides the cases for the other activities in the POPC. Consequently, the use of random sampling for each stratum might result in a few mills under

the Felda Holding Group to be selected as respondents. These cases are not overlapping as each case is incorporated as a private limited company and concurrently are located in different areas. The findings of the pilot study conducted prior to this support such a selection. Groups that have a holding company structure can have 2 or more subsidiaries or cases in a particular stratum. The pilot study conducted an interview with two cases or respondents from such a Group. One of the elements or respondents is an old mill that was established approximately thirty years ago whereas the other which has a very recent history was established approximately five years ago. The findings indicated that the old mill has higher pollution intensity as it is applying older technology and fairly obsolete production processes whereas the new mill is much more environmentally friendly as the utilization of new technology and production processes result in much more lower levels of pollutants.

2. Standalones incorporated as a company and as such there is no problem of overlapping element.

Table 6.4 illustrates the number of firms for each activity in the POPC. However, for the purpose of stratification, two strata in the form of the upstream palm oil milling stratum and the downstream manufacturing stratum that comprises of palm kernel crushing, refining and palm oil finished products (specialty fats) manufacturing and oleochemical manufacturing activities are formed. The upstream palm oil millers are grouped in a particular stratum as they are the most polluting in the POPC as mentioned in Chapter 4. The palm kernel crushers, the refiners and palm oil finished products manufacturers and oleochemical manufacturers are grouped in another stratum as they are considered as downstream manufacturers and are much less polluting as compared to palm oil millers as also mentioned in Chapter 4. As pollution is one of the primary variables under study, this is used as the basis for the delineation of the two strata (Cooper & Schindler 1998: 238). These two strata, also known as sub-sectors in the POPC, are illustrated in Table 6.5.

Table 6.5 shows that if proportionate stratified random sampling were carried out, the number of respondents selected for the upstream palm oil milling sub-sector and the downstream manufacturing sub-sector are 26 and 9 respectively based on a sample size of 35 as determined earlier. Proportionate stratified random sampling was discarded as the downstream manufacturing activities have greater variability due to different manufacturing processes or activities. The nine respondents selected for the downstream manufacturing sub-sector will result in a particular stratum not having sufficient representation to allow for precise inference (Agresti & Findlay 1997: 26) as the sub-sample size is relatively small. As a result of the problem of getting sufficient cases for adequate analysis for the downstream manufacturing sub-sector, it demands the adoption of disproportionate stratified random sampling (Lin, Nan 1976: 293). The adoption of disproportionate stratified random sampling aided by the judgment of the researcher which is allowed for in disproportionate stratified random sampling (Cooper and Schindler 1998; Bryman and Cramer 2005), means that the number of respondents has increased from nine to 14 for the downstream manufacturing sub-sector and as such has greater representation. Another supporting rationale is that the upstream palm oil milling sub-sector, which is fairly homogenous in terms of the manufacturing process, allows for a relatively smaller sub-sample size to be drawn as it provides good estimates of the strata characteristics (Anderson, Sweeney & Williams 1997: 266). As such the number of respondents has been reduced from 26 to 21 under disproportionate stratified random sampling.

Table 6.4 Number Of Firms For Each Activity In The POPC

Types Of Activities	Palm Oil Milling	Palm Kernel Crushing	Refining Palm Oil Finished products (Specialty Fats) Manufacturing	Oleochemical Manufacturing	Total
Number of firms	249	28	37	16	330

Source: Malaysia Palm Oil Directory 2003-2004 4th Edition.

Table 6.5 Application Of Disproportionate Stratified Sampling For The POPC

	Upstream Palm Oil Milling Sub-sector	Downstream Manufacturing Sub-sector	Total
Stratified population of Peninsular Malaysia	249	81	330
Percentage of population (%)	75.5	24.5	100.0
Proportionately stratified number of respondents	26	9	35
Disproportionately stratified no. of respondents	21	14	35

Disproportionate Stratified Sampling For The TAPC

The sampling frame and the elements within it are covered first prior to the discussion of disproportionate stratified sampling as applied for the TAPC. The sampling frame and the elements within it are culled from interviews with the players in the TAPC, MTMA's membership directory from year 2003-2005, MKMA's membership directory from year 2003-2005 and website, and promotional brochures obtained in the pilot study and field research.

Table 6.6 illustrates the number of firms for each activity (the standalones) and combined activities (vertically integrated) for the TAPC. The elements or cases for the TAPC are more complicated as compared to the POPC. Some of the cases or firms in the TAPC are different in the context of the involvement in activities or levels within the production chain. The activities or levels of the TAPC in Malaysia start from the upstream non-natural or synthetic fiber production, followed by spinning of yarns and threads, the production of fabric either by knitting or weaving, wet processing and culminating in the manufacturing of garments. A case or a firm, a legal entity in the form of a private limited company, can be involved in two or more activities or levels within the production chain, thereby making delineation not as clearly defined as for the POPC. A case in point is Ramatex Berhad, a highly vertically-integrated group with a holding company structure, has a subsidiary namely Ramatex Textile Industrial Sdn Bhd (private limited company) which is involved in spinning, knitting and dyeing cum finishing, and a few garment manufacturing subsidiaries in Malaysia. (Ramatex Online). However, in the application of stratified sampling, the strata or sub-sectors must be mutually exclusive. If the same formula for profiling the sub-sectors in the POPC is applied, the criterion of mutual exclusivity for the strata will be violated as a case or a firm for the TAPC can be found in two or more strata. As such, the ground rules for the delineation of the sub-sectors have to take into consideration the peculiarities that exist in the TAPC in order to meet the criteria for stratified sampling. The ground rules or the pre-requisites for delineation of the sub-sectors in the TAPC are:

1. Each case or firm is a separate legal entity. If a firm is involved in two or more activities or levels in the TAPC, this characteristic has to be given due consideration in the profiling of the sub-sectors to ensure that the criteria of stratified sampling are met. If the firm is involved in two or more activities or levels, it is classified as vertically integrated in which the activities are interlocked to bring about complementariness or as a result of organic growth. Each vertically integrated firm or case, regardless of the number of levels or activities it is involved in has only one legal entity.
2. Wet processing which comprises of dyeing, printing, dyeing cum finishing, printing cum finishing, and also dyeing cum printing cum finishing, is the highest waste generator in the TAPC and is classified as one of the most effluent polluting industries in Malaysia as mentioned in Chapter 1 and Chapter 5. However, in scenarios where a firm is involved in two or more activities or levels, and if wet processing is one of them, the firm is categorized under the wet processing and wet processing vertically integrated activities as seen in Table 6.6. Wet processing is made the anchor as the measurement of pollution for this type of firm is on an aggregate basis as the combined activities are at the same site with the main polluter being wet processing activities. For other vertically integrated firms that are involved in two or more activities not related to wet processing, the categorization is as listed in Table 6.6.
3. Like in the POPC, the holding company organizational structure also exists in the TAPC. In the Malaysian context, the holding company organizational structure is represented by the group with the parent company in overall charge of the subsidiary or subsidiaries. In the case of subsidiaries found in a particular stratum or sub-sector, the subsidiaries are elements or cases that stand a chance to be randomly selected as respondents. Likewise, hypothetically, two or more subsidiaries of a group in a particular stratum or sub-sector can be selected as respondents. However, in reality the chances are much slimmer as compared to the POPC as the groups in the TAPC are very much smaller with the maximum of three subsidiaries in garment manufacturing whereas for the other activities, there may be a

subsidiary. If by random two or more subsidiaries are selected as respondents, there is the likelihood of variance due to the age of the plants, different activities and other localized factors.

Table 6.7 illustrates the number of firms for each activity or combined activities in the TAPC. These activities are grouped into two sub-sectors, namely the high pollutant generating sub-sector and the low pollutant generating sub-sector. The justification for this is that pollution is one of the primary variables under study and thus is used to delineate the two strata or sub-sectors (Cooper & Schindler 1998: 238). As mentioned above, wet processing is the highest pollutant generating activity and any firm with wet processing activity, be it on a standalone basis or part of vertically integrated activities (combination of two or more activities), will be in the high pollutant generating stratum or sub-sector. The other activities like fiber manufacturing, spinning and spinning cum weaving, knitting and knitting cum garment fabrication, and garment fabrication as listed in Table 6.6 are grouped collectively in the low pollutant generating stratum or sub-sector as seen in Table 6.7. As discussed in Chapter 5, the activities that are related to fiber manufacturing, spinning, weaving, knitting and garment fabrication are low in terms of pollution generation.

If proportionate stratified random sampling is applied, the number of respondents for the high pollutant generating sub-sector and the low pollutant generating sub-sector is 5 and 30 respectively for a total of 35 respondents as discussed earlier. Wet processing which comprises of dyeing, printing, dyeing cum finishing, printing cum finishing, and dyeing cum printing cum finishing, and also any of the wet processing activity or activities above combined with other activity or activities in the TAPC in the high pollutant generating sub-sector, having a representation of five would be a gross under-representation as high variability exists in terms of manufacturing processes. This would result in a particular stratum not having sufficient representation to allow for precise inference (Agresti & Finlay 1997: 26). Like in the above, the problem of getting sufficient cases for adequate analysis for the high pollutant generating sub-sector demands the adoption of disproportionate stratified random sampling (Lin, Nan 1976: 293). As outlined in Table 6.7, if disproportionate stratified random sampling together with the researcher's judgment is applied, the number of respondents for the high pollutant generating sub-sector would be increased from 5 to 18 whereas for the low pollutant generating sub-sector, the reduction would be from 30 to 17. The reduction for the low pollutant generating sub-sector is justified on the grounds that despite the various manufacturing processes involved, these manufacturing processes are fairly homogenous in generating a low level of pollution as discussed in Chapter 5 (Anderson, et al., 1997: 266).

Table 6.6 Number Of Firms For Each Activity And Combined Activities In The TAPC

Types of Activities	Fiber Manufacturing	Spinning and Spinning Cum Weaving	Knitting; and Knitting cum Garment Fabrication	Wet Processing; and Wet Processing Vertically-integrated Activities	Garment Fabrication	Total
Number of firms	1	5[a]	70[b]	53[c]	246	375

Notes:
[a]. *4 spinners and 1 spinner cum weaver.*
[b]. *40 knitters and 30 knitting cum garment fabrication firms.*
[c]. *20 wet processors; 6 wet processing cum spinning firms; 10 wet processing cum knitting firms; 3 wet processing cum batik garment fabricating firms; 6 wet processing cum spinning cum knitting firms; 1 wet processing cum spinning cum knitting cum garment fabricating firms; 1 wet processing cum knitting cum weaving cum garment fabricating firms; 6 wet processing cum knitting cum garment fabricating firms.*
Source: (1) MTMA Members' Directory, 2003-2005.
(2) MKMA Members' Directory 2003-2005.

Table 6.7 Application Of Disproportionate Stratified Sampling For The TAPC

	High Pollutant Generating Sub-sector	Low Pollutant Generating Sub-sector	Total
Stratified population of Peninsular Malaysia	53	322	375
Percentage of population (%)	14.1	85.9	100.0
Proportionately stratified number of respondents	5	30	35
Disproportionately stratified no. of respondents	18	17	35

6.5.3 Data Sources for Statistical Analysis

Data for the independent variables are from the survey interview via the questionnaire for both the POPC and TAPC. This would be complemented and supplemented by the corporate annual reports, corporate promotional brochures, corporate sponsored books and corporate web-sites for group or corporate philosophy, culture and core values, especially environmental policy for verification purposes. On the other hand, data in relation to the dependent variables are also obtained through the survey interview via the acquisition of data from the company archive or records. This covers the DOE reports, the Factories and Machinery reports, the various ISO certification reports, the HACCP certification reports and the Oeko-Tex Standard 100 certification reports, the plant's productivity and production reports. In addition, personal observation is to complement and supplement the above data.

6.5.4 Statistical Tools For Data Analysis

This section starts off with the underlying rationality for using non-parametric test. This is followed suit by a discussion on the appropriateness and suitability of Kendall's tau-b as it is a non-parametric test. This section ends with the test for hypothesis for the correlation coefficient derived from Kendall's tau-b.

6.5.4.1 Rationality For Using Non-parametric Test

Parametric tests as compared to non-parametric tests are more powerful. However, the data for this research do not comply to one of the requirements of parametric testing, which says that the measurement scales must be interval or ratio scales (Norusis 2004). In this research, ordinal and nominal scales are used in the questionnaire and in the construction of independent and dependent variables. Therefore, they are not fit for parametric testing, particularly when relatively small samples are analyzed (Norusis 2004), as is the case in this research. For these reasons, the research has to adopt non-parametric testing.

6.5.4.2 Rationality For Using Kendall's Tau-b (Non-parametric)

Kendall's tau and Spearman's correlation coefficient are both widely used non-parametric correlation tests. However, when there is a large number of tied ranks, it is suggested in literature that Kendall's statistic is the better estimate (Bryman and Cramer 2005). In this research the number of tied ranks is fairly large (many scores having the same rank); therefore Kendall's tau was chosen as tool of analysis.

The correlation coefficient (τ_b) indicates the correlation between two variables, and ranges from -1 to +1, with 0 indicating no relationship between the two variables, and +1.0 indicating perfect positive relationship between the two variables and -1.0 indicating perfect negative relationship between two variables (Bailey 1978, Veal 1997, Punch 2005).

6.5.4.3 Test For Hypothesis For The Correlation Coefficient

The test for hypothesis or test for significance for the correlation coefficient will be conducted via two levels of significance, i.e. at the 5% and 1 % level. "Most tests in SPSS are for alternative hypothesis that don't specify the direction of the difference. That's why they are labeled as two-tailed." (Norussis 2003: 118). The decision rule is to reject the null hypothesis if the observed significance level is small. "If the p value is small enough (usually less than 0.05), reject the null hypothesis. Traditionally, 0.05 is used as the threshold for "small enough, "although a more stringent criterion of 0.01 is also used. These criteria are called the significance levels or alpha levels for a statistically significance test. If your observed significance level is less than 0.05, your results are said to be "statistically significant" at the 5% level. If your observed significance level is less than 0.01, your results are said to be statistically significant at the 1% level."(Norussis 2003: 117). This test for significance is used for the postulated hypotheses for both the POPC and the TAPC, which subsequently leads to comparative analysis. For example if a hypothesis is statistically significant for the POPC and not for the TAPC or vice versa, it means sector variation exists. If the hypothesis is either statistically significant or not statistically significant for both the POPC and the TAPC, it means no sector variation or similarity exists.

CHAPTER 7
Analysis of Data for the Malaysian Palm Oil Production Chain

7.1 Introduction

The government-industry linkage and the industry-industry linkage and their relationships with the environmental performances in the POPC will be discussed in this chapter. The relationship between the operationalized independent variables from the nine hypotheses and the environmental performances will be tested via correlation analysis and correlation coefficients. Section 7.2 does so for the government-industry relations and Section 7.3 for the industry-industry relations. The final Section 7.4 summarizes the main findings.

7.2 Analysis Of Data For The Postulated Hypotheses In The Government-Industry Linkage

7.2.1 Industry Involvement In The Policy Formulation Process

Table 7.1 outlines the First Hypothesis (H1), which is the more the industry is involved in the policy formulation process, the better the environmental performance. It is operationalized in the form of four aggregate sub-hypotheses. The aggregation refers to the different sub-sectors within the POPC. The first (H1.1) and second (H1.2) aggregate sub-hypotheses are related to the degree of activeness and the level of influence respectively of industry representatives from the overall POPC (H1.1.1; H1.2.1), the upstream palm oil milling sub-sector (H1.1.2; H1.2.2) and the downstream manufacturing sub-sector (H1.1.3; H1.2.3) in the MPOB Board in the aggregate policy formulation process, and environmental performance. The seventh (H1.7) and eighth (H1.8) aggregate sub-hypotheses are related to the degree of activeness and the level of influence respectively of industry representatives from the overall POPC(H1.7.1; H1.8.1), the upstream palm oil milling sub-sector (H1.7.2; H1.8.2) and the downstream manufacturing sub-sector (H1.7.3; H1.8.3) in the MPOC Board in the aggregate policy formulation process, and environmental performance. Each of these aggregate sub-hypotheses is a constitution of two individual sub-hypotheses. The first aggregate sub-hypothesis (H1.1) consists of the third sub-hypothesis (H1.3), namely the degree of activeness of industry representatives from the palm oil milling sub-sector (H1.3.2) (the overall POPC and the downstream manufacturing sub-sector are not included as the OER policy only affects the upstream palm oil milling sub-sector) in the MPOB Board in the formulation of the OER policy and environmental performance, and the fifth sub-hypothesis (H1.5), namely the degree of activeness of industry representatives from the overall POPC (H1.5.1), the palm oil milling sub-sector (H1.5.2) and the downstream manufacturing sub-sector (H1.5.3) in the MPOB Board in the formulation of the value added downstream policy and environmental performance. The second aggregate sub-hypothesis (H1.2) consists of the fourth sub-hypothesis (H1.4), namely the level of influence of industry representatives from the palm oil milling sub-sector (H1.4.2) in the MPOB Board in the formulation of the OER policy and environmental performance, and the sixth sub-hypothesis (H1.6), namely the level of influence of industry representatives from the overall POPC (H1.6.1), the palm oil milling sub-sector (H1.6.2) and the downstream manufacturing sub-sector (H1.6.3) in the MPOB Board in the formulation of the value added downstream policy and environmental performance.

The seventh aggregate sub-hypothesis (H1.7) consists of the ninth sub-hypothesis (H1.9), namely the degree of activeness of industry representatives from the overall POPC (H1.9.1), the palm oil milling sub-sector (H1.9.2), and the downstream manufacturing sub-sector(H1.9.3) in the MPOC Board in policy formulation for the Task Force on the Environment and environmental performance, and the eleventh sub-hypothesis (H1.11), namely the degree of activeness of industry representatives from the overall POPC (H1.11.1), the palm oil milling sub-sector (H1.11.2) and the downstream manufacturing sub-sector (H1.11.3) in the MPOC Board in policy formulation for the promotion of oils and fats in the international market.and environmental performance. The eight aggregate sub-hypothesis (H1.8) consists of the tenth sub-hypothesis(H1.10), namely the level of influence of industry representatives from the overall POPC (H1.10.1), the palm oil milling sub-sector (H1.10.2) and the downstream manufacturing sub-sector (H1.10.3) in the MPOC Board in policy formulation for the Task Force on the Environment and environmental performance, and the twelfth sub-hypothesis (H1.12), namely the level of influence of industry representatives from the overall POPC (H1.12.1), the palm oil milling sub-sector(H1.12.2) and the downstream manufacturing sub-sector (H1.12.3) in the MPOC Board in policy formulation for the promotion of oils and fats in the international market and environmental performance.

The results (of Table 7.1) show that the null hypothesis at the significance level of five percent is not rejected for the overall POPC for the first and second aggregate sub-hypotheses. This conveys the meaning that on an aggregate basis, there is no significant relationship between the degree of activeness and the level of influence of industry representatives in the MPOB Board in the aggregate policy formulation process, and environmental performance. The results also show that the null hypothesis at the significance level of five percent is not rejected for the downstream manufacturing sub-sector for the four aggregate sub-hypotheses, namely the first, second, seventh and eighth sub-hypothesis. This means that on an aggregate basis there is no significant relationship between the degree of activeness and the level of influence of industry representatives from the downstream manufacturing sub-sector in the MPOB Board and MPOC Board that are involved in the policy formulation process, and environmental performance.

In addition, the null hypothesis at the significant level of five percent is not rejected for the fifth, sixth and ninth sub-hypothesis for the overall POPC which carries the meaning that there is no significant relationship between the degree of activeness and the level of influence of industry representatives from the overall POPC in the MPOB Board in the formulation of the value added downstream policy and also the degree of activeness of industry representatives in the MPOC Board in policy formulation for the Task Force on Environment, and environmental performance.

The fifth, ninth and eleventh sub-hypotheses for the downstream manufacturing sub-sector could also not reject the null hypothesis at the significance level of five percent. This means that there is no significant relationship between the degree of activeness of industry representatives from the downstream manufacturing sub-sector in the MPOB Board in the formulation of the value added downstream policy, and also in the MPOC Board in the formulation of policy for the Task Force on the Environment, and the promotion of oils and fats in the international market, and environmental performance. Likewise, the null hypothesis at the significance level of five percent is not rejected for the sixth, tenth and twelfth sub-hypotheses. This means that there is no significant relationship between the level of influence of industry representatives from the downstream manufacturing sub-sector in the MPOB Board in the formulation of the value added downstream policy, and also in the MPOC Board in the formulation of policy for the Task Force on the Environment and the promotion of oils and fats in the international market, and environmental performance.

With reference to Table 7.1, the null hypothesis (H_0) is rejected whereas the alternative hypothesis (Ha) of positive correlation is accepted for the following :-

First sub–hypothesis for H1:	The higher the degree of activeness of industry representatives from the upstream palm oil milling sub-sector (H1.1.2) (τ_b = .500, p <0.01, n=24) in the MPOB Board in the aggregate policy formulation process (aggregated for all pertinent policies), the better the environmental performance.
Second sub-hypothesis for H1:	The higher the level of influence of industry representatives from the upstream palm oil milling sub-sector (H1.2.2) (τ_b = .514, p <0.01, n=24) in the MPOB Board in the aggregate policy formulation process (aggregated for all pertinent policies), the better the environmental performance.
Third sub-hypothesis for H1:	The higher the degree of activeness of industry representatives from the upstream palm oil milling sub-sector (H1.3.2) (τ_b = .424, p < 0.05, n=24) in the MPOB Board in the formulation of the OER Policy, the better the environmental performance.
Fourth sub-hypothesis for H1:	The higher the level of influence of industry representatives from the upstream palm oil milling sub-sector (H1.4.2) (τ_b = .365, p < 0.05, n=24) in the MPOB Board in the formulation of the OER Policy, the better the environmental performance.

Fifth sub-hypothesis for H1: The higher the degree of activeness of industry representatives from the upstream palm oil milling sub-sector (H1.5.2) (τ_b = .459, $p < 0.01$, n=24) in the MPOB Board in the formulation of the Value Added Downstream Policy, the better the environmental performance.

Sixth sub-hypothesis for H1: The higher the level of influence of industry representatives from the upstream palm oil milling sub-sector (H1.6.2) (τ_b = .585, $p <0.01$, n=24) in the MPOB Board in the formulation of the Value Added Downstream Policy, the better the environmental performance.

Seventh sub-hypothesis for H1: The higher the degree of activeness of industry representatives from the overall POPC (H1.7.1) (τ_b = .243, $p <0.05$, n=39) and the upstream palm oil milling sub-sector (H1.7.2) (τ_b = .470, $p <0.01$, n=24) in the MPOC Board in the aggregate policy formulation process (aggregated for all pertinent policies), the better the environmental performance.

Eight sub-hypothesis for H1: The higher the level of influence of industry representatives from the overall POPC (H1.8.1) (τ_b = .341, $p < 0.01$, n=39) and the upstream palm oil milling sub-sector (H1.8.2) (τ_b = .553, $p <0.01$, n=24) in the MPOC Board in the aggregate policy formulation process (aggregated for all pertinent policies), the better the environmental performance.

Ninth sub-hypothesis for H1: The higher the degree of activeness of industry representatives from the upstream palm oil milling sub-sector (H1.9.2) (τ_b = .488, $p < 0.01$, n=24) in the MPOC Board in the formulation of policy for the Task Force on the Environment, the better the environmental performance.

Tenth sub-hypothesis for H1: The higher the level of influence of industry representatives from the overall POPC (H1.10.1) (τ_b = .315, $p < 0.05$, n=39) and the upstream palm oil milling sub-sector (H1.10.2) (τ_b = .487, $p <0.01$, n=24) in the MPOC Board in the formulation of policy for the Task Force on the Environment, the better the environmental performance.

Eleventh sub-hypothesis for H1: The higher the degree of activeness of industry representatives from the overall POPC (H1.11.1) (τ_b = .262, $p < 0.05$, n=39) and the upstream palm oil milling sub-sector (H1.11.2) (τ_b = .540, $p < 0.01$, n=24) in the MPOC Board in the formulation of the Promotion of Oils and Fats In The International Market Policy, the better the environmental performance.

Twelfth sub-hypothesis for H1: The higher the level of influence of industry representatives from the overall POPC (H1.12.1) (τ_b = .278, $p < 0.05$, n=39) and the upstream palm oil milling sub-sector (H1.12.2) (τ_b = .538, $p < 0.01$, n=24) in the MPOC Board in the formulation of the Promotion of Oils and Fats in the International Markets Policy, the better the environmental performance.

The first and second aggregate sub-hypothesis for H1 and the constituent sub-hypotheses within each will be collectively discussed as these sub-hypotheses are intertwined together. The significant relationship for the first aggregate sub-hypothesis for the palm oil milling sub-sector is mainly due to the constituents' significant relationship for the third and fifth sub-hypotheses for the palm oil milling sub-sector. Likewise, the significant relationship for the second aggregate sub-hypothesis for the palm oil milling sub-sector is mainly due to the constituents' significant relationship for the fourth and sixth sub-hypotheses for the palm oil milling sub-sector.

The underlying premise for the significant relationship for activeness and influence for the OER policy for the palm oil milling sub-sector, namely the third and fourth sub-hypothesis, is the collective development of this policy by MPOB, the palm oil millers and the oil palm growers. The seed for this policy was initiated by palm oil millers from the Southern Peninsular POMA, which later enveloped the entire nation. The genesis of this policy is mainly due to unripe or semi-ripe FFBs leading to low OER. By overcoming this problem with oil palm growers, it works to the advantage of the palm oil millers in terms of higher yield and financial return and in tandem the lesser the amount of unrecovered oil, the lesser the amount of waste generated. However, this also puts the onus on palm oil millers to have an efficient operation so as to attain the mandatory minimum OER of 18 percent as imposed by MPOB. As the licensing requirement for mill operation comes under MPOB's purview, millers flouting this OER policy with an OER of lower than 18 percent, will have their license withdrawn. However, as this policy has a positive effect both from an economic and environmental perspective, all parties generally, are working collectively to attain the minimum 18 percent OER. Some of the players in the POPC have even raised the bar by having a higher OER benchmark.

In addition, the significant relationship for both the fifth and sixth sub-hypothesis only for the palm oil milling sub-sector for the value added downstream policy in terms of activeness and influence and environmental performance is primarily due to two main reasons. Firstly, the value added downstream policy has led to the development and expansion of refining and POFP manufacturing and oleochemical manufacturing. The refining and POFP manufacturing sub-sector is edible related and export-oriented and as such a slew of requirements be it explicit or implicit like food hygiene, quality, traceability, food safety, environmental protection, social welfare and consumer protection have to be incorporated as part of the operations of palm oil milling. Even though some of these requirements are voluntary in nature and not necessarily imposed by importers, voluntary compliance is seen primarily as a platform to gain market access and for product promotion. As one palm oil milling respondent succinctly said "we are in the food business". As such, the farm to fork preventive measures can lead to better environmental performance. Secondly, the biomass wastes generated from palm oil milling have led to the genesis and development of biomass-based manufacturing, albeit slowly. Previously, shell has no economic value, but with the development of biomass-based manufacturing, the shells today are being sold at RM 80 per ton (USD 21.05/tonne).

Therefore, as a result of the significant relationship of the third, fourth, fifth and sixth sub-hypothesis for the palm oil milling sub-sector, this has consequently led to the significant relationship for the first and second aggregate sub-hypothesis for the palm oil milling sub-sector. This also indicates sub-sectoral variation between the palm oil milling sub-sector and that of the downstream manufacturing sub-sector. The significant relationships for both the aggregate sub-hypothesis as well as the constituent sub-hypotheses for the palm oil milling sub-sector highlight the role played by the palm oil milling sub-sector together with MPOB, in improving environmental performance. The palm oil milling sub-sector at the forefront of criticisms for not being environmentally friendly in the early years and to a limited extent today by rogue millers, is sensitized to the need for environmental improvement and progressive action required to make this industry an environmentally friendly one. The lessons learnt from the past in which the BOD level was progressively reduced via the government-industry linkage also bode well for this sub-sector. By working together with MPOB, the palm oil milling sub-sector has the ability and the capacity to make environmental improvements. However, for the downstream manufacturing sub-sector, there was no such legacy.

Likewise, the seventh and eight aggregate sub-hypothesis and the constituent sub-hypotheses within each will be collectively discussed as these sub-hypotheses are interlinked together. The significant relationship for the seventh aggregate sub-hypothesis for the overall POPC and the palm oil milling sub-sector is mainly due to the constituents' significant relationship for the ninth and eleventh sub-hypotheses for the palm oil milling sub-sector. Likewise, the significant relationship for the eight aggregate sub-hypothesis for the overall POPC and the palm oil milling sub-sector is mainly due to the constituents' significant relationship for the tenth and twelfth sub-hypotheses for the palm oil milling sub-sector.

The significant relationship for the ninth, tenth, eleventh and twelfth sub-hypothesis in terms of activeness and influence of the palm oil milling sub-sector in the MPOC's Task Force on the Environment and the Promotion of Oils and Fats in the International Market, and environmental performance, is due largely to the collective efforts between the government and industry in effectively countering the anti-palm oil campaign that oil palm cultivation leads to environmental degradation (Yusof Basiron 2006). The sensitivity raised with regard to this issue has led to better agricultural and manufacturing practices. This imposes an imperative on the oil palm and palm oil industry to be environmentally friendly so as to be in sync with the environmentally friendly themes advocated by MPOC. The need to be environmentally friendly has been translated by MPOB in the form of policies like Zero Burn, Zero Waste and Zero Discharge (MPOPC and Jora-Aki Technology 2003; Yusof and Arifin 1996). These policies are meant more for oil palm cultivation but concomitantly have cascaded down to the POPC even though these policies are difficult to attain in totality. POME, the most polluting stream from palm oil milling, after treatment, is used for cropland application. The fiber and shell wastes are used as solid fuel for the boiler and as discussed above, the value-added downstream policy has led to the genesis and development of biomass-based manufacturing. The downstream policy also acts as a catalyst for the development of value-added palm oil and oil palm (e.g. oleo chemicals) related products. All these measures, in turn, lead to better environmental performance. The oil palm and palm oil industry in general has to be seen "talking the walk and walking the talk" in the eyes of the international community.

Therefore the significant relationship for the ninth, tenth, eleventh and twelfth sub-hypothesis for the palm oil milling sub-sector has contributed mainly to the significant relationship for the aggregate seventh and eight sub-hypothesis for the overall POPC and the palm oil milling sub-sector. Thus, sub-sector variation exists between the palm oil milling sub-sector and the downstream manufacturing sub-sector as illustrated by the results above. The significant relationships for the palm oil milling sub-sector indicate the existence of government-industry synergy in promoting the economic and environmental welfare of the oil palm and palm oil milling sub-sector in Malaysia. The impetus and the implementation of better agricultural and manufacturing practices provide the ammunition for MPOC in its promotion exercises and countering the international criticisms by adversarial international parties or their proxies.

7.2.2 The Cooperation between the Government and Industry in Technological Development and Technological Transfer

Table 7.2 illustrates the results for the Second Hypothesis, which is the better the cooperation between the government and industry in technological development and technological transfer, the better the environmental performance, via the operationalization of three sub-hypotheses. The results show that the null hypothesis of no relationship between the two variables is not rejected at the significance level of five percent for all three sub-hypotheses. This means that on an aggregate basis there is no significant relationship in cooperation between government and industry in the adoption of technologies offered by MPOB (H2.1), the participation in technological development programmes offered by the various government agencies (H2.2), and the government incentives in the form of tax incentives offered by MIDA and MOF for investing in direct or indirect environment-related projects and technologies (H2.3), and environmental performance.

7.2.3 Emphasis Of Government Regulatory Efforts On Environmental Issues

Table 7.3 shows the operationalization of the Third Hypothesis, which is the more the government regulatory efforts emphasize on environmental issues, the better the environmental performance, via six sub-hypotheses. The results also demonstrate that for all the six sub-hypotheses, the null hypothesis of no relationship at the five percent significance level is not rejected. Thus, on an aggregate basis there is no significant relationship between government regulatory efforts emphasizing on environmental issues and environmental performance. The implication is that the stringency of inspection and the intensity of enforcement by the DOE, LA and DOSH with regard to the EQA and related Regulations (H3.1 and H3.4), local by-laws (H3.2 and H3.5) and Occupational Safety and Health Act (OSHA) and related regulations and Factories and Machinery Act (FMA) and related regulations (H3.3 and H3.6) respectively, are not significantly related to environmental performance.

7.2.4 The Preventive Approaches Advocated By The Government Agencies

As shown in Table 7.4, five sub-hypotheses have been operationalized to support the Fourth Hypothesis, which is the more preventive the approach advocated by the various government ministries and government agencies, the better the environmental performance. The first aggregate sub-hypothesis is a constitution of the second, third, fourth and fifth sub-hypotheses. The first aggregate sub-hypothesis (H4.1) is related to the aggregate preventive approaches advocated by the various government ministries and government agencies to the overall POPC, the palm oil milling sub-sector and the downstream manufacturing sub-sector, and environmental performance. The second, third, fourth and fifth sub-hypotheses are related to the advocacy by the various government ministries and government agencies of ISO 9000 standards (H4.2), ISO 14000 standards (H4.3), ISO 18000 standards (H4.4) and ISO 22000 standards (HACCP) (H4.5) respectively to the overall POPC, the palm oil milling sub-sector and the downstream manufacturing sub-sector, and environmental performance.

The null hypothesis is not rejected at the five percent significance level for the overall POPC, the upstream palm oil milling sub-sector and the downstream manufacturing sub-sector for the fifth sub-hypothesis. The results show that the inability to reject the null hypothesis which carries the meaning of no significant relationships are found between the advocacy of ISO 22000 (HACCP) standards by the various government ministries and government agencies towards the overall POPC, the upstream palm oil milling sub-sector and the downstream manufacturing sub-sector, and environmental performance. In addition, the null hypothesis is not rejected at the five per cent significance level for the downstream manufacturing sub-sector for the second and third sub-hypothesis. The inability to reject the null hypothesis carries the meaning that no significant relationships are found between the advocacy of ISO9000 standards and ISO14000 standards by the various government ministries and government agencies towards the downstream manufacturing sub-sector, and environmental performance.

On the other hand, the results also illustrate that the null hypothesis is rejected whereas the alternative hypothesis of positive correlation that is statistically significant were found for the following:-

First sub-hypothesis for H4: The more the various government ministries and government agencies advocate the aggregate preventive approaches towards the overall POPC (H4.1.1) (τ_b = .408, $p < 0.01$, n=39), the upstream palm oil milling sub-sector (H4.1.2) (τ_b = .439, $p < 0.01$, n=24), and the downstream manufacturing sub-sector (H4.1.3) (τ_b = .424, $p < 0.05$, n=15), the better the environmental performance.

Second sub-hypothesis for H4: The more the various government ministries and government agencies advocate the ISO9000 standards towards the overall POPC (H4.2.1) (τ_b = .374, $p < 0.01$, n=39), and the upstream palm oil milling sub-sector (H4.2.2) (τ_b = .430, $p < 0.01$, n=24), the better the environmental performance.

Third sub-hypothesis for H4: The more the various government ministries and government agencies advocate the ISO14000 standards towards the overall POPC (H4.3.1) (τ_b = .371, $p < 0.01$, n=39), and the upstream palm oil milling sub-sector (H4.3.2) (τ_b = .402, $p < 0.01$, n=24), the better the environmental performance.

Fourth sub-hypothesis for H4: The more the various government ministries and government agencies advocate the OHSAS18000 standards towards the overall POPC (H4.4.1) (τ_b= .423, $p < 0.01$, n=39), the upstream palm oil milling sub-sector (H4.4.2) (τ_b= .485, $p < 0.01$, n=24), and the downstream manufacturing sub-sector (H4.4.3) (τ_b = .443, $p < 0.05$, n=15), the better the environmental performance.

The first aggregate sub-hypothesis for the overall POPC and the upstream palm oil milling sub-sector, the second sub-hypotheses for the overall POPC and the upstream palm oil milling sub-sector, the third sub-hypotheses for the overall POPC and the upstream palm oil milling sub-sector and the fourth sub-hypothesis for the overall POPC and the upstream palm oil milling sub-sector are statistically significant at the five percent level and also at the more stringent one percent level. However, the first aggregate sub-hypothesis for the downstream manufacturing sub-sector and the fourth sub-hypotheses for the downstream manufacturing sub-sector are only statistically significant at the five percent level.

The significant relationship for the first aggregate sub-hypothesis for the overall POPC is mainly due to the significant relationship for the aggregate preventive approaches advocated by the various government ministries and government agencies towards the palm oil milling sub-sector, and to a limited extent by the significant relationship for the aggregate preventive approaches advocated by the various government ministries and government agencies towards the downstream manufacturing sub-sector.

The reason why there is a significant relationship for the overall POPC between more advocacy of ISO 9000 standards, ISO 14000 standards and OHSAS 18000 standards by the various government ministries and government agencies and better environmental performance, is mainly due to the palm oil milling sub-sector. The significant relationship with regard to the advocacy of OHSAS 18000 standards for the overall POPC is contributed not only by the upstream palm oil milling sub-sector but also the downstream manufacturing sub-sector. The stronger the statistical relationship for ISO 9000 standards and ISO 14000 standards carries the implication of the primacy or priority placed on them in comparison to OHSAS 18000 standards. The ISO 9000 standards and the ISO 14000 standards are perceived as the torchbearers and having a heavier weightage at the market place even though it may not be mandatory. The underlying premise why there is a significant relationship between the more the various government ministries and government agencies advocate ISO 9000 standards, ISO 14000 standards and OHSAS 18000 standards and better environmental performance is the preparation for any eventuality. As many of these standards and certifications are voluntary in nature and concurrently are imposed by only some importers, the strategic worry going forward is that these voluntary standards or certifications might one day haunt them if there is a lack of preparedness for them. To mitigate this from happening and in preparation for today and the future, the standards and certification journey has begun. This is also aided in no small measure by the government's effort in instilling the spirit of standard certification, starting with some of the Federal Ministries and cascading down to government agencies like FELDA and Government-Linked Companies (GLCs) like the Golden Hope Group, Guthrie Group, and Sime Darby Group. The adoption of the various ISO standards and certifications by the palm oil milling sub-sector is underscored by the historical context or legacy and also being the most polluting in the POPC. The historical context of being one of the most polluting industries in the past and the eventual reduction in the pollution load generally to be in compliance with the EQA and related regulations, lend credence to the fact that being a frontliner bearing the brunt of environmental criticisms, complying with ISO standards and certifications is one of the basic and vital steps in the farm to fork food supply chain. The adoption of ISO 9000 standards and certifications, ISO 14000 standards and certifications and OSHA 18000 standards and certifications will assist the palm oil millers in meeting the parameters of quality products, environmental care, and occupational safety and health requirements. The palm oil millers, thus, have the tools to objectively argue and at the same time have the ability and capacity to overcome objections raised by any quarters. However, in terms of sub-sectoral variation, the results show there are no significant relationships between the advocacy of ISO 9000 standards and ISO 14000 standards, and environmental performance, for the downstream manufacturers. This carries the implication that the ISO 9000 standards and ISO 14000 standards are not given the high ground as prioritized by the palm oil milling sub-sector.

7.2.5 The Local Communities' Involvement In Environmental Monitoring

Table 7.5 illustrates that the Fifth Hypothesis (H5), which is the higher the local communities' involvement via the institutional structure in environmental monitoring, the better the environmental performance is not statistically significant at the five percent level. This means that the null hypothesis of no relations between the two variables is not rejected. This carries the implication that the government related community infrastructure in environmental monitoring is not significantly related to environmental performance.

7.3 Analysis of Data for the Postulated Hypotheses in the Industry-Industry Linkage

7.3.1 The Exposure To International Trade

The Sixth Hypothesis (H6), which is the higher the exposure to international trade, the better the environmental performance is operationalized by two aggregate sub-hypotheses, namely the export of products (H6.1), and the imposition of environmental standards for market access (H6.2) for the downstream manufacturing sub-sector are as shown in Table 7.6(i). The palm oil milling sub-sector is not relevant for this hypothesis as CPO is sold in the domestic market with the exception of an industry overhang in the Malaysian market. If CPO is licensed to be sold overseas by MPOB, it is sold only to overseas sister subsidiaries and thus, there is virtually no exposure to international trade. The first aggregate sub-hypothesis is a constitution of the third to thirteenth sub-hypothesis whereas the second aggregate sub-hypothesis is a constitution of the fourteenth to twenty-fourth sub-hypothesis.

The null hypothesis is not rejected at the five percent significance level for the first and second aggregate sub-hypothesis as seen in Table 7.6(i). As shown in Table 7.6(ii), the exports of products based on region, namely the EU markets, non-EU markets, North American markets, Latin American markets, Middle Eastern markets, African markets, Oceanian markets, East Asian markets, ASEAN markets, West Asian markets and other markets also show that there is no significant relationship with environmental performance at the five percent level. This means it is not possible to reject the null hypothesis. Likewise, as seen in Table 7.6(iii) there is no significant relationship at the five percent significance level between the imposition of environmental standards for market access for the EU markets, non-EU markets, North American markets, Latin American markets, Middle Eastern markets, African markets, Oceanic markets, ASEAN markets and other markets, and environmental performance. However, the following regions have the null hypothesis being rejected with the acceptance of the alternative hypothesis of positive correlation:-

Twenty-first sub-hypothesis for H6: The higher the level of imposition of environmental standards for access to the East Asian markets for the downstream manufacturing sub-sector (H6.21.3) (τ_b= .475, p <0.05, n=15), the better the environmental performance.

Twenty-third sub-hypothesis for H6: The higher the level of imposition of environmental standards for access to the West Asian markets for the downstream manufacturing sub-sector (H6.23.3) (τ_b= .442, $p < 0.05$, n=15), the better the environmental performance.

Even though there is significant relationship for the East Asian markets and the West Asian markets, these two significant relationships are insufficient to impact on the aggregate sub-hypothesis which states that the higher the level of imposition of environmental standards for market access, the better the environmental performance. The significant relationship at the five percent level between the level of imposition of environmental standards for access to the East Asian markets on the downstream manufacturers and environmental performance carries the implication that it is mainly due to the stringent Japanese market requirements for quality, consumer health and safety, and environmental concerns. These stringent requirements impose on the need for Malaysian downstream manufacturers to comply fully and if otherwise, market access will be denied. However, the significant relationship for the West Asian market also carries the implication that it is due largely to the issue of quality, particularly that of India. The results also show that in terms of sub-sectoral variation, the two significant relationships as discussed above are seen only for the downstream manufacturers but not for the upstream palm oil milling sub-sector as the later sub-sector is not allowed to export the CPO with the exception of an existing inventory overhang in the Malaysian market. If the CPO is allowed to be exported, the related overseas subsidiaries of the respondents will be absorbing the Malaysian exports, thus not imposing any additional environmental requirements.

7.3.2 The Level Of Vertical Integration

Table 7.7 illustrates the results for Hypothesis Seven (H7) which is the higher the level of vertical integration, the better the environmental performance. The null hypothesis is rejected with the acceptance of the alternative hypothesis of positive correlation at the more stringent significance level of one percent for the overall POPC (τ_b= .356, $p < 0.01$, n=39) and at the significance level of five percent for the upstream palm oil milling sub-sector (τ_b= .347, $p < 0.05$, n=24). The strong significant relationship for the POPC (H7.1.1) is due largely to the strong significant relationship of the upstream palm oil milling sub-sector (H7.1.2) whereas the downstream manufacturing sub-sector (H7.1.3) is in the opposing direction of not displaying any significant relationship. This carries the implication that there is a strong significant relationship between vertical integration and environmental performance, that is the higher the level of vertical integration, the better the environmental performance for the overall POPC and the palm oil milling sub-sector. The highly and moderately vertically integrated groups are dominated mainly by GLCs and large Malaysian public listed companies. These organisations are generally well managed, with sufficient financial resources and a group strategy or policy instituted to drive down specific programmes like the various

ISO standards or certifications. This is especially true for GLCs as they have to toe the government line in terms of the National Environmental Policy, complying fully with the EQA and OSHA, and also adopting the various ISO standards and certifications as advocated by the Federal Government. For the highly and moderately vertically integrated groups, the strongest point is in strengthening the weakest link in the POPC. As the weakest link in the POPC is the upstream palm oil milling sub-sector, which is the most polluting, this also explains why the upstream palm oil milling sub-sector has a strong significant relationship. Being the most polluting, it is the starting or focal point for environmental improvement programmes for vertically integrated groups. By being the main focus, it acts as a catalyst for driving environmental related improvements and programmes in palm oil milling operation so as to reduce and overcome to a large extent the environmental historical baggage and also being the most polluting in the POPC till today. The downstream manufacturers have no such legacy and are not on the radar screen like the upstream palm oil milling sub-sector.

7.3.3 The Intensity Of International Relationship

The results for the Eight Hypothesis (H8), which is the more intensive the international relationship, the better the environmental performance, are as shown in Tables 7.8 (i) and (ii). This hypothesis is operationalized via two aggregate sub-hypotheses (H8.1 and H8.5) for the downstream manufacturing sub-sector. The palm oil milling sub-sector is not relevant for this hypothesis as CPO is sold in the domestic market with the exception of an industry overhang in the Malaysian market. If CPO is licensed by MPOB to be sold overseas, it is sold only to overseas sister subsidiaries, and thus there is virtually no international relationship. Both the aggregate sub-hypotheses are made up of a further three sub- hypotheses, of which each is based on an activity that is related to environmental collaboration by the parent company of the overseas customers and the overseas customers themselves. The results show that the null hypothesis is not rejected for the two aggregate sub-hypotheses (H8.1 and H8.5) as well as the individual sub-hypotheses within each at the significant level of five percent for the downstream manufacturing sub-sector. This means that there is no significant relationship for the downstream manufacturing sub-sector between the environmental collaboration shared with the parent company of the overseas customers, and also the overseas customers themselves, in the form of updates on environmental regulation (H8.2; H8.6), the development of minimum environmental requirements for products (H8.3; H8.7), and the development and audit of product safety and quality (H8.4; H8.8), and environmental performance.

7.3.4 The Intensity of Local Collaboration

Tables 7.9(i) and (ii) show that the Ninth hypothesis (H9), which is the more intensive the local collaboration, the better the environmental performance is operationalized via two aggregate sub-hypotheses with each aggregate sub-hypothesis having a composition of three individual sub-hypotheses. The first aggregate sub-hypothesis is a composition of the second, third and fourth sub-hypothesis whereas the fifth aggregate sub-hypothesis is a constitution of the sixth, seventh and eighth sub-hypothesis. The first aggregate sub-hypothesis (H9.1) is made up of the aggregation of activities that are related to environmental collaboration shared by the (local) parent company of the local customers with the overall POPC (H9.1.1), the palm oil milling sub-sector (H9.1.2) and the downstream manufacturing sub-sector (H9.1.3), and environmental performance. The second, third and fourth sub-hypothesis which make up the first aggregate sub-hypothesis, are in relation to sharing updates on environmental regulations (H9.2), sharing the development of minimum environmental requirements for products (H9.3), and the development and audit of product safety and quality (H9.4) by the (local) parent company of the local customers with the overall POPC, the palm oil milling sub-sector and the downstream manufacturing sub-sector. The fifth aggregate sub-hypothesis is made up of the aggregation of activities that are related to environmental collaboration shared by the local customers with the overall POPC (H9.5.1), the palm oil milling sub-sector (H9.5.2) and the downstream manufacturing sub-sector (H9.5.3), and environmental performance. Likewise, the sixth, seventh and eighth sub-hypotheses which make up the fifth aggregate sub-hypothesis, are in relation to sharing updates on environmental regulations (H9.6), sharing the development of minimum environmental requirements for products (H9.7), and the development and audit of product safety and quality (H9.8) by the local customers with the overall POPC, the palm oil milling sub-sector and the downstream manufacturing sub-sector.

The results in Tables 7.9(i) and (ii) show that the null hypothesis is not rejected at the significance level of five percent for the first aggregate sub-hypothesis and its constituent second, third and fourth sub-hypothesis, and also the fifth aggregate sub-hypothesis and its constituent sixth, seventh and eighth sub-hypotheses for the downstream manufacturing sub-sector. This means that the sharing of updates on environmental regulations, the sharing of the development of minimum environmental requirements for products, and the development of product safety and quality by the (local) parent company of the local customers and the local customers themselves with the downstream manufacturing sub-sector are not significantly related to environmental performance. In addition for the third and seventh sub-hypothesis for the overall POPC and the palm oil milling sub-sector, the null hypothesis is also not rejected at the significance level of five percent. This means that the sharing of the development of minimum environmental requirements for products by the (local) parent company of the local customers and the local customers themselves with the overall POPC and the palm oil milling sub-sector is not significantly related to environmental performance.

The results also illustrate that the rejection of the null hypothesis and the acceptance of the alternative hypothesis of positive correlation is found for the following:-

The first aggregate sub-hypothesis for H9: The more the aggregate activities on environmental collaboration shared by the (local) parent company of the local customers with the overall POPC (H9.1.1) (τ_b= .376, $p < 0.01$, n=39), and

	the upstream palm oil milling sub-sector (H9.1.2) (τ_b = .519, p <0.01, n=24), the better the environmental performance.
The second sub-hypothesis for H9:	The sharing of updates on environmental regulations by the (local) parent company of the local customers with the overall POPC (H9.2.1) (τ_b = .457, p <0.01, n=39), and the upstream palm oil milling sub-sector (H9.2.2) (τ_b= .517, p < 0.01, n=24), the better the environmental performance.
The fourth sub-hypothesis for H9:	The development and audit of product safety and quality by the (local) parent company of the local customers with the overall POPC (H9.41) (τ_b= .316, p <0.05, n=39) and the upstream palm oil milling sub-sector (H9.4.2) (τ_b = .391, p <0.05, n=24), the better the environmental performance.
The fifth aggregate sub-hypothesis for H9:	The more the aggregate activities on environmental collaboration shared by the local customers with the overall POPC (H9.5.1) (τ_b = .428, p <0.01, n=39) and the upstream palm oil milling sub-sector (H9.5.1) (τ_b = .464, p <0.01, n=24), the better the environmental performance.
The sixth sub-hypothesis for H9:	The sharing of updates on environmental regulations by the local customers with overall POPC (H9.6.1) (τ_b = .456, p <0.01, n=39) and the upstream palm oil milling sub-sector (H9.6.2) (τ_b = .521, p < 0.01, n=24), the better the environmental performance.
The eighth sub-hypothesis for H9:	The development and audit of product safety and quality by the local customers with the overall POPC (H9.8.1) (τ_b= .289, p < 0.05, n=39) and the upstream palm oil milling sub-sector (H9.8.2) (τ_b =. 357, p < 0.05, n=24), the better the environmental performance.

The significant relationship for the first aggregate sub-hypothesis for the overall POPC and the palm oil milling sub-sector is mainly due to the significant relationship for the second and fourth sub-hypothesis for the upstream palm oil milling sub-sector. This means that the sharing of updates on environmental regulations and the development and audit of product safety and quality by the (local) parent company of the local customers with the upstream palm oil milling sub-sector, is significantly related to environmental performance. Likewise, the significant relationship for the fifth aggregate sub-hypothesis for the overall POPC and the upstream palm oil milling sub-sector is mainly due to the significant relationship for the sixth and eighth sub-hypothesis for the upstream palm oil milling sub-sector. This also means that the sharing of updates on environmental regulations and the development and audit of product safety and quality by the local customers with the upstream palm oil milling sub-sector, is significantly related to environmental performance.

The underlying reason for the sharing of the updates on environmental regulation and the development and auditing of product safety and quality is mainly due to vertical ownership linkages A highly centralized organizational structure, influenced by group policy, leads to strong linkage between head office and its subsidiaries and also between sister subsidiaries. For such groups, the sale of CPO to sister subsidiaries, be it refinery cum POFP manufacturers and oleochemical manufacturers is to capture the value added within the group. The existence of structural embeddedness (Baum and Dutton 1996) leads to local collaborative efforts between the parent company and its subsidiaries and also between sister subsidiaries (downstream subsidiaries are internal customers for the palm oil milling subsidiaries). In terms of sub-sectoral variations, no significant relationship is recorded for the downstream manufacturing sub-sector due to the 'external customers' which do not have the propensity to share like the parent company and sister companies.

7. 4 Summary

The results show that for the government-industry linkage, government policies and preventive approaches advocated by the various government ministries and agencies have led in various instances to better environmental performances. Government policies that are developed as a result of joint cooperation, a two-way process and the advocacy of preventive approaches acting like a catalyst have led to better environmental performance. Intra-sectoral variation indicates that the upstream palm oil milling sub-sector has a stronger government-industry linkage leading to significant relationships between policies and advocacy of preventive approaches and better environmental performance. This is mainly due to the palm oil milling sub-sector being in the forefront of environmental criticism and also the largesse of being a major polluter in the early years of the development of the upstream palm oil milling sub-sector. However, this is not so for the downstream manufacturing sub-sector which is generally a low-waste generator.

For the industry-industry linkage, the downstream manufacturing sub-sector has significant relationships with regard to the imposition of environmental regulations by the West Asian and East Asian markets and better environmental performance. However, on an overall basis, there is no significant relationship for the level of exposure to international trade and environmental performance. The industry-industry linkage shows strong significant relationships for vertical integration and local collaboration, in relation to better environmental performance. This is mainly due to the upstream palm oil milling sub-sector. This highlights the existence of intra-sectoral variation as the downstream manufacturing sub-sector does not display such significant relationships. The significant relationships for vertical integration and local collaboration is basically due to the strongest point is in strengthening the weakest link and the culture of group policy respectively.

Table 7.1 Correlation Coefficients for Industry Involvement in the Policy Formulation Process and Environmental Performance

H1: The more the industry is involved in the policy formulation process, the better the environmental performance.

Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H1.1) for H1	Degree of Activeness of industry representatives in the MPOB Board in the aggregate policy formulation process	$\tau_b = 0.183$ p = 0.146 ($p > 0.05$; $p>0.01$)	Unable to reject H_0. Reject H_a.	**$\tau_b = 0.500$** p = 0.003** ***($p < 0.05$); ($p<0.01$)***	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b = -0.096$ p = 0.643 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Second sub-hypothesis (H1.2) for H1	Level of Influence of industry representatives in the MPOB Board in the aggregate policy formulation process	$\tau_b = 0.135$ p = 0.281 ($p > 0.05$; $p>0.01$)	Unable to reject H_0. Reject H_a.	**$\tau_b = 0.514$** p = 0.002 ($p < 0.05$; $p< 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b = -0.165$ p = 0.442 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Third sub-hypothesis (H1.3) for H1	Degree of activeness of industry representatives in the MPOB Board in the formulation of the Oil Extraction Rate (OER) Policy	*Not Applicable*	*Not Applicable*	**$\tau_b = 0.424$* p = 0.015** *($p < 0.05$; but $p > 0.01$)*	**Reject H_0; Accept H_a at the 5% level.**	*Not Applicable*	*Not Applicable*
Fourth sub-hypothesis (H1.4) for H1	Level of influence of industry representatives in the MPOB Board in the formulation of the Oil Extraction Rate (OER) Policy	*Not Applicable*	*Not Applicable*	**$\tau_b = 0.365$* p = 0.034** *($p < 0.05$; but $p > 0.01$)*	**Reject H_0; Accept H_a at the 5% level.**	*Not Applicable*	*Not Applicable*

Table 7.1 continued

Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Fifth sub-hypothesis (H1.5) for H1	Degree of activeness of industry representatives in the MPOB Board in the formulation of the Value Added Downstream Policy	$\tau_b = 0.191$ $p = 0.117$ *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	**$\tau_b = 0.459$**** **$p = 0.005$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b = -0.096$ $p = 0.643$ *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Sixth sub-hypothesis (H1.6) for H1	Level of influence of industry representatives in the MPOB Board in the formulation of the Value Added Downstream Policy	$\tau_b = 0.222$ $p = 0.070$ *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	**$\tau_b = 0.585$**** **$p = 0.000$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b = -0.165$ $p = 0.442$ *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Seventh sub-hypothesis (H1.7) for H1	Degree of activeness of industry representatives in the MPOC Board in the aggregate policy formulation process	**$\tau_b = 0.243$*** **$p = 0.050$** *($p < 0.05$; but $p > 0.01$)*	**Reject H_0; Accept H_a at the 5% level.**	**$\tau_b = 0.470$**** **$p = 0.005$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b = 0.230$ $p = 0.274$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0; Reject H_a.
Eighth sub-hypothesis (H1.8) for H1	Level of influence of industry representatives in the MPOC Board in the aggregate policy formulation process	**$\tau_b = 0.341$**** **$p = 0.005$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	**$\tau_b = 0.553$**** **$p = 0.001$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b = 0.191$ $p = 0.369$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0; Reject H_a.
Ninth sub-hypothesis (H1.9) for H1	Degree of activeness of industry representatives in the MPOC Board in the policy formulation for the Task Force on the Environment	$\tau_b = 0.189$ $p = 0.127$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0; Reject H_a.	**$\tau_b = 0.488$**** **$p = 0.004$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b = 0.000$ $p = 1.000$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0; Reject H_a.

Table 7.1 continued

Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Tenth sub-hypothesis (H1.10) for H1	Level of influence of industry representatives in the MPOC Board in the policy formulation or the Task Force on the Environment	**τ_b = 0. 315*** **p = 0. 010** *($p < 0.05$; but $p > 0.01$)*	**Reject H_0; Accept H_a at the 5% level.**	**τ_b = 0. 487**** **p = 0. 003** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.032 p = 0. 878 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0; Reject H_a.
Eleventh sub-hypothesis (H1.11) for H1	Degree of activeness of industry representatives in the MPOC Board in the formulation of the Promotion of Oils and Fats In The International Market Policy	**τ_b = 0. 262*** **p = 0. 037** *($p < 0.05$; but $p > 0.01$)*	**Reject H_0; Accept H_a at the 5% level.**	**τ_b = 0. 540**** **p = 0. 001** *($p < 0.05$; $p <0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.032 p = 0. 878 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0; Reject H_a.
Twelfth sub-hypothesis (H1.12) for H1	Level of influence of industry representatives in the MPOC Board in the formulation of the Promotion of Oils and Fats In The International Market Policy	**τ_b = 0. 278*** **p = 0. 025** *($p < 0.05$; but $p > 0.01$)*	**Reject H_0; Accept H_a at the 5% level.**	**τ_b = 0. 538**** **p = 0. 001** *($p < 0.05$; $p <0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.021 p = 0. 918 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0; Reject H_a.

Note:

* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*

** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*

Y : Environmental Performance Indicator

Table 7.2 Correlation Coefficients For Cooperation Between Government and Industry in Technological Development and Technological Transfer and Environmental Performance

H2: The better the cooperation between government and industry in technological development and technological transfer, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H2.1) for H2	The adoption of technologies offered by MPOB	$\tau_b = 0.140$ p = 0.302 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	$\tau_b = 0.342$ p = 0. 054 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	$\tau_b = -0.158$ p = 0. 487 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Second sub-hypothesis (H2.2) for H2	The participation in technological development programs offered by various governmental agencies	$\tau_b = 0.050$ p = 0.711 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	$\tau_b = -0.092$ p = 0.600 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	$\tau_b = 0.223$ p = 0.327 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Third sub-hypothesis (H2.3) for H2	Government incentives in the form of tax incentives offered by MIDA and MOF for investing in direct or indirect environment-related projects and technologies	$\tau_b = 0.166$ p = 0.223 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	*No correlation coefficient is computed.*		$\tau_b = 0.427$ p = 0.060 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.

_*Note:*
* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 7.3 Correlation Coefficients For Emphasis Of Regulatory Efforts On Environmental Issues and Environmental Performance

H3: The more the government regulatory efforts emphasize on environmental issues, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H3.1) for H3	Stringency of DOE in the inspection of factory operations with regard to EQA and related regulations	τ_b = -0.035 p = 0.789 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	τ_b = -0.207 p = 0.228 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	τ_b = 0.200 p = 0.351 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Second sub-hypothesis (H3.2) for H3	Stringency of LA in the inspection of factory operations with regard to local by-laws and related regulations	τ_b = -0.063 p = 0.618 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	τ_b = 0.031 p = 0.850 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	τ_b = -0.314 p = 0.134 *(p >0.05 p > 0.01)*	Unable to reject H_0. Reject H_a.
Third sub-hypothesis (H3.3) for H3	Stringency of DOSH in the inspection of factory operations with regard to OSHA and related regulations and FMA and related regulations	τ_b = 0.007 p = 0.089 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	τ_b = 0.014 p = 0.932 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	τ_b = 0.046 p = 0.829 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Fourth sub-hypothesis (H3.4) for H3	The intensity of enforcement by the DOE towards the company in complying with EQA and related regulations	τ_b = 0. 089 p = 0.500 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	τ_b = 0.035 p = 0.846 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	τ_b = 0.155 p = 0.479 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.

Table 7.3 continued

Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Fifth sub-hypothesis (H3.5) for H3	The intensity of enforcement by the LA towards the company in complying with local by-laws and related regulations	$\tau_b = 0.126$ p = 0.346 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	$\tau_b = 0.125$ p = 0. 482 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	$\tau_b = 0.155$ p = 0.479 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Sixth sub-hypothesis (H3.6) for H3	The intensity of enforcement by the DOSH towards the company in complying with OSHA and related regulations and FMA and related regulations	$\tau_b = -0.021$ p = 0.873 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	$\tau_b = -0.028$ p = 0.866 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.	$\tau_b = 0.000$ p = 1.000 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.

Note:

** Correlation coefficient is significant at p < 0.05 (2-tailed)*

*** Correlation coefficient is significant at p < 0.01 (2-tailed)*

Y : Environmental Performance Indicator

Table 7.4 Correlation Coefficients For Preventive Approaches Advocated By The Various Government Ministries and Government Agencies Towards the Company And Environmental Performance.

H4: The more preventive the approach advocated by the various government agencies, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H4.1) for H4	Aggregated preventive approaches advocated by the various government ministries and government agencies	**$\tau_b = 0.408^{**}$ $p = 0.001$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	**$\tau_b = 0.439^{**}$ $p = 0.007$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	**$\tau_b = 0.424^{*}$ $p = 0.044$ *($p < 0.0$ but $p > 0.01$)***	**Reject H_0; Accept H_a at the 5% level.**
Second sub-hypothesis (H4.2) for H4	The advocacy by the various government ministries and government agencies of ISO9000 standards	**$\tau_b = 0.374^{**}$ $p = 0.003$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	**$\tau_b = 0.430^{**}$ $p = 0.009$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b = 0.330$ $p = 0.121$ *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Third sub-hypothesis (H4.3) for H4	The advocacy by the various government ministries and government agencies of ISO14000 standards	**$\tau_b = 0.371^{**}$ $p = 0.003$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	**$\tau_b = 0.402^{**}$ $p = 0.015$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b = 0.379$ $p = 0.070$ *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Fourth sub-hypothesis (H4.4) for H4	The advocacy by the various government ministries and government agencies of OHSAS 18000 standards	**$\tau_b = 0.423^{**}$ $p = 0.001$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	**$\tau_b = 0.485^{**}$ $p = 0.003$** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1%.**	**$\tau_b = 0.443^{*}$ $p = 0.034$ ($p < 0.05$; but $p > 0.01$)**	**Reject H_0; Accept H_a at the 5% level.**

Table 7.4 continued

Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient
Fifth sub-hypothesis (H4.5) for H4	The advocacy by the various government ministries and government agencies of ISO22000 (HACCP) standards.	$\tau_b = 0.242$ $p = 0.052$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a	$\tau_b = 0.326$ $p = 0.052$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a	$\tau_b = 0.210$ $p = 0.307$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a

Note:

* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 7.5 Correlation Coefficients For Local Communities' Involvement Via The Institutional Structure In Environmental Monitoring and Environmental Performance

H5: The higher the local communities' involvement via the institutional structure in environmental monitoring, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient
H5	Institutional relationship between the local communities and the relevant government authorities with regard to environmental monitoring.	$\tau_b = -0.092$ $p = 0.499$ *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	$\tau_b = -0.229$ $p = 0.197$ *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	$\tau_b = 0.046$ $p = 0.828$ *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.

Note:

* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 7.6(i) Correlation Coefficients For Exposure To International Trade and Environmental Performance

H6: The higher the exposure to international trade, the better the environmental performance.							
Hypothesis (G-I)/ Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H6.1) for H6	Exports of products to the overseas markets	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	$\tau_b = 0.035$ p = 0.804 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Second sub-hypothesis (H6.2) for H6	Imposition of environmental standards for access to the overseas markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	$\tau_b = 0.090$ p = 0.664 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.

Note:

* *Correlation coefficient is significant at p < 0.05 (2-tailed)*

** *Correlation coefficient is significant at p < 0.01 (2-tailed)*

Y : Environmental Performance Indicator

Table 7.6(ii) Correlation Coefficients For Exports Of Products Based On Regions and Environmental Performance

H6.1: The higher the exposure to international trade, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Third sub-hypothesis (H6.3) for H6	Export products to EU markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = -0.263 p = 0.225 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Fourth sub-hypothesis (H6.4) for H6	Export products to non EU-Europe markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = -0.016 p = 0. 943 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Fifth sub-hypothesis (H6.5) for H6	Export products to North American markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = -0.362 p = 0.088 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Sixth sub-hypothesis (H6.6) for H6	Export products to Latin American markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*No correlation coefficient is computed.*	
Seventh sub-hypothesis (H6.7) for H6	Export products to Middle East markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0.037 p = 0.865 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Eighth sub-hypothesis (H6.8) for H6	Export products to Africa markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = -0.057 p = 0.799 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Ninth sub-hypothesis (H6.9) for H6	Export products to Oceanic markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*No correlation coefficient is computed.*	
Tenth sub-hypothesis (H6.10) for H6	Export products to East Asian markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0.246 p = 0.256 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Eleventh sub-hypothesis (H6.11) for H6	Export products to ASEAN markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0.026 p = 0.908 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.

Table 7.6(ii) continued

Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Twelfth sub-hypothesis (H6.12) for H6	Export products to West Asian markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	$\tau_b = 0.366$ p = 0.094 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Thirteenth sub-hypothesis (H6.13) for H6	Export products to Other markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	*No correlation coefficient is computed.*	

Note:

* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*

** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*

Y : Environmental Performance Indicator

Table 7.6(iii) Correlation Coefficients For The Imposition of Environmental Standards For Access to Overseas Markets and Environmental Performance

Sub-hypothesis (H6.2) for H6: The higher the level of imposition of environmental standards for market access, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Fourteenth sub-hypothesis (H6.14) for H6	Imposition of environmental standards for access to EU markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = -0.250 p = 0.254 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Fifteenth sub-hypothesis (H6.15) for H6	Imposition of environmental standards for access to the non-EU Europe markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0.072 p = 0. 746 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Sixteenth sub-hypothesis (H6.16) for H6	Imposition of environmental standards for access to North American markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = -0.339 p = 0.117 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Seventeenth sub-hypothesis (H6.17) for H6	Imposition of environmental standards for access to Latin American markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0.026 p = 0.908 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Eighteenth sub-hypothesis (H6.18) for H6	Imposition of environmental standards for access to Middle East markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0.038 p = 0.862 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.

Table 7.6(iii) continued

Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient
Nineteenth sub-hypothesis (H6.19) for H6	Imposition of environmental standards for access to African markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = -0.077 p = 0.734 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Twentieth sub-hypothesis (H6.20) for H6	Imposition of environmental standards for access to Oceanic markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0.026 p = 0.908 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Twenty first sub-hypothesis (H6.21) for H6	Imposition of environmental standards for access to East Asian markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	**τ_b = 0.475* p = 0.032** ***(p < 0.05 but p > 0.01)***	**Reject H_0. Accept H_a at the 5% level.**
Twenty second sub-hypothesis (H6.22) for H6	Imposition of environmental standards for access to ASEAN markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0.026 p = 0.908 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Twenty third sub-hypothesis (H6.23) for H6	Imposition of environmental standards for access to West Asian markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	**τ_b = 0.442* p = 0.046** ***(p < 0.05 but p > 0.01)***	**Reject H_0. Accept H_a at the 5% level.**
Twenty fourth sub-hypothesis (H6.24) for H6	Imposition of environmental standards for access to Other markets.	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0.026 p = 0.908 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.

Note:

* *Correlation coefficient is significant at p < 0.05 (2-tailed)*
** *Correlation coefficient is significant at p < 0.01 (2-tailed)*
Y : Environmental Performance Indicator

Table 7.7 Correlation Coefficients For Vertical Integration and Environmental Performance.

H7: The higher the level of vertical integration, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
	Level of vertical integration	**τ_b = 0. 356** p = 0. 007** *($p < 0.05$; $p < 0.01$)*	**Reject H_0; Accept H_a at the 5% level and also at the more stringent 1% level.**	**τ_b = 0. 347* p = 0. 047** *($p < 0.05$ but $p > 0.01$)*	**Reject H_0; Accept H_a at the 5% level.**	τ_b = 0.326 p = 0. 123 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.

Note:

**   Correlation coefficient is significant at p < 0.05 (2-tailed)*

*** Correlation coefficient is significant at p < 0.01 (2-tailed)*

Y : Environmental Performance Indicator

Table 7.8(i) Correlation Coefficients For International Relationship and Environmental Performance (Parent Company Of The Overseas Customers)

H8: The more intensive the international relationship, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H8.1) for H8	Aggregate activities on environmental collaboration shared by the parent company of the overseas customers	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	$\tau_b = 0.425$ p = 0.061 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Second sub-hypothesis (H8.2) for H8	Sharing updates on environmental regulations	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	$\tau_b = 0.309$ p = 0.173 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Third sub-hypothesis (H8.3) for H8	Sharing development of minimum environmental requirements for products	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	$\tau_b = 0.253$ p = 0.266 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Fourth sub-hypothesis (H8.4) for H8	The development and audit of product safety and quality	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	$\tau_b = 0.135$ p = 0.552 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.

Note:

* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 7.8(ii) Correlation Coefficients For International Relationship and Environmental Performance (Overseas Customers)

H8: The more intensive the international relationship, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Fifth sub-hypothesis (H8.5) for H8	Aggregate activities on environmental collaboration shared by the overseas customers	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b =- 0.027 p = 0.906 *(p > 0.05; p > 0.01)*	Unable to reject H_0. Reject H_a.
Sixth sub-hypothesis (H8.6) for H8	Sharing updates on environmental regulations	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0. 195 p = 0.390 *(p > 0.05; p > 0.01*	Unable to reject H_0. Reject H_a.
Seventh sub-hypothesis (H8.7) for H8	Sharing the development of minimum environmental requirements for products/ services	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = 0.131 p = 0.563 *(p > 0.05; p > 0.01*	Unable to reject H_0. Reject H_a.
Eighth sub-hypothesis (H8.8) for H8	The development and audit of product safety and quality	*Not Applicable*	*Not Applicable*	*Not Applicable*	*Not Applicable*	τ_b = -0.357 p = 0.117 *(p > 0.05; p > 0.01*	Unable to reject H_0. Reject H_a.

Note:

* *Correlation coefficient is significant at p < 0.05 (2-tailed)*
** *Correlation coefficient is significant at p < 0.01 (2-tailed)*
Y : Environmental Performance Indicator

Table 7.9(i) Correlation Coefficients For Local Collaboration and Environmental Performance (Local Parent Company Of The Local Customers).

H9: The more intensive the local collaboration by the company, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H9.1) for H9	Aggregate activities on environmental collaboration shared by the local parent company of the local customers	**τ_b = 0.376** p =0.006 *($p < 0.05$ $p < 0.01$)***	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	**τ_b =0. 519** p =0.003 *($p < 0.05$; $p < 0.01$)***	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1%.**	τ_b = 0.268 p = 0.238 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Second sub-hypothesis (H9.2) for H9	Sharing updates on environmental regulations	**τ_b = 0.457** p = 0.001 *($p < 0.05$; $p < 0.01$)***	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	**τ_b = 0.517** p =0.004 *($p < 0.05$; $p < 0.01$)***	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.416 p = 0.067 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Third sub-hypothesis (H9.3) for H9	Sharing development of minimum environmental requirements for products	τ_b = 0.196 p =0.149 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	τ_b = -0.039 p =0.828 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	τ_b =0.404 p = 0.075 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Fourth sub-hypothesis (H9.4) for H9	The development and audit of product safety and quality	**τ_b = 0.316* p = 0.020 *($p < 0.05$; but $p > 0.01$)***	**Reject H_0. Accept H_a at the 5% level.**	**τ_b = 0.391* p = 0.028 *($p < 0.05$; but $p > 0.01$)***	**Reject H_0. Accept H_a at the 5% level.**	τ_b = 0.268 p = 0.238 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.

Note:

* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*

** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*

Y : Environmental Performance Indicator

Table 7.9(ii) Correlation Coefficients For Local Collaboration and Environmental Performance. (Local Customers)

H9: The more intensive the local collaboration by the company, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall POPC		Upstream Palm Oil Milling Sub-sector		Downstream Manufacturing Sub-sector	
		Sample size, n=39		Sample size, n=24		Sample size, n=15	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Fifth sub-hypothesis (H9.5) for H9	Aggregate activities on environmental collaboration shared by the local customers	**τ_b = 0.428** p =0.002 *($p < 0.05$; $p < 0.01$)***	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	**τ_b =0. 464** p =0.009 *($p < 0.05$; $p < 0.01$)***	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.435 p = 0.056 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Sixth sub-hypothesis (H9.6) for H9	Sharing updates on environmental regulations	**τ_b = 0.456** p = 0.001 *($p < 0.05$; $p < 0.01$)***	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	**τ_b = 0.521** p =0.003 *($p < 0.05$; $p < 0.01$)***	**Reject H_0. Accept H_a at the 5% level and also at the 1% level.**	τ_b = 0.362 p = 0.111 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Seventh sub-hypothesis (H9.7) for H9	Sharing development of minimum environmental requirements for products	τ_b = 0.195 p = 0.151 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	τ_b = 0.279 p =0.116 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.	τ_b =0.148 p = 0.515 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.
Eighth sub-hypothesis (H9.8) for H9	The development and audit of product safety and quality	**τ_b = 0.289* p = 0.034 *($p < 0.05$; but $p >0.01$)***	**Reject H_0. Accept H_a at the 5% level.**	**τ_b = 0.357* p = 0.045 *($p < 0.05$; but $p > 0.01$)***	**Reject H_0. Accept H_a at the 5% level.**	τ_b = 0.193 p = 0.395 *($p > 0.05$; $p > 0.01$)*	Unable to reject H_0. Reject H_a.

Note:

* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*

** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*

Y : Environmental Performance Indicator

CHAPTER 8
Analysis Of Data For The Malaysian Textile And Apparel Production Chain

8.1 Introduction

This chapter will discuss the government-industry linkage and the industry-industry linkage and their relationships with the environmental performances of the TAPC. Correlation analysis and correlation coefficients are used to test the relationship between the operationalized independent variables from the nine hypotheses and the environmental performances. Section 8.2 covers the results of the test of correlation analysis and correlation coefficients for the relationship between government-industry linkage and the environmental performances. Section 8.3 covers the results of the test of correlation analysis and correlation coefficients for the relationship between industry-industry linkage and the environmental performances. For both these sections, the discussion in text will be presented first, followed by the relevant tables.

8.2 Analysis of Data For The Postulated Hypotheses In The Government-Industry Linkage

8.2.1 Industry Involvement In The Policy Formulation Process

The first hypothesis (H1), which is the more the industry is involved in the policy formulation process, the better the environmental performance is outlined in Table 8.1. This hypothesis is operationalized via six sub-hypotheses. The first aggregate sub-hypothesis is a constitution of the third and fifth sub-hypothesis which pertains to the degree of activeness of industry representatives in the aggregate policy formulation process for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector. The second aggregate sub-hypothesis is a constitution of the fourth and sixth sub-hypothesis which pertains to the level of influence of industry representatives in the aggregate policy formulation process for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector. The third and fourth sub-hypotheses are related to the degree of activeness and the level of influence respectively of industry representatives from the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector in the policy formulation process via the Standards Committee of the Department of Standards Malaysia, and environmental performance. The fifth and sixth sub-hypotheses are related to the degree of activeness and the level of influence respectively of industry representatives from the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector in the policy formulation process via the MITI Dialogue, and environmental performance. The results in Table 8.1 show that the null hypothesis at the significance level of five percent is not rejected for the first to the sixth sub-hypothesis for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector. This conveys the meaning that there is no significant relationship between the industry involvement in the policy formulation process and environmental performance.

8.2.2 Cooperation Between The Government and Industry in Technological Development and Technological Transfer

The results for the second hypothesis (H2), which is the better the cooperation between the government and industry in technological development and technological transfer, the better the environmental performance, via the operationalization of three sub-hypotheses, are outlined in Table 8.2. The null hypothesis of no relationship between the two variables at the significance level of five percent is not rejected for all three sub-hypotheses for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector. This means that there is no significant relationship between the participation in the courses offered by MATAC, the participation in technological development programs offered by the various government agencies, and government incentives in the form of tax incentives offered by MIDA and MOF for investing in direct or indirect environment-related projects and technologies, and environmental performance for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector. Thus, on an overall basis, there is no significant relationship in the cooperation between the government and industry in technological development and technological transfer, and environmental performance.

8.2.3 Emphasis Of Government Regulatory Efforts On Environmental Issues

Table 8.3 shows the results of the Third Hypothesis (H3), which is the more the government regulatory efforts emphasize on environmental issues, the better the environmental performance, via six sub-hypotheses. The null hypothesis of no relationship at the five percent level is not rejected, for all six sub-hypotheses. This demonstrates that the stringency of inspection and the intensity of enforcement by the DOE, LA and the DOSH with regard to the EQA and related regulations, local by-laws and Occupational Safety and Health Act (OSHA) and related regulations and Factories and Machinery Act (FMA) and related regulations respectively, are not significantly related to environmental performance for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector. Therefore, on an overall basis, there is no significant relationship between government regulatory efforts focusing on environmental issues, and environmental performance.

8.2.4 Preventive Approaches Advocated By The Government Agencies

Table 8.4 shows the four sub-hypotheses that have been operationalized for the Fourth Hypothesis (H4), which is the more preventive the approach advocated by the various government ministries and government agencies, the better the environmental performance. The first aggregate sub-hypothesis is a constitution of the second, third and fourth sub-hypothesis for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector. The results show that at the significance level of five percent, the null hypothesis is not rejected for all the sub-hypotheses. This means that the advocacy by the various government ministries and government agencies of ISO9000 standards, ISO14000 standards and ISO18000 standards has no significant relationship with environmental performance for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector. Thus, on an overall basis, there is no significant relationship between the preventive approaches advocated by the various government ministries and government agencies, and environmental performance.

8.2.5 Local Communities' Involvement In Environmental Monitoring

The result for the Fifth Hypothesis (H5), which is the higher the local communities' involvement via the institutional structure in environmental monitoring, the better the environmental performance, is illustrated in Table 8.5. The null hypothesis is not rejected at the five percent level for this hypothesis means that there is no significant relationship between the government related community infrastructure in environmental monitoring and environmental performance for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector. Thus, on an overall basis, there is no significant relationship between the local communities' involvement in environmental monitoring, and environmental performance.

8.3 Analysis of Data For The Postulated Hypotheses In The Industry-Industry Linkage

8.3.1 The Exposure To International Trade

As shown in Table 8.6(i), two aggregate sub-hypotheses have been operationalized for the Sixth Hypothesis (H6), which is the higher the exposure to international trade, the better the environmental performance. The two aggregate sub-hypotheses are the export of products (H6.1) and the imposition of environmental standards for market access to the export markets (H6.2). The aggregate first and second sub-hypothesis is a constitution of the third to thirteenth sub-hypothesis and the fourteenth to twenty-fourth sub-hypothesis respectively. The null hypothesis is not rejected at the five percent significance level for the high-pollutant generating sub-sector for the aggregate first and second sub-hypothesis. This means that on an aggregate basis, there is no significant relationship between the exports of products according to region and the imposition of environmental standards for market access to the export markets, and environmental performances for the high-pollutant generating sub-sector.

The supporting hypotheses, the third to thirteenth sub-hypotheses, are outlined in Table 8.6(ii). The null hypothesis is not rejected at the five percent significance level for the exports of products based on region to the non-EU Europe markets, African markets, Oceanic markets, ASEAN markets, West Asian markets and Other markets for the overall TAPC as shown in Table 8.6(ii). The null hypothesis is also not rejected at the five percent significance level for the exports of products based on region to the EU markets, North American markets, Oceanic markets, ASEAN markets, West Asian markets and Other markets for the high-pollutant generating sub-sector. This means that there is no significant relationship between the exports to the above regions, and environmental performance, for the high-pollutant generating sub-sector. For the low-pollutant generating sub-sector, the null hypothesis is also not rejected at the five percent significance level for the non-EU markets, African markets, East Asian markets, ASEAN markets, West Asian markets and Other markets. This means that there is no significant relationship between the exports to the above regions, and environmental performance, for the low-pollutant generating sub-sector.

Likewise, a replication of no significant relationship at the five percent level exists between the imposition of environmental standards for market access for the above markets with the exception of the African markets, ASEAN markets, West Asian markets and Other markets, and environmental performance for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector as illustrated in Table 8.6(iii). No correlation coefficient is computed as the independent variable is a constant (universal same responses for all respondents) for the exceptions. However, the following regions or hypotheses have the null hypothesis (H_0) being rejected with the acceptance of the alternative hypothesis (H_a) of positive correlation:-

Third sub-hypothesis for H6:	The higher the export from the overall TAPC (H6.3.1) (τ_b = .418, $p < 0.01$, n=38) and low-pollutant generating sub-sector (H6.3.3) (τ_b = .441, $p < 0.05$, n=18) to the EU markets, the better the environmental performance.
Fifth sub-hypothesis for H6:	The higher the export from the overall TAPC (H6.5.1) (τ_b = .445, $p < 0.01$, n=38) and low-pollutant generating sub-sector (H6.5.3) (τ_b = .599, $p < 0.01$, n=18) to the North American markets, the better the environmental performance.
Tenth sub-hypothesis for H6:	The higher the export from the overall TAPC (H6.10.1) (τ_b = .373, $p < 0.01$, n=38) to the East Asian markets, the better the environmental performance.
Fourteenth sub-hypothesis for H6:	The higher the level of imposition of environmental standards for access to the EU markets for the overall TAPC (H6.14.1)(τ_b = .445 , $p < 0.01$, n=38) and low-pollutant generating sub-sector (6.14.3)(τ_b = .673 , $p < 0.01$, n=18), the better the environmental performance.
Sixteenth sub-hypothesis for H6:	The higher the level of imposition of environmental standards for access to the North American markets for the overall TAPC (6.16.1) (τ_b = .431, $p < 0.01$, n=38) and low-pollutant generating sub-sector (H6.16.3) (τ_b = .490, $p < 0.05$, n=18), the better the environmental performance.

Twenty-first sub-hypothesis for H6: The higher the level of imposition of environmental standards for access to the East Asian markets for the overall TAPC (H6.21.1) (τ_b = .324, $p < 0.05$, n=38), the better the environmental performance.

The third and fourteenth sub-hypothesis, the fifth and sixteenth sub-hypothesis, and the tenth and twenty-first sub-hypothesis, are related to one another based on the same geographical markets and as such, a tandem discussion will be carried out. The third, fifth and tenth sub-hypotheses for the overall TAPC have a significant relationship at the more stringent one percent. The low-pollutant generating sub-sector has a significant relationship at the more stringent one percent for the fifth sub-hypothesis and the less stringent five percent for the third sub-hypothesis and these have in part contributed to the significant relationship at the more stringent one percent for the third and fifth sub-hypothesis for the overall TAPC. A fairly similar scenario also exists for the fourteenth, sixteenth and twenty-first sub-hypothesis where: (1) the results for the third sub-hypothesis parallels with that of the fourteenth sub-hypothesis for the overall TAPC at the more stringent one percent significance level, but for the fourteenth sub-hypothesis is significant at the more stringent one percent level for the low-pollutant generating sub-sector as compared to the less stringent five percent level for the third sub-hypothesis. (2) the results for the fifth sub-hypothesis parallels with the sixteenth sub-hypothesis for the overall TAPC at the more stringent one percent significance level for the sixteenth sub-hypothesis, it is significant at the less stringent five percent for the low-pollutant generating sub-sector as compared to the more stringent one percent for the fifth sub-hypothesis, and (3) the tenth sub-hypothesis parallels with the twenty-first sub-hypothesis for the overall TAPC with the variation that the twenty-first sub-hypothesis is significant at the less stringent five percent as compared to the tenth sub-hypothesis at the more stringent one percent.

For the EU markets, the North American markets and the East Asian markets, especially Japan, exports to these regions are also dictated by the imposition of environmental standards, like the Oekotex Standard 100 (azo-free dyes), WRAP certification and brand-marketer or vendor specific environmental standards. For the North American markets, especially the USA market, WRAP certification is a necessity for most apparel imports. The higher level of imposition of environmental requirements is a major driving force for compliance for the overall Malaysian TAPC. If compliance is not forthcoming, market access will be denied. The results also show that in terms of sub-sectoral variation, the significant relationship for the low-pollutant generating sub-sector for both the EU markets and North American markets is due mainly to compliance with "human-ecological" requirements (Oekotex Standard 100), human rights requirements like employment terms and workplace conditions (WRAP certification) and firm-based environmental standards for gaining market access. The high-pollutant generating sub-sector has no significant relationship for both these markets is due in part to inefficient wastewater management (a few TNCs impose proper wastewater management) and also with some players like the standalones or lowly-vertically integrated groups which solely serve the domestic market. Thus, they do not see the need to comply with such environmental standards at this juncture.

8.3.2 The Level Of Vertical Integration

Table 8.7 shows the results for the Seventh Hypothesis (H7), which is the higher the level of vertical integration, the better the environmental performance. The null hypothesis is not rejected at the five percent significance level for the high-pollutant generating sub-sector. This means that there is no significant relationship between vertical integration, and environmental performance of the high-pollutant generating sub-sector.

The null hypothesis is rejected with the acceptance of the alternative hypothesis of positive correlation at the more stringent one pecent significance level for the overall TAPC (H7.1.1) (τ_b = .383, $p < 0.01$, n=38) and the less stringent five percent significance level for the low-pollutant generating sub-sector (H7.1.3) (τ_b = .506, $p < 0.05$, n=18). The strong significant relationship for the overall TAPC carries the implication that the higher the level of vertical integration, the better the environmental performance.

Vertically integrated groups are dominated by large corporations that are either locally or foreign public-listed. These vertically integrated groups have a deeper pocket to finance initiatives to fulfill environmental requirements. As the Malaysian TAPC is export-oriented, fulfilling the environmental requirements means gaining or maintaining market access. Obtaining OekoTex Standard certification, WRAP certification and other forms of certification like ISO9000, ISO14000 and ISO18000 standards serves the dual purpose of not only gaining market entry but also as a marketing tool. The results also show that in terms of sub-sectoral variation, the low-pollutant generating sub-sector has a significant relationship albeit at the less stringent five percent significance level as compared to no significant relationship for the high-pollutant generating sub-sector. This carries the implication that the vertically-integrated groups in the low-pollutant generating sub-sector are able to undertake initiatives to fulfill environmental requirements or standards. The major environmental problems for the low-pollutant generating sub-sector are air emissions and noise nuisance. Both air emissions and noise nuisance are relatively easy to abate for the vertically integrated groups which have a deeper pocket. Moreover, for meeting "human-ecological" (Oekotex Standard 100) requirements, these vertically integrated groups impose strict conditions on the use of acceptable azo-free dyes and finishes on their commission wet processors. However, for the high-pollutant generating sub-sector, the various wastewater streams mean that pollution abatement requires a larger capital outlay. For standalones or lowly vertically integrated groups in the high-pollutant generating sub-sector which serve the domestic market, a shallower pocket may deter investment in highly effective pollution abatement systems. Vertically integrated groups with wet processing are beginning to feel the pressure from some TNCs on wastewater management but have yet to arrive at the tipping point. This situation is also exacerbated by factories that have to comply with the stricter Standard A parameters for effluent in the EQA (ILBS 2004). The major and oft-heard complaint is that Standard A parameters are equivalent to the Standards for Reverse Osmosis bottled drinking water. These Standard A parameters in the eye of wet processing players in the TAPC are virtually impossible to achieve.

8.3.3 The Intensity of International Relationship

Tables 8.8(i) and 8.8(ii) show the results for the Eighth Hypothesis (H8), which is the more intensive the international relationship, the better the environmental performance. This hypothesis is operationalized via two aggregate sub-hypotheses, one for the parent company of the overseas customers and the other for the overseas customers. Both the aggregate sub-hypotheses are each made up of a further three sub-hypotheses. Each of these supporting sub-hypotheses is based on an activity that is related to environmental collaboration. The first aggregate sub-hypothesis is made up of the second sub-hypothesis to the fourth sub-hypothesis whereas the fifth aggregate sub-hypothesis is made up of the sixth sub-hypothesis to the eighth sub-hypothesis.

The results for the first aggregate sub-hypothesis, which is related to the parent company of the overseas customers show that no significant relationship exists. The supporting sub-hypotheses which comprise of the constituent second sub-hypothesis, namely the sharing of updates on environmental regulations, the third constituent sub-hypothesis, namely the sharing of the development of minimum environmental requirements for products/services and the fourth constituent sub-hypothesis, namely the development and audit of product safety and quality, also show no significant relationship.

The results for the overseas customers show that no significant relationship exists for both the constituent seventh sub-hypothesis and eighth sub-hypothesis for the low-pollutant generating sub-sector. This means that the sharing of the development of minimum environmental requirements for products or services and the development and audit of product safety and quality have no significant relationship with environmental performance for the low-pollutant generating sub-sector.

The results also show that the rejection of the null hypothesis and the acceptance of the alternative hypothesis of positive correlation are found for the following:-

The fifth aggregate sub-hypothesis for H8:	The more the aggregate activities on environmental collaboration shared with the overseas customers with the overall TAPC (H8.5.1) (τ_b = .520, $p < 0.01$, n=38), high-pollutant generating sub-sector (8.5.2) (τ_b = .540, $p < 0.01$, n=20) and low-pollutant generating sub-sector (8.5.3) (τ_b = .446, $p < 0.05$, n=18), the better the environmental performance.
The sixth sub-hypothesis for H8:	The sharing of updates on environmental regulations by the overseas customers with the overall TAPC (H8.6.1) (τ_b = .474, $p < 0.01$, n=38), high-pollutant generating sub-sector (H8.6.2) (τ_b = .479, $p < 0.05$, n=20), and

low-pollutant generating sub-sector (H8.6.3) (τ_b = .446, $p < 0.05$, n=18), the better the environmental performance.

The seventh sub-hypothesis for H8: The sharing of the development of minimum environmental requirements for products/services by the overseas customers with the overall TAPC (H8.7.1) (τ_b = .272, $p < 0.05$, n=38), the better the environmental performance.

The eighth sub-hypothesis for H8: The development and audit of product safety and quality by the overseas customers with the overall TAPC (H8.8.1) (τ_b = .547, $p < 0.01$, n=38) and high-pollutant generating sub-sector (H8.8.2) (τ_b = .590, $p < 0.01$, n=20), the better the environmental performance.

The significant relationship at the more stringent one percent for the fifth aggregate sub-hypothesis for the overall TAPC as shown in Table 8.8(ii) is due mainly to the significant relationship at the more stringent one percent of both the constituent sixth and eighth sub-hypothesis and also the significant relationship at the lesser stringent five percent for the seventh sub-hypothesis for the overall TAPC. This means that for the overall TAPC, the sharing of updates on environmental regulations, the sharing of the development of minimum environmental requirements for products or services, and the development and audit of product safety and quality have significant relationship with better environmental performance.

The significant relationship at the more stringent one percent for the fifth aggregate sub-hypothesis for the high-pollutant generating sub-sector as shown in Table 8.8(ii) is mainly due to the significant relationship at the more stringent one percent for the eighth sub-hypothesis and in part by the significant relationship at the less stringent five percent for the sixth sub-hypothesis for the high-pollutant generating sub-sector. This means that the collaborative efforts via development and audit of product safety and quality, and to a lesser extent sharing of updates on environmental regulations are significantly related to environmental performance for the high-pollutant generating sub-sector. The significant relationship at the less stringent five percent for the fifth aggregate sub-hypothesis for the low-pollutant generating sub-sector is mainly due to the significant relationship at the less stringent five percent for the sixth sub-hypothesis as seen in Table 8.8(ii). This means that the collaborative effort via sharing updates on environmental regulations is significantly related to environmental performance.

The sharing of updates on environmental regulations is a relatively easy task as the communication media is only utilized as compared to the development and audit of product safety and quality. However, the research shows that the development and audit of product safety and quality for the high-pollutant generating sub-sector is accorded a relatively higher priority. This carries the implication that the development and audit of product safety and quality, mainly by global apparel brand marketers and internationally renowned hypermarkets and other retail chains, is in line with the corporate social responsibility or corporate ethics which they espouse. These major brand marketers and retailers, in espousing corporate social responsibility, have to ensure that "human ecology" (Oekotex Standard 100) is not impaired via their product offerings. As part of the global supply chain and also being very close to the end-customers, antagonizing their customers with negative issues like carcinogenic dyestuff, formaldehyde and pesticide content, extractable heavy metals, volatile compounds and such likes do not augur well in building their brands. The above substances come mainly from wet processing and thus the focus of attention is on the high-pollutant generating sub-sector, the underpinning activity being wet processing. One of the main ways in ensuring the elimination of such substances in textile and apparel is the development and audit of product safety and quality for the wet processors. This corporate social responsibility also extends to the development of minimum environmental requirements for products or services for the overall TAPC. Water quality programs for treated dye effluent and less packaging materials are prime examples of the development of minimum environmental requirements.

However, the relatively more rigorous environmental collaborations in the form of sharing of the development of minimum environmental requirements for products or services and also the development and audit of product safety and quality are not statistically significant for the low-pollutant generating sub-sector as such collaborative efforts are given less emphasis. The principal environmental problems for the low-pollutant generating sub-sector are air emissions and noise nuisance within the factory. Such environmental problems are mainly related to occupational safety and health and are relatively easy to mitigate. These environmental problems do not impact on end-consumers of textile and apparel the way wet processors do. This also explains the sub-sectoral variation for the eighth sub-hypothesis which illustrates a significant relationship for the high-pollutant generating sub-sector and a divergent no significant relationship for the low-pollutant generating sub-sector.

8.3.4 The Intensity of Local Collaboration

The results for the Ninth Hypothesis (H9), which is the more intensive the local collaboration, the better the environmental performance, are shown in Table 8.9(i) and (ii). This hypothesis is operationalized via two aggregate sub-hypothesis with each having a composition of three individual sub-hypotheses. The first aggregate sub-hypothesis is for the (local) parent company of the local customers whereas the fifth aggregate sub-hypothesis is for the local customers. The first aggregate sub-hypothesis is a constitution of the second to fourth sub-hypothesis whereas the fifth aggregate sub-hypothesis is a constitution of the sixth to eighth sub-hypothesis. This is a replication of the Eighth Hypothesis (H8) with the only difference being that for the Eighth Hypothesis, the focus is on international collaboration while the Ninth Hypothesis focuses on local collaboration.

The null hypothesis of no relationship at the significance level of five percent is not rejected for all eight sub-hypotheses for the overall TAPC, the high-pollutant generating sub-sector and the low-pollutant generating sub-sector. This means that there is no significant relationship between the sharing of updates on environmental regulations, the sharing of the development of minimum environmental requirements for products or services, and the development and audit of product safety and quality, for both the parent company of the local customers and the local customers, and environmental performance.

8.4 Summary

The five hypotheses of policy formulation process, technological development and technological transfer, regulatory efforts, preventive approach and local communities' involvement via the institutional structure in environmental monitoring are not significantly related to environmental performance. This shows that the TAPC has a strong laissez faire characteristic with limited government interaction.

For the industry-industry linkage, the act of exporting and the imposition of environmental standards for access to the EU markets, North American markets and the East Asian markets are significantly related to environmental performance. Significant relationship exists between vertical integration and environmental performance for the overall TAPC, especially the low-pollutant generating sub-sector as environmental problems are easier to abate. The intensity of international relationship and environmental performance is significantly related due mainly to fulfilling the requirements for corporate social responsibility. However, there is no significant relationship between local collaboration and environmental performance.

Table 8.1 Correlation Coefficients For Industry Involvement In The Policy Formulation Process and Environmental Performance

H1: The more the industry is involved in the policy formulation process, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n=18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H1.1) for H1	Degree of Activeness of industry representatives in the aggregate policy formulation process	$\tau_b = 0.179$ $p = 0.160$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.243$ $p = 0.176$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.259$ $p = 0.185$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.
Second sub-hypothesis (H1.2) for H1	Level of Influence of industry representatives in the aggregate policy formulation process	$\tau_b = 0.199$ $p = 0.117$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.235$ $p = 0.188$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.321$ $p = 0.102$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.
Third sub-hypothesis (H1.3) for H1	Degree of activeness of industry representatives in the Standards Committee of Department of Standards Malaysia (DSM)	$\tau_b = 0.158$ $p = 0.215$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.171$ $p = 0.339$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.284$ $p = 0.147$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.
Fourth sub-hypothesis (H1.4) for H1	Level of influence of industry representatives in the Standards Committee of the DSM	$\tau_b = 0.222$ $p = 0.079$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.265$ $p = 0.135$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.359$ $p = 0.065$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a.

Table 8.1 continued

Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n=18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Fifth sub-hypothesis (H1.5) for H1	Degree of activeness of industry representatives in the MITI DIALOGUE	$\tau_b =$ 0.147 p = 0.243 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.129 p = 0.468 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.270 p = 0.162 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Sixth sub-hypothesis (H1.6) for H1	Level of influence of industry representatives in the MITI Dialogue	$\tau_b =$ 0.163 p = 0.195 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.187 p = 0.292 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.147 p = 0.448 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.

Note:
* *Correlation coefficient is significant at p < 0.05 (2-tailed)*
** *Correlation coefficient is significant at p < 0.01 (2-tailed)*
Y : Environmental Performance Indicator

Table 8.2 Correlation Coefficients For Cooperation Between Government and Industry in Technological Development and Technological Transfer and Environmental Performance

H2: The better the cooperation between government and industry in technological development and technological transfer, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H2.1) for H2	Participation in the courses offered by MATAC	$\tau_b =$ 0.186 p = 0.176 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.195 p = 0.314 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.085 p = 0.688 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Second sub-hypothesis (H2.2) for H2	The participation in technological development programs offered by various governmental agencies	$\tau_b =$ 0.032 p = 0.814 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.177 p = 0.359 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ -0.126 p = 0.552 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Third sub-hypothesis (H2.3) for H2	Government incentives in the form of tax incentives offered by MIDA and MOF for investing in direct or indirect environment-related projects and technologies	$\tau_b =$ 0.091 p = 0.511 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.331 p = 0.087 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.011 p = 0.957 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.

Note:
* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 8.3 Correlation Coefficients For Emphasis Of Regulatory Efforts On Environmental Issues and Environmental Performance

H3: The more the government regulatory efforts emphasize on environmental issues, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H3.1) for H3	Stringency of DOE in the inspection of factory operations with regard to EQA and related regulations	$\tau_b =$ 0.083 p = 0.513 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.217 p = 0.230 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.205 p = 0.305 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Second sub-hypothesis (H3.2) for H3	Stringency of LA in the inspection of factory operations with regard to local by-laws and related regulations	$\tau_b =$ 0.179 p = 0.172 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.165 p = 0.363 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.380 p = 0.061 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Third sub-hypothesis (H3.3) for H3	Stringency of DOSH in the inspection of factory operations with regard to OSHA and related regulations and FMA and related regulations	$\tau_b =$ 0.065 p = 0.615. ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.187 p = 0.299 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.315 p = 0.124 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Fourth sub-hypothesis (H3.4) for H3	The intensity of enforcement by the DOE towards the company in complying with EQA and related regulations	$\tau_b =$ 0.135 p = 0.283 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.200 p = 0.265 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.345 p = 0.077 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.

Table 8.3 continued

Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Fifth sub-hypothesis (H3.5) for H3	The intensity of enforcement by the LA towards the company in complying with local by-laws and related regulations	$\tau_b = 0.377$ $p = 0.539$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.220$ $p = 0.217$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.230$ $p = 0.251$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Sixth sub-hypothesis (H3.6) for H3	The intensity of enforcement by the DOSH towards the company in complying with OSHA and related regulations and FMA and related regulations	$\tau_b = 0.098$ $p = 0.434$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0. 068 $p = 0.704$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.346$ $p = 0.073$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.

Note:
* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 8.4 Correlation Coefficients For Preventive Approaches Advocated By The Various Government Ministries and Government Agencies Towards the Company And Environmental Performance.

H**4**: The more preventive the approach advocated by the various government agencies, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H4.1) for H4	Aggregate preventive approaches advocated by the various government ministries and government agencies	$\tau_b = 0.178$ $p = 0.162$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.256$ $p = 0.155$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.110$ $p = 0.572$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Second sub-hypothesis (H4.2) for H4	The advocacy by the various government ministries and government agencies of ISO9000 standards	$\tau_b = 0.201$ $p = 0.112$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.228$ $p = 0.208$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.254$ $p = 0.186$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Third sub-hypothesis (H4.3) for H4	The advocacy by the various government ministries and government agencies of ISO14000 standards	$\tau_b = 0.101$ $p = 0.426$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.236$ $p = 0.191$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.073$ $p = 0.711$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Fourth sub-hypothesis (H4.4) for H4	The advocacy by the various government ministries and government agencies of OHSAS 18000 standards	$\tau_b = 0.\ 132$ $p = 0.317$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.115$ $p = 0.544$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.057$ $p = 0.773$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.

Note:
* Correlation coefficient is significant at $p < 0.05$ (2-tailed)
** Correlation coefficient is significant at $p < 0.01$ (2-tailed)
Y : Environmental Performance Indicator

Table 8.5 Correlation Coefficients For Local Communities' Involvement Via The Institutional Structure In Environmental Monitoring and Environmental Performance

H5: The higher the local communities' involvement via the institutional structure in environmental monitoring, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
H5	Institutional relationship between the local communities and the relevant government authorities with regard to environmental monitoring.	$\tau_b = 0.198$ $p = 0.151$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.169$ $p = 0.383$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.247$ $p = 0.243$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.

Note:
* Correlation coefficient is significant at $p < 0.05$ (2-tailed)
** Correlation coefficient is significant at $p < 0.01$ (2-tailed)
Y : Environmental Performance Indicator

Table 8.6(i) Correlation Coefficients Between Exposure To International Trade And Environmental Performance

H6: The higher the exposure to international trade, the better the environmental performance.							
Hypothesis (G-I)/ Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H6.1) for H6	Exports of products to the overseas markets	**τ_b = 0. 411** p = 0.003 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.358 p = 0.064 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	**τ_b = 0. 435* p = 0.011 ($p < 0.05$ but $p > 0.01$)**	**Reject H_0. Accept H_a at the 5% level.**
Second sub-hypothesis (H6.2) for H6	Imposition of environmental standards for access to the overseas markets	**τ_b = 0.459** p = 0.001 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.368 p = 0.057 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	**τ_b = 0.601** p = 0.004 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**

Note:
* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 8.6(ii) Correlation Coefficients For Exports Of Products Based On Regions And Environmental Performance

H6. The higher the exposure to international trade, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Third sub-hypothesis (H6.3) for H6	Export products to EU markets.	**$\tau_b =$ 0. 418** $p =$ 0.001 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b =$ 0.345 $p =$ 0.063 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	**$\tau_b =$ 0. 441* $p =$ 0.029 ($p < 0.05$ but $p > 0.01$)**	**Reject H_0. Accept H_a at the 5% level.**
Fourth sub-hypothesis (H6.4) for H6	Export products to non EU-Europe markets.	$\tau_b =$ 0.107 $p =$ 0.438 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	*No export*	*No export*	$\tau_b =$ 0.144 $p =$ 0.495 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .
Fifth sub-hypothesis (H6.5) for H6	Export products to North America markets.	**$\tau_b =$ 0. 445** $p =$ 0.001 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b =$ 0.328 $p =$ 0.090 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	**$\tau_b =$ 0. 599** $p =$ 0.004 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**
Sixth sub-hypothesis (H6.6) for H6	Export products to Latin America markets.	*No export*	*No export*	*No export*	*No export*	*No export*	*No export*
Seventh sub-hypothesis (H6.7) for H6	Export products to Middle East markets.	*No export*	*No export*	*No export*	*No export*	*No export*	*No export*
Eighth sub-hypothesis (H6.8) for H6	Export products to Africa market.	$\tau_b =$ 0.246 $p =$ 0.074 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0.305 $p =$ 0.115 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0.267 $p =$ 0.206 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .
Ninth sub-hypothesis (H6.9) for H6	Export products to Oceanic markets.	$\tau_b =$ 0.195 $p =$ 0.157 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0.252 $p =$ 0.193 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	*No export*	*No export*
Tenth sub-hypothesis (H6.10) for H6	Export products to East Asia markets.	**$\tau_b =$ 0. 373** $p =$ 0.006 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	$\tau_b =$ 0.373 $p =$ 0.051 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0.309 $p =$ 0.136 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .

Table 8.6(ii) continued

Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient
Eleventh sub-hypothesis (H6.11) for H6	Export products to ASEAN markets.	$\tau_b = -0.066$ $p = 0.622$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.132$ $p = 0.488$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = -0.313$ $p = 0.126$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.
Twelfth sub-hypothesis (H6.12) for H6	Export products to West Asian markets.	$\tau_b = 0.092$ $p = 0.498$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = -0.117$ $p = 0.543$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.390$ $p = 0.065$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.
Thirteenth sub-hypothesis (H6.13) for H6	Export products to Other markets.	$\tau_b = 0.225$ $p = 0.102$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.185$ $p = 0.340$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.	$\tau_b = 0.267$ $p = 0.206$ $(p > 0.05;$ $p > 0.01)$	Unable to reject H_0. Reject H_a.

Note:
* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 8.6(iii) Correlation Coefficients For The Imposition of Environmental Standards For Access To Overseas Markets and Environmental Performance

(H6.2) for H6: The higher the level of imposition of environmental standards for market access, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient
Fourteenth sub-hypothesis (H6.14) for H6	Imposition of environmental standards for access to EU markets.	**τ_b = 0. 445** p = 0.001 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.311 p = 0.107 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	**τ_b = 0. 673** p = 0.001 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1 % level.**
Fifteenth sub-hypothesis (H6.15) for H6	Imposition of environmental standards for access to non-EU Europe markets.	τ_b = 0.107 p = 0.438 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	*No export*	*No export*	τ_b = 0.144 p = 0.495 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .
Sixteenth sub-hypothesis (H6.16) for H6	Imposition of environmental standards for access to North American markets.	**τ_b = 0. 431** p = 0.002 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.358 p = 0.064 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	**τ_b = 0. 490* p = 0.020 ($p < 0.05$ but $p > 0.01$)**	**Reject H_0. Accept H_a at the 5% level.**
Seventeenth sub-hypothesis (H6.17) for H6	Imposition of environmental standards for access to Latin American markets.	*No export*	*No export*	*No export*	*No export*	*No export*	*No export*
Eighteenth sub-hypothesis (H6.18) for H6	Imposition of environmental standards for access to	*No export*	*No export*	*No export*	*No export*	*No export*	*No export*

Table 8.6(iii) continued

Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient
Nineteenth sub-hypothesis (H6.19) for H6	Imposition of environmental standards for access to African markets.	*No export*	*No export*	*No export*	*No export*	*No export*	*No export*
Twentieth sub-hypothesis (H6.20) for H6	Imposition of environmental standards for access to Oceanic markets.	$\tau_b =$ 0.195 $p =$ 0.157 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.252 $p =$ 0.193 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	*No export*	*No export*
Twenty-first sub-hypothesis (H6.21) for H6	Imposition of environmental standards for access to East Asian markets.	**$\tau_b =$ 0. 324* $p =$ 0.018 ($p < 0.05$ but $p > 0.01$)**	**Reject H_0. Accept H_a at the 5% level.**	$\tau_b =$ 0.319 $p =$ 0.099 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b =$ 0.350 $p =$ 0.098 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Twenty-second hypothesis (H6.22) for H6	Imposition of environmental standards for access to ASEAN markets.	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*
Twenty-third sub-hypothesis (H6.23) for H6	Imposition of environmental standards for access to West Asian markets.	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*
Twenty-fourth sub-hypothesis (H6.24) for H6	Imposition of environmental standards for access to Other markets.	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*

Note:
** Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
*** Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 8.7 Correlation Coefficients Between Vertical Integration and Environmental Performance.

H7: The higher the level of vertical integration, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
	Level of vertical integration	**τ_b = 0. 383** p = 0.004 ($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.344 p = 0.066 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	**τ_b = 0. 506* p = 0.012 ($p < 0.05$ but $p > 0.01$)**	**Reject H_0. Accept H_a at the 5% level.**

Note:
* *Correlation coefficient is significant at p < 0.05 (2-tailed)*
** *Correlation coefficient is significant at p < 0.01 (2-tailed)*
Y : Environmental Performance Indicator

Table 8.8(i) Correlation Coefficients For International Relationship and Environmental Performance (Parent Company Of The Overseas Customers)

H8: The more intensive the international relationship, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H8.1) for H8	Aggregate activities on environmental collaboration shared by the parent company of the overseas customers	$\tau_b =$ 0. 266 p = 0.054 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0.328 p = 0.090 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0.350 p = 0.098 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .
Second sub-hypothesis (H8.2) for H8	Sharing updates on environmental regulations	$\tau_b =$ 0.266 p = 0.054 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0.319 p = 0.099 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0.350 p = 0.098 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .
Third sub-hypothesis (H8.3) for H8	Sharing development of minimum environmental requirements for products	$\tau_b =$ 0.233 p = 0.091 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0.328 p = 0.090 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*
Fourth sub-hypothesis (H8.4) for H8	The development and audit of product safety and quality	$\tau_b =$ 0.229 p = 0.096 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0. 328 p = 0.090 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	$\tau_b =$ 0.135 p = 0.523 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .

Note:
* *Correlation coefficient is significant at p < 0.05 (2-tailed)*
** *Correlation coefficient is significant at p < 0.01 (2-tailed)*
Y : Environmental Performance Indicator

Table 8.8(ii) Correlation Coefficients For International Relationship and Environmental Performance (Overseas Customers)

H8: The more intensive the international relationship, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
Fifth sub-hypothesis (H8.5) for H8	Aggregate activities on environmental collaboration shared by the overseas customers	**τ_b = 0. 520**** **p = 0.000** **($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	**τ_b = 0.540**** **p = 0.005** **($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	**τ_b = 0. 446*** **p = 0.035** **($p < 0.05$ but $p > 0.01$)**	**Reject H_0. Accept H_a at the 5% level.**
Sixth sub-hypothesis (H8.6) for H8	Sharing updates on environmental regulations	**τ_b = 0. 474**** **p = 0.001** **($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	**τ_b = 0. 479*** **p = 0.013** **($p < 0.05$ but $p > 0.01$)**	**Reject H_0. Accept H_a at the 5% level.**	**τ_b = 0. 446*** **p = 0.035** **($p < 0.05$ but $p > 0.01$)**	**Reject H_0. Accept H_a at the 5% level.**
Seventh sub-hypothesis (H8.7) for H8	Sharing the development of minimum environmental requirements for products/ Services	**τ_b = 0. 272*** **p = 0.048** **($p < 0.05$ but $p > 0.01$)**	**Reject H_0. Accept H_a at the 5% level.**	τ_b = 0.232 p = 0.231 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .	τ_b = 0.390 p = 0.065 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .
Eighth sub-hypothesis (H8.8) for H8	The development and audit of product safety and quality	**τ_b = 0. 547**** **p = 0.000** **($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	**τ_b = 0. 590**** **p = 0.002** **($p < 0.05$; $p < 0.01$)**	**Reject H_0. Accept H_a at the 5% level and also at the more stringent 1% level.**	τ_b = 0.315 p = 0.136 ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a .

Note:
* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 8.9(i) Correlation Coefficients For Local Collaboration and Environmental Performance (Local Parent Company Of The Local Customers)

H9: The more intensive the local collaboration by the company, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b ; Observed p value;	Testing for hypothesis for the correlation coefficient
First sub-hypothesis (H9.1) for H9	Aggregate activities on environmental collaboration shared by the local parent company of the local customers	$\tau_b = 0.181$ $p = 0.188$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .	$\tau_b = 0.169$ $p = 0.383$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .	$\tau_b = 0.180$ $p = 0.394$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .
Second sub-hypothesis (H9.2) for H9	Sharing updates on environmental regulations	$\tau_b = 0.200$ $p = 0.147$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .	$\tau_b = 0.149$ $p = 0.440$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .	$\tau_b = 0.285$ $p = 0.178$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .
Third sub-hypothesis (H9.3) for H9	Sharing development of minimum environmental requirements for products	$\tau_b = 0.163$ $p = 0.237$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .	$\tau_b = 0.186$ $p = 0.336$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .	$\tau_b = 0.350$ $p = 0.098$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .
Fourth sub-hypothesis (H9.4) for H9	The development and audit of product safety and quality	$\tau_b = 0.165$ $p = 0.231$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .	$\tau_b = 0.073$ $p = 0.704$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .	$\tau_b = 0.275$ $p = 0.193$ $(p > 0.05; p > 0.01)$	Unable to reject H_0. Reject H_a .

Note:
* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

Table 8.9(ii) Correlation Coefficients For Local Collaboration and Environmental Performance. (Local Customers)

H9: The more intensive the local collaboration by the company, the better the environmental performance.							
Sub-hypothesis	Variables X	Overall TAPC		High-pollutant generating sub-sector (wet processing and wet processing integrated combines)		Low- pollutant generating sub-sector (spinning, spinning and weaving; knitting, knitting and garment; Garment)	
		Sample size, n=38		Sample size, n=20		Sample size, n= 18	
		Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value ;	Testing for hypothesis for the correlation coefficient	Correlation Coefficient, τ_b; Observed p value;	Testing for hypothesis for the correlation coefficient
Fifth sub-hypothesis (H9.5) for H9	Aggregate activities on environmental collaboration shared by the local customers	$\tau_b = 0.204$ $p = 0.139$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.247$ $p = 0.201$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.360$ $p = 0.088$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Sixth sub-hypothesis (H9.6) for H9	Sharing updates on environmental regulations	$\tau_b = 0.159$ $p = 0.248$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.184$ $p = 0.342$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.326$ $p = 0.123$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.
Seventh sub-hypothesis (H9.7) for H9	Sharing development of minimum environmental requirements for products/ services	$\tau_b = 0.212$ $p = 0.124$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.329$ $p = 0.089$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	*No correlation coefficient is computed.*	*No correlation coefficient is computed.*
Eighth sub-hypothesis (H9.8) for H9	The development and audit of product safety and quality	$\tau_b = 0.076$ $p = 0.582$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.137$ $p = 0.478$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.	$\tau_b = 0.190$ $p = 0.369$ ($p > 0.05$; $p > 0.01$)	Unable to reject H_0. Reject H_a.

Note:
* *Correlation coefficient is significant at $p < 0.05$ (2-tailed)*
** *Correlation coefficient is significant at $p < 0.01$ (2-tailed)*
Y : Environmental Performance Indicator

CHAPTER 9
Comparative Analysis Between The Palm Oil Production Chain And The Textile And Apparel Production Chain

9.1 Introduction

This chapter covers the comparative analysis between the palm oil sector and the textile and apparel sector with respect to the government-industry relations and the industry-industry relations. Section 9.2 covers the government-industry linkage via a comparative analysis of the POPC and TAPC in terms of significant relationships for the 5 hypotheses postulated, as listed in Table 9.1. Likewise, Section 9.3 covers the industry-industry linkage via a comparative analysis of the POPC and TAPC in terms of the significant relationships for the 4 hypotheses postulated, as listed in Table 9.2. The last section, Section 9.4, covers a discussion of the main findings of this comparative analysis by focusing on sectoral variations.

9.2 Government - Industry Linkage

Table 9.1 Comparison Of Significant Relationships For The G-I Linkage For The POPC and TAPC

POPC						TAPC					
H	Sub Hyp	Postulation	OV POPC	POMSS	DSMSS	H	Sub-Hyp	Postulation	Ov TAPC	HPGSS	LPGSS
H1	1st	Activeness in MPOB for aggregate policy formulation	-	**	-	H1		Involvement in policy formulation	-	-	-
	2nd	Influence in MPOB for aggregate policy formulation	-	**	-						
	3rd	Activeness in MPOB's OER policy	*N Ap*	*	*N Ap*						
	4th	Influence in MPOB's OER policy	*N Ap*	*	*N Ap*						
	5th	Activeness in MPOB's Value Added Downstream Policy	-	**	-						
	6th	Influence in MPOB's Value Added Downstream Policy	-	**	-						
	7th	Activeness in MPOC for aggregate policy formulation	*	**	-						
	8th	Influence in MPOC for aggregate policy formulation	**	**	-						
	9th	Activeness in MPOC's Task Force on Environment	-	**	-						
	10th	Influence in MPOC's Task Force on Environment	*	**	-						

POPC						TAPC							
H	**Sub Hyp**	**Postulation**	**O V PO PC**	**PO M SS**	**DS M SS**	**H**	**Sub-Hyp**	**Postulation**	**Ov TA PC**	**HP G SS**	**LP G SS**
	11th	Activeness in MPOC's Promotion of Oils and Fats In International Market	*	**	-						
	12th	Influence in MPOC's Promotion of Oils and Fats In International Market	*	**	-						
H 2		Cooperation in Technological Development and Technological Transfer	-	-	-	H2		Cooperation in Technological Development and Technological Transfer	-	-	-
H 3		Government regulatory efforts on environment	-	-	-	H3		Government regulatory efforts on environment	-	-	-
H 4	1st	Aggregate preventive approaches advocated by the various government agencies	**	**	*	H4		Preventive approaches advocated by various government agencies	-	-	-
	2nd	Advocacy of ISO9000 standards by the various government agencies	**	**	-						
	3rd	Advocacy of ISO14000 standards by the various government agencies	**	**	-						
	4th	Advocacy of OHSAS18001 standards by the various government agencies	**	**	*						
	5th	Advocacy of HACCP standards by the various government agencies	-	-	-						
H 5		Local communities involvement in environmental monitoring	-	-	-	H5		Local Communities involvement in environmental monitoring	-	-	-

Notes:
*** : Significant at $p < 0.01$*
** : Significant at $p < 0.05$*
- : No significant relationship
NAp: Not Applicable

H: Hypothesis
Sub-Hyp: Sub-Hypothesis
OvPOPC: Overall POPC
POM: Palm Oil Milling
DSSS: Downstream Sub-sector
OvTAPC: Overall TAPC
HPGSS: High-Pollutant Generating Sub-sector
LPGSS: Low-Pollutant Generating Sub-sector

Table 9.1 outlines all five hypotheses with either the presence or absence of significant relationship. This section covers the results of the significant relationship for the 5 hypotheses postulated in the G-I linkage.

Comparison For The First Hypothesis

The results for the First Hypothesis (H1), which is the more the industry is involved in the policy formulation process, the better the environmental performance, show that significant relationship exists for all sub-hypotheses (aggregate and constituents) for the upstream palm oil milling sub-sector, a part of the POPC and also for five sub-hypotheses for the overall POPC whereas no significant relationship is recorded for the TAPC. This sectoral variation carries the implication that the more the palm oil milling (POM) sub-sector, a part of the POPC, is involved in the policy formulation process, the better the environmental performance. The palm oil milling sub-sector is the most polluting in the POPC and also the most vulnerable manufacturing activity in terms of environmental pollution of the palm oil supply chain. However, as a result of the oil palm and palm oil industry being one of Malaysia's largest revenue earners and also for its long-term socio-economic development (government agencies involved in poverty eradication and socio-economic restructuring), this industry is accorded high priority by the Federal Government. Government related institutions like the MPOB and MPOC are established with the purpose of looking after the strategic interest of the industry. Participation of industry specific private sector representatives in the Executive Board of MPOB and MPOC, and thus in the policy formulation process, have promulgated and yielded effective policies. The OER policy and the Value-Added Downstream policy by the MPOB, and the Task Force on the Environment and the general Promotion of Oils and Fats in the International Markets by the MPOC have sensitized the players in the oil palm and palm oil chain, especially the upstream palm oil milling sub-sector, to adopt good agricultural and manufacturing practices that lead to better environmental performances. As palm oils and fats are mainly edible-related, they compete with other oils and fats in the international market. But these alternative oils and fats may not have the environmental baggage of the anti-palm oil campaigns, which focus mainly on the destruction of natural forest and also the destruction of the natural habitat of the *orang utan*. These anti-palm oil campaigns have acted as a catalyst in spurring environmental initiatives. Many respondents from the upstream palm oil milling sub-sector have highlighted this salient point. The palm oil milling sub-sector, the weakest link in the POPC, has to be seen not only 'talking the walk' but also 'walking the talk' in terms of environmental initiatives undertaken. At the same time, these policies are palatable as they involved industry-specific private sector representatives in the formulation process.

The genesis of the Oil Extraction Rate (OER) policy was a result of a joint initiative in the policy formulation process. This undertaking which was later made into a national policy was developed jointly by the Johore state MPOB and Southern Peninsular POMA (Tay 2003; Yu 2003). A few milling respondents recounted the development of this policy. Millers from Southern Peninsular POMA faced the perennial problem of unripe or not fully ripe FFBs sold by the oil palm smallholdings to the millers. Some of the small holdings were more concerned about maximizing income as the FFBs were sold on a tonnage basis. The more the smallholders can sell to the millers, the more they will eventually earn. This consequently led to lower extraction rates and poorer quality of CPO. A dialogue was held between the Johore State MPOB and Southern Peninsular POMA to resolve this issue. The measures taken eventually led to the situation that the millers would not accept unripe or not fully ripe FFBs. These unwanted FFBs would be placed in an area where the smallholders, if they so wish, could collect back for themselves. The smallholders would also incur a penalty of RM10.00 per bunch. This return cum penalty policy, to a very large extent, has led to better harvesting practices not only from the smallholdings but also the plantations as these good practices were diffused and assimilated in the oil palm growers' fraternity. Concomitantly, ripe FFBs would also ensure a higher OER and better quality CPO. In addition, the licensing requirement for mill operation came under the purview of MPOB. This leverage, thus allows MPOB to impose a minimum 18% OER policy. Millers flouting this policy of having OER lower than 18% will have their licenses withdrawn. This policy has a positive effect, both from an economic and environmental perspective as more oil is recovered and in tandem lesser unrecovered oil will contribute to lesser waste generated.

The upstream palm oil millers, with the benefit of hindsight, can see the positive development in the value-added downstream policy jointly developed by MPOB and industry. MPOB is seen to be encouraging the oil palm and palm oil actors to value add, especially in relation to palm oil wastes. This is also viewed as a means by many of the milling respondents to counter the anti-palm oil campaigns. A respondent indicated that it has a medium density fiberboard factory in the vicinity of the palm oil mill, with palm fiber as the main input. A number of milling respondents also indicated that palm fiber is also used by many nurseries as soil cover for potted plants to retain moisture. Another respondent indicated that broken shells are manufactured into activated carbon for water filtration purposes. Fiber and broken shells, which fetch no economic value in the earlier years, are today valuable. Especially broken shells have economic value, selling at RM80 per ton (USD 21.05 per ton). A few milling respondents also indicated that palm oil wastes have prospects as Clean Development Mechanism projects under the Kyoto Protocol.

The involvement of MPOC and industry players in the policy formulation process of the Task Force on the Environment and the general Promotion of Oils and Fats in the International Markets have sensitized the players in the POPC, especially the upstream palm oil milling sub-sector, to adopt good manufacturing practices. Many of the respondents, especially the palm oil millers, view that the adoption of good manufacturing practices is an effective way of countering the anti-palm oil campaigns. Many milling respondents stress that treated POME is channeled into the fields and is treated as an economic resource and not as waste. Two respondents indicated very distinctly that they are an integral part of the food chain and have to ensure that the best manufacturing practices are adopted. Both the factories are particularly clean with not only good housekeeping but also attractive landscaping outside the factory premises.

The effectiveness of these policies is also due in part to the duality of purpose, one addressing financial returns like higher oil yield, value-added downstream products and increasing marketability, and the other addressing environmental improvements like less oil wastage, better higher-value added utilization of oils and fats, and better utilization of biomass wastes. This helps in explaining the significant relationship between industry involvement in the policy formulation process and environmental performance.

In comparison, the TAPC, even though a major revenue earner for the country, is declining in importance with the advent of post MFA. The textile and apparel industry is accorded a lower priority by the federal government. The only government related institution is MATAC, which is basically a training institute. The lack of industry specific government related institutions have led to a paucity of industry specific policies, which also includes industry specific environmental policies. As the wet processing activities in the TAPC generate a high volume of effluent, no state intervention in the form of developing environmental technologies together with the industry occurred like in the early years for the POPC. In addition, the industry involvement in the MITI's Dialogue (generally once a year) does not provide sufficient weight and depth like an industry-specific government related institution as MPOB, which can deliberate and promulgate effective policy.

Comparison For The Second Hypothesis

The results from the Second Hypothesis (H2), which is the better the cooperation between the government and the industry in technological development and technological transfer, the better the environmental performance, show no significant relationship for both the POPC and the TAPC. At the sub-hypothesis level there is also no significant relationship in cooperation between the government and the industry for both the POPC and the TAPC in the adoption of technologies and the participation in technological development programs offered by the various industry specific government institutions and other government agencies. In addition, there is also no significant relationship for both the POPC and the TAPC in the form of tax incentives offered by MIDA and MOF for investing in direct or indirect environment-related projects and technologies, and environmental performance. One of the major drawbacks faced by many industries and not only the POPC and the TAPC is the highly procedurized bureaucratic processes which hinder and deter the private sector from such collaborative efforts. A few of the respondents from the non-GLCs in the POPC voiced their unhappiness in terms of having to contribute a cess to MPOB but at the same time have to pay for the technologies developed by it. They also indicated that the negotiation, pricing and the eventual transfer of technology are too time-consuming and highly bureaucratic. A respondent which is co-developing a technology in-situ at the mill with MPOB also indicated the bottleneck of slow responses. For the other government agencies, the major complaints are bureaucracy or red tape in terms of too many procedures to follow and the slow process in decision making. This helps in explaining why there is no significant relationship between the government and the industry in technological development and technological transfer and environmental performance. In addition, tax incentives offered by MIDA and MOF for investing in direct or indirect environment-related projects and technologies are not taken up by many relatively smaller non-GLCs in the POPC and a vast majority in the TAPC are facing bureaucratic procedures, too many criteria to fulfill, and the slow process in decision making. A number of respondents has voiced the opinion that they did not apply for such incentives as they perceived the above problems to be ingrained in the public delivery process. These explanations also helped in explaining why there is no significant relationship for both the POPC and the TAPC between tax incentives offered by MIDA and MOF for investing in direct or indirect environment-related projects and technologies, and environmental performance.

Comparison For The Third Hypothesis

The results illustrate that there is no significant relationship for both the POPC and the TAPC for the Third Hypothesis (H3), which is the more the government regulatory efforts emphasize on environmental issues, the better the environmental performance. This is due to the fact that there is no significant relationship for both the POPC and TAPC between the stringency of inspection and the intensity of enforcement by the Department of Environment DOE, LA and DOSH with regard to the Environmental Quality Act (EQA) and related regulations, local by-laws, OSHA and related regulations cum FMA and related regulations respectively, and environmental performance. It has been reported in the press that there is a sufficient number of environmental laws to "hang an elephant on the wall" (Goh Ban Lee 2006) but poor enforcement is a major drawback. There is very high variability in enforcement by DOE. TAPC respondents from Minyak Beku, for instance, indicated there is no monitoring and enforcement by DOE up until recently, prior to DOE setting up a branch office in Batu Pahat (the largest town in the vicinity). The majority of knitting respondents indicated that there has been no monitoring and enforcement by DOE. Likewise, no monitoring and enforcement is carried out on all palm kernel crushing respondents as they are deemed to be very environmentally friendly. The refining respondents indicated that the visits by DOE are sporadic and their staff would only come when pollution problems surface. In cases of environmental violation detected by DOE, remedial actions taken must be in accordance to DOE requirements. The remedial works need to be photographed and sent to DOE. The maxim of *no news is good news* applies if there are no further responses from DOE.

Variability also exists in enforcement by DOSH. Some respondents in the POPC indicated that DOSH would carry out inspection in a fifteenth month interval subjected to extension. These respondents indicated they will do the necessary to ensure the attainment of approval for their machineries prior to inspection. A few relatively smaller respondents in the POPC highlighted that DOSH will only carry out inspection when problems occur. If a problem occurs and is reported, DOSH will pay a visit and recommend remedial actions. However, there is variability in terms of follow up visits according to these respondents. For the TAPC, vertically integrated groups are inspected on a fifteenth month interval subjected to extension. The relatively smaller respondents involved in knitting and garment manufacturing say that DOSH has not yet visited them before. For the LA, virtually no enforcement is carried out in the view of a large majority of respondents from both the POPC and the TAPC.

The variability in enforcement in terms of intensity and stringency also aid in explaining the existence of no significant relationship for both the POPC and TAPC between the stringency of inspection and the intensity of enforcement by the DOE, LA and DOSH, and environmental performance. This in turn helps in explaining on an overall basis the existence of no significant relationship between government regulatory efforts emphasizing on environmental issues and environmental performance.

Comparison For The Fourth Hypothesis

The results show that for the Fourth Hypothesis (H4), which is the more preventive the approach advocated by the various government ministries and agencies, the better the environmental performance, significant relationship exists for four sub-hypotheses for the overall POPC and the upstream palm oil milling sub-sector and also two out of four sub-hypotheses for the downstream manufacturing sub-sector. However, for the TAPC, no significant relationship exists at all. ISO certification like the ISO9000 standards, the ISO14000 standards and OHSAS 18000 standards have become part of the standard operating procedures, starting with some Federal Ministries and cascading down to government agencies and government-linked companies in all sectors, inclusive of the oil palm and palm oil industry. The greater emphasis on such certifications by the palm oil milling sub-sector is part of the process of strengthening the weakest link. This is very much in evidence for Felda and GLCs. Felda and GLCs, having a longer history and deeper pocket and the need to toe the government line, have adopted such certifications to comply with the requirements in the farm to fork supply chain and concomitantly fulfilling environmental care, thus blunting and providing the tools to counter the environmental criticisms. Two milling respondents perceptively illustrated these preventive measures as sharing the responsibility of environmental management. They also contended that by instituting the preventive approach as part of the standard operating procedures, the necessary conditions for self-regulations are invoked. This also means that part of the responsibility in environmental improvement can also be transferred from the state to the economic actors in the POPC. The adoption of such preventive approaches by government ministries and departments provide the cue that Felda and GLCs should follow suit.

No significant relationship exists for the TAPC as there are no GLCs and very little or no government equity within the sector. The TAPC has a dominant *laissez faire* characteristic. The government advocacy of preventive measures has limited effect as there are no push and pull factors. The absence of pull factors is due to the lack of incentives for the companies in the sector, whereas the absence of push factors is due to the voluntary rather than mandatory nature of preventive measures advocated by the government (which is by the way also true for the POPC sector).

Comparison For The Fifth Hypothesis

The postulation of the Fifth Hypothesis, which is the higher the local communities' involvement via the institutional structure in environmental monitoring, the better the environmental performance, is not significant for both the POPC and the TAPC. Local communities' involvement can take place via formal institutional relations like seminars, workshops and official channels of communication, and via informal relations such as complaints via phone calls, office visits and letters by the representatives of local communities and interested individuals. If complaints of environmental violations are being made by the local communities, the respondents from both the POPC and the TAPC will be made aware of. DOE or DOSH will carry out inspection and if environmental violation has indeed taken place, remedial actions need to be carried out. However, many of the respondents indicated very few or virtually no complaints at all. Complaints are only made if environmental violations are severe in nature. The researcher's observation supported this claim. On a site visit in Penang, chemical mists emitting from a nearby factory had a fairly strong odor which could be smelled by residents in the vicinity of a nearby commercial area. Most of the residents were nonchalant about it and a few even commented that the paint work of vehicles parked for a long duration are affected by the chemical mists. Another site visit in Selangor also indicated likewise. The residents in a nearby housing estate did not complain about the chemical mists with a fairly strong odor emitting from a nearby factory. This implies that the local communities are yet to be sensitized to environmental pollution and the possibility and usefulness of complaining. This explains why there is no significant relationship between the local communities' involvement via the institutional structure in environmental monitoring, and environmental performance.

Overall review

An overall review of the G-I linkage reveals that for the POPC, G-I linkage in the form of government policies and advocacy of various ISO standards certification, have significant relationship with better environmental performance. However, there is a total absence of significant relationship for the TAPC with regard to the G-I linkage. The positive relationships in the G-I linkage for the POPC is due to the stronger state involvement in the POPC. As POPC is part of a high priority industry with vested political interest in the form of equity investment, the need to toe the government line in terms of environmental policy pushes the economic actors in the POPC towards environmental reform. For the TAPC with regard to the G-I linkage, a dominant *laissez faire* market characteristic does not provide the impetus for the sector to line up with the government in environmental reform.

9.3 Industry - Industry Linkage

This section covers the results of significant relationship for the 4 hypotheses postulated in the I-I linkage as indicated in Table 9.2.

Table 9.2 Comparison Of Significant Relationships For The I-I Linkage For The POPC and TAPC

POPC						TAPC					
H	Sub H	Postulation	OV POPC	POM SS	DSM SS	H	Sub - H	Postulation	OV TAPC	HPG SS	LPG SS
H6		Exposure to international trade	-	*N Ap*	-	H6	3rd	Export products to EU markets	**	-	*
							5th	Export products to North American markets	**	-	**
							10th	Export products to East Asian markets	**	-	-
							14th	Imposition of environmental standards by EU markets	**	-	**
							16th	Imposition of environmental standards by North American markets	**	-	*
	21st	Imposition of environmental standards for access to the East Asian markets	-	*N Ap*	*		21st	Imposition of environmental standards by East Asian markets	*	-	-
	23rd	Imposition of environmental standards for access to the West Asian markets	-	*N Ap*	*						
H7		The level of vertical integration	**	*	-	H7		The level of vertical integration	**	-	*
H8		Intensity of international relationship	-	*N Ap*	-	H8	5th	Aggregate environmental collaborative efforts by overseas customers	**	**	*
							6th	Sharing updates on environmental regulations by overseas customers	**	*	*
							7th	Development of minimum environmental requirements by overseas customers	*	-	-
							8th	Development and audit of product safety and quality by overseas customers	**	**	-

POPC						TAPC					
H	Sub H	Postulation	OV POPC	POM SS	DSM SS	H	Sub - H	Postulation	OV TAPC	HPG SS	LPG SS
H9	1st	Aggregate environmental collaborative efforts by the local parent company of the local customers	**	**	-	H9		Intensity of local collaboration by parent company of local customers	-	-	-
	2nd	Sharing updates on environmental regulations by the local parent company of the local customers	**	**	-						
	4th	Development and audit of product safety and quality by the local parent company of the local customers	*	*	-						
	5th	Aggregate environmental collaborative efforts by local customers	**	**	-						
	6th	Sharing updates on environmental regulations by local customers	**	**	-						
	8th	Development and audit of product safety and quality by local customers	*	*	-						

Notes:
*** : Significant at $p < 0.01$*
** : Significant at $p < 0.05$*
- : No significant relationship
NAp: Not Applicable
H: Hypothesis
Sub-Hyp: Sub-Hypothesis
OvPOPC: Overall POPC
POM: Palm Oil Milling
DSSS: Downstream Sub-sector
OvTAPC: Overall TAPC
HPGSS: High-Pollutant Generating Sub-sector
LPGSS: Low-Pollutant Generating Sub-sector

Comparison For The Sixth Hypothesis

Both the POPC and TAPC show significant relationship for the Sixth Hypothesis (H6), which is the higher the exposure to international trade, the better the environmental performance. The number of significant relationships for the overall TAPC and the low-pollutant generating sub-sector are six and four respectively as compared to only two for the downstream manufacturing sub-sector for the POPC. This reflects on a broader-based significant relationship for the TAPC as compared to the POPC. For the TAPC, the act of exporting to the EU markets, the North American markets and the East Asian markets, especially Japan, triggers the adoption of environmental initiatives on a voluntary basis, especially for the low-pollutant generating sub-sector. This (voluntary) move is a preemptive measure in anticipation of the implementation of environmental requirements and at the same time, is used as a marketing tool. However, in comparison, the act of exporting is not significant for the POPC.

Likewise, a broader-based significant relationship exists for the imposition of environmental standards for market access for the TAPC as compared to the POPC. The composition of significant relationships for the overall TAPC and low-pollutant generating sub-sector are three and two respectively as compared to only two for the downstream manufacturing sub-sector for the POPC. Significant relationship exists for the imposition of environmental standards for market access to the EU markets, the North American markets and the East Asian markets for the overall TAPC and only the EU markets and the North American markets for the low-pollutant generating sub-sector. Many TAPC respondents who are contract manufacturers underlined the point that TNCs, acting as a strategic decision maker cum central coordinating body, impose their environmental requirements on the global supply chain. These environmental requirements are basically firm based global environmental standards which exceed national requirements, especially on "human-ecology" (Oekotex Standard 100), occupational safety and health and human rights. In addition to meeting regulatory requirements on all markets TNCs are involved in, these TNCs also have to protect their global brand names. However, in comparison with the downstream manufacturing sub-sector for the POPC, significant relationship exists only for the East Asian markets and the West Asian markets. One of the refining respondents aptly characterized that for the Japanese market in East Asia, stringent market requirements of quality and environmental standards must be met. For the Indian market in West Asia, quality requirement is the most important factor. The quality parameters for crude palm oil and crude olein must have an acid value of two percent or less and a carotenoid value of between 500-2,500 milligrams per kilogram. Thus, on a broader regional basis for the TAPC, significant relationship exists between environmental standards for market access and better environmental performance. This is mainly due to the reach of the TNCs in the textile and apparel trade. Many of these TNCs are global brand owners with a wide distribution network and at the same time their products are coveted for especially in OECD countries. However, for the POPC, significant relationship is driven by (regional) market specific demands and not mainly by the TNCs as in the case for the TAPC.

Comparison For The Seventh Hypothesis

The results show that there is significant relationship for both the POPC and TAPC for the Seventh Hypothesis (H7), which is the higher the level of vertical integration, the better the environmental performance. Sectoral variation comes in the form of significant relationship for highly (in particular) and moderately vertically integrated (lesser extent) groups with palm oil milling activity (most polluting activity in the POPC) in direct contrast to also significant relationship for highly (in particular) and moderately vertically (lesser extent) groups with low-pollutant activities for the TAPC. Likewise, akin to the flipside of the above, no significant relationship is recorded between the level of integration for groups or standalones involved in downstream activities of the POPC and environmental performance. And also no significant relationship exists between the level of vertical integration for groups or standalones involved in wet processing activities (the most polluting in the TAPC) and environmental performance.

For the POPC, highly and moderately vertically integrated groups in the overall POPC, and highly and moderately vertically integrated groups with upstream palm oil milling activity, and with palm oil milling being the weakest link in the manufacturing chain in terms of environmental pollution, show a strong significant relationship (at the more stringent one percent) and significant relationship (at the less stringent five percent) respectively. The TAPC, in contrast, shows a strong significant relationship (at the more stringent one percent) for the highly (in particular) and moderately (lesser extent) vertically integrated groups for the overall TAPC and significant relationship for highly and moderately vertically integrated groups with involvement in low-pollutant generating activities. The significant relationship for the vertically-integrated groups which are involved in upstream palm oil milling carries the implication that the strongest point is in strengthening the weakest link. The weakest link in the POPC in terms of pollution is palm oil milling. The implication of this is that the higher level of vertical integration is associated with higher environmental risk and vice versa. As palm oils and fats are mainly related to the edible sector, strengthening the weakest link is vital in the farm to fork supply chain. The majority of respondents in the POPC indicated that the food-related sector, especially from the Western European and U.S. markets, being a volume user of edible oils and fats, are sensitive to environmental and health requirements. The global anti-palm oil campaigns that emanate from these markets focused mainly on the destruction of natural forest and the habitat of the *orang utan.* Some of these anti-palm oil campaigns by foreign environmental non-governmental organizations (ENGOs) can adversely impact on the consumer behavior of downstream players in the farm to fork supply chain and interested members of the public in their home country. To counter these global environmental campaigns, and in consonance with meeting the health and social requirements of the global market, especially the Western markets, many of the palm oil millers have undertaken a host of direct and indirect environmental initiatives, such as ISO certifications and better waste management practices (treated POME, shell and fiber and EFBs are treated as a valuable resource). Two respondents perceptively linked the strengthening of the weakest link to that of risk management. They highlighted that if environmental problems were to surface in palm oil milling, they may have a domino effect in a highly vertically integrated group. The risk is heightened as these vertically integrated groups are involved in a sole industrial sector. One of the respondents framed this as ‘putting all the eggs in one basket’. To mitigate this environmental risk, these highly vertically integrated groups focus their attention in strengthening the weakest link by undertaking more environmental initiatives. This assists in explaining the significant relationship between the higher the level of vertical integration and better environmental performance for the POPC, especially the vertically integrated groups with upstream palm oil milling activity.

For the TAPC in general, and the highly and moderately vertically integrated groups that are involved in low-pollutant generating activities in particular, the TNCs impose their environmental requirements mainly on the garment manufacturers.

These environmental requirements are in the form of acceptable dyes and finishes in order to meet "human-ecological" requirements (for example azo-free dyes), occupational safety and health measures, and human rights especially in relation to employment terms and workplace conditions. The imposition of acceptable dyes and finishes on garment manufacturers (part of a vertically integrated group involved in low-pollutant activities), are in turn imposed on their commissioned wet processors. However, a respondent in a vertically integrated group which has wet processing facilities indicated that TNCs are beginning to pay more attention to environmental problems associated with wet processing. But at this juncture, it has yet to arrive at the tipping point leading to significant relationship for vertically integrated groups that have wet processing facilities. At the same time, highly vertically-integrated groups that are involved in low-pollutant generating activities, have the relatively easier task of implementing pollution abatement systems as capital expenditure required is not large. This is also aided by the highly vertically integrated groups in the TAPC having a deeper pocket.

No significant relationship is recorded for the level of integration for groups or standalones involved in downstream activities of the POPC. This is due to the reason that all downstream activities are clean or relatively much cleaner as compared to palm oil milling. The downstream activities also have existing proven environmental technologies to effectively manage pollutants. Thus, whether the group is highly or lowly vertically integrated does not have any bearing at all. This stands in contrast to groups or standalones that are involved in wet processing. This is especially so for economic actors in the TAPC that have to meet the parameter requirements of Standard A. All the respondents that have to meet this standard complain that this standard is equivalent to reverse osmosis drinking water. As such, the level of vertical integration does not matter at all as all groups, be they highly or lowly vertically integrated, have to make the arduous effort to improve treated effluent quality.

Comparison For The Eight Hypothesis

The POPC shows no significant relationship at all for the Eighth Hypothesis (H8), which is the more intensive the international collaboration, the better the environmental performance. Likewise, this situation is also reflected at the level of the parent company of the overseas customers of the TAPC. However, a contradictory situation is reflected at the overseas customers' level for the overall TAPC and both the high pollutant generating sub-sector and the low pollutant generating sub-sector for aggregate environmental collaborative efforts and also sharing updates on environmental regulations. Significant relationship for the overall TAPC is shown for environmental collaborative efforts in the form of sharing the development of minimum environmental requirements for products or services. However, for the development and audit of product safety and quality, significant relationship exists for the overall TAPC and also the high pollutant generating sub-sector.

Sharing updates on environmental regulations is the easiest to implement, with modern communication media being used. For respondents which have TNCs as their customer base, forthcoming environmental and related health and safety laws and regulations that will be imposed on the textile and apparel industry will be channeled quickly by the TNCs to their contract manufacturers. One of the respondents pointed out a recent development in the restriction of azo dyes that must be harmonized with the amended draft proposal for the EEC Council Directive 76/769/EEC which prohibits the use of certain azocolorants. Another respondent highlighted the sharing of information on preferred dyestuff suppliers, who are members of the Ecological and Toxicological Association of Dyes and Organic Pigments Manufacturers (ETAD).

Sharing the development of minimum environmental requirements for products/ services comes in various guises for the respondents concerned. One of the most important is packaging with the primary focus of eliminating unnecessary packaging to safeguard merchandise. In addition, packaging materials, where possible, should come from recycled materials. Another is the implementation of water quality programs for treated dye effluent. An audit on on-site management of dyeing, printing and finishing chemicals will be carried out and if the treated effluent does not meet the prescribed standards, corrective measures are recommended to the contract manufacturers. Two respondents have shown the researcher the rearing of fishes in treated effluent. The survival of the fishes is a testimony of the quality of treated effluent. In one of these cases, expensive *koi* (a species of Japanese ornamental fish) is kept in such water. Health and safety requirement is another area of collaboration. An audit or assessment will be carried out by the TNC at the workplace and corrective actions mainly in the form of better manufacturing processes and stricter enforcement of safety and health protocols are recommended. These collaborative efforts are complemented by visits, meetings and discussions by the TNCs with contract manufacturers. These TNCs will also provide the necessary training in the above areas if they are deemed to be sufficiently important in meeting the environmental requirements.

The development and audit of product safety and quality mainly by TNCs at their contract manufacturers is their corporate social responsibility in ensuring their product offerings do not impair the "human-ecological" (Oekotex Standard 100) health of their customers. The TNCs do not want to antagonize their customers with negative issues such as carcinogenic dyes, formaldehyde and pesticide content, extractable heavy metals, and volatile compounds. The above substances come from wet processing and thus it is not surprising that the focus of attention is on this high pollutant generating sub-sector. The development and audit of product safety and quality also includes the listing of all dyes and chemicals used in a product safety data sheet from the contract manufacturers. The contract manufacturers have to provide adequate warning on the health and safety and environmental hazards of the products. The TNCs or their independent laboratories will carry out an audit or test, and if necessary corrective measures are recommended. The collaborative efforts in the development and audit of product safety and quality have also yielded positive results in matters like the requirement for needle scanning, the elimination of small parts in children apparel that can lead to choking, the elimination of mechanical hazards with the like of sharp points on trims and the inflammability of fabrics. Training will also be provided by the TNCs if they are deemed to be necessary.

The TNCs act as the strategic decision maker as well as a central coordinating body with the design centers, appointed contract manufacturers as well as the distributive traders. Knowledge developed by the TNCs is shared with the contract manufacturers via collaborative efforts with the primary aim of meeting the needs of the marketplace. Many of these TNC have global brand names and there is the strategic need to protect their well-known and highly coveted brands. TNCs in the form of global brand marketers and international retail chains, guided by corporate social responsibility or corporate ethos as well as economic interests, have to ensure their product offerings do not harm their customers particularly from a "human-ecological" standpoint as well as the environment in general. Eliminating this danger is a collaborative effort, especially for the high-pollutant generating sub-sector with wet processing.

Comparison For The Ninth Hypothesis

A contrasting outcome exists for the Ninth Hypothesis (H9) in comparison with the Eighth Hypothesis. The Ninth Hypothesis is the more intensive the local collaboration, the better the environmental performance. The POPC shows a significant relationship for the (local) parent company of the local customers as well as the local customers for overall POPC, especially for the upstream palm oil milling sub-sector. However, no significant relationship is recorded at all for the TAPC in the Ninth Hypothesis. The collaborative environmental efforts in the form of sharing updates on environmental regulations and the development and audit of product safety and quality by the overall POPC and especially the upstream palm oil milling sub-sector are mainly due to the vertically-integrated groups possessing strong group policies. This is particularly pertinent for vertically-integrated GLCs, which have a strong group culture cum policy to drive programs that are in line with government policy. State policies have a pervasive influence on GLCs. The calling of the government to implement preventive approaches, like various ISO certifications, are given very high priority and attention. The GLCs have a holding company structure with the parent company at the apex and the subsidiaries under it. Corporate culture dictates the highly centralized organizational structure. Past and present chief executive officers of the GLCs are either retired senior civil servants or from other government agencies. The highly centralized organizational structure, aided by a strong chain of command with well defined authority and responsibilities, leads to strong interfirm vertical linkages especially between the parent company and its subsidiaries and also between sister subsidiaries (for example upstream palm oil milling subsidiaries selling CPO to downstream sister subsidiaries). This highly centralized organizational structure allows the parent company to cascade group policy, including environmental policy, effectively to its subsidiaries. Thus, the collaborative efforts in the sharing of updates on environmental regulations and the development and audit of product safety and quality are driven mainly by the parent company, as mentioned by GLC respondents. If interrelated operational problems were to arise, the sister subsidiaries are expected to resolve these problems themselves. This strong interfirm vertical linkage within the group provides the space for environmental collaborative efforts, and consequently also relate positively to environmental performance.

These collaborative efforts are to ensure consistent quality within the group. If any one level or activity within the vertical chain is not compliant in terms of product safety and quality, then the whole group cannot proclaim that there is stringent quality, and high safety and health standards being practiced. Another reason for this concern is the variability in oil quality as a group can be geographically dispersed. The plantations and the palm oil mills can be in the peripheral regions, whereas the refineries and oleochemical plants are located in industrial estates in the nearby vicinity of towns or cities. The requirement is that supplies or feedstock and outputs produced at each level of the vertical chain, wherever geographically, must meet the prescribed standards. For example, a refinery is dependent on feedstock supplied by a few palm oil mills within the group. High variability in oil quality and safety will compound the problems of manufacturing and meeting the prescribed harmonized standards. In addition, product safety and quality must not only meet local but also international standards as well as they are a vital player in the farm to fork supply chain. This is not the case for the TAPC as the vertically integrated groups have a relatively more decentralized organizational structure with each activity or subsidiary on an operational basis, acting fairly independently.

Overall review

Despite the similarity between POPC and TAPC in terms of significant relationship for higher exposure to international trade and higher level of vertical integration, the significant relationships differ in breadth, regions, sub-sectors and market dynamics. A broader based significant relationship exists for the higher exposure to international trade for the TAPC as compared to the POPC. The broader based significant relationship for the TAPC is mainly due to the industry structure of the global textile and apparel trade. The TNCs play a dominant role by virtue of being brand owners cum marketers or international retailers and at the same time having built a wide distribution cum supply chain network. As highlighted above, the difference is it involves the vertically integrated groups with having the most polluting activity for the POPC as oppose to vertically integrated groups that have low pollutant generating activities for the TAPC. Significant relationship exists between the more intense international collaboration and better environmental performance for the TAPC and not for the POPC. For the TAPC, this is mainly due to the TNCs' central position as the strategic decision maker and coordinator in the supply chain and also the protection of global brands. However, significant relationship exists between the more intense local collaboration and better environmental performance for the POPC, and not for the TAPC. This is due to the GLCs' strong group culture and policy, which embodies the environmental dimension.

These contrasting relationships, in sum, appear to be caused by the different market dynamics and actions of economic actors from different industries with differing markets (exposure to international trade), differing market requirements and capital investment affordability (vertical integration), the dominance of TNCs in the industrial structure (intensity of international collaboration) and group culture or policy (intensity of local collaboration) which in turn are shaped by both global and local forces.

9.4 A Discussion Of The Main Findings

The transformational role of the state, one of the central tenets of EMT, is the overarching central premise in the G-I linkage. Another central tenet, that is the increasing importance of market dynamics and economic agents in the era of globalization is the overarching central premise in the I-I linkage. The following discussion encompasses a comparative analysis of the POPC and TAPC in terms of sectoral variations, similarities (if any) and overall comparison for the G-I and I-I linkage, respectively.

9.4.1 Main Findings In The G-I Linkage

Sectoral variations in the G-I linkage

For the G-I linkage, two claims are evident for the POPC but not for the TAPC:(i) the more the industry is involved in policy formulation process, the better the environmental performance; and (ii) the more the preventive approach advocated by the various government ministries and agencies, the better the environmental performance.

The industry involvement in the policy formulation process is especially pertinent for the upstream palm oil milling sub-sector. This sectoral variation carries the implication that the oil palm and palm oil industry is accorded as a high priority resource-based industry by the Federal Government. As such, government related institutions like the MPOB and the MPOC, established to look after the strategic interest of the industry, have an interactive form of governance with the participation of industry-specific private sector representatives like the MPOA, POMA, PORAM, MEOMA and MOMG. This participative, cooperative and interactive form of governance has yielded effective policies, inclusive of environmental policies like OER and Value Added Downstream Policy (for the by-products like fibers, shells, EFBs, etc.) which have attained measurable success. This is especially so for the upstream palm oil milling sub-sector as it is the weakest link in the POPC. These policies, including environmental policies, help in strengthening the weakest link. The EMT characteristics of participatory, consensual, cooperative and interactive form of governance are abundantly evident in the POPC. Negotiated environmental policy and the creation of favorable conditions can lead to environmental improvement. On the other hand, the TAPC is not given the same kind of attention and status as accorded to the POPC, despite the fact that it is one of Malaysia's major revenue earners. The TAPC has a more laissez faire character and MATAC has only ex-officio representation. In comparison, the TAPC lacks sector-specific state related institutions which have the political clout and influence in the policy formulation process. The existence of sector-specific state related institutions provides the institutional structure and staff to formulate, promulgate, implement and monitor policies, inclusive of environmental policy to the advantage of the industry. The depth and breadth of involvement by the government in the TAPC is much less as compared to the POPC.

The advocacy of preventive approach by the various government ministries and agencies is applicable generally for the overall POPC but especially pertinent for the upstream palm oil milling sub-sector and to a lesser extent the downstream sub-sector. Preventive approaches in the form of ISO9000 standards, ISO14000 standards and OHSAS 18000 standards are part of the standard operating procedures. The adoption of such preventive approaches is in the same vein of the EMT characteristic of diversification of policy instruments. As the oil palm and palm oil industry has a very strong government influence in the form of investment by government agencies and government-linked companies, the cascading of government policy in the form of certifications has taken an important bearing. Taking the cue from several Federal Ministries and government departments in adopting ISO certification, government agencies and GLCs in the oil palm and palm oil sector have done likewise. The greater emphasis on certification has a dual purpose of toeing the government line and at the same time complying with the farm to fork supply chain requirement. This, in itself pushes the government agencies and government-linked companies toward environmental reform. Thus, the state's role is aligned to the EMT characteristic of creating the necessary conditions to stimulate social self-regulation. Self-regulation is in the form of preventive approaches like the various ISO certifications where the burden of the state is shared with the economic actors. This is in line with the EMT characteristic of the move towards preventive options that embraces the active involvement of economic actors who are also polluters themselves. At the same time, the transfer of responsibilities and tasks from the state to the market actors also has occurred.

The preventive approach, in contrast, is not evident in the TAPC. The TAPC has a dominant *laissez faire* characteristic with very little or no government equity in it. The absence of pull factors due to the lack of incentives and also the absence of push factors due to the voluntary nature of government advocacy of preventive measures do not provide the necessary conditions for self-regulation.

Similarities for the G-I linkage

Three claims are not met by neither the POPC nor the TAPC. Better environmental performance could not be significantly related to (i) better cooperation between the government and the industry in technological development and technological transfer, (ii) more regulatory efforts emphasize on environmental issues, and (iii) higher local communities' involvement via the institutional structure in environmental monitoring.

Cooperation between government and industry in technological development and technological transfer faces bureaucratic drawbacks. The adoption of technologies and the participation in technological development programs offered by industry specific government institutions and other government agencies face the drawbacks of highly procedural bureaucratic red tape and time-consuming application processes. In addition, tax incentives offered by MIDA and MOF for investing in direct or indirect environment-related projects and technologies are not taken up by the relatively smaller non-GLCs in the POPC sector and the TAPC sector due to bureaucratic procedures, too many criteria to fulfill, and the slow decision making process. These major drawbacks act as a virulent deterrence to the extent that some economic actors, especially the smaller economic actors in both the POPC and the TAPC, do not make any attempt whatsoever. These major drawbacks act as a schism in view of one of the prescriptions by Weale (1992) that government action or intervention in innovation, invention and diffusion of new technologies in industrial processes can lead to environmental reform. Another grouse by a number of economic actors in the POPC is the payment of cess per ton of CPO to fund MPOB activities, while at the same time having to pay for indigenous technologies, including environmental technologies, developed by MPOB.

The regulatory agencies are backed by more than sufficient environmental-related laws to "hang an elephant on the wall" but poor enforcement leads to few parties "hammering the elephant onto the wall" (Goh Ban Lee 2006). This is the case for both the POPC and the TAPC. DOE, the main environmental regulatory agency, is hampered by manpower shortage which leads to poor enforcement (Salleh Buang 2006, Farah Naz Karim 2006). The high variability in enforcement by both DOE and DOSH, and also virtually no enforcement by LA, contribute to this malaise in enforcement. As such, the EMT characteristic of regulations as one of the main drivers of environmental reform will not take root with ineffective enforcement. Any law or regulation is only as effective as its enforcement. Regulations by themselves cannot be an enabler in capacity building and by helping companies to overcome barriers to innovation and move beyond control technology to clean technology. Regulations can only become a precursor to more preventive technology if effective enforcement is put in place.

The local communities' involvement via the state's institutional structure in environmental monitoring is ineffective for both the POPC and TAPC. The environmental dimension has not attained sufficient importance in the worldview of the local communities. At the same time, the environmental dimension has yet to be a part of the national psyche or has yet to be articulated via a socio-political voice. Complaints of environmental violations will only occur if they are severe in nature. This in all likelihood will occur if environmental violations would impact directly on the economic well being or the visible impairment of health of residents in a local community. This, in essence, runs counter to one of the central tenets of EMT of the role of civil society in environmental reform.

Overall comparison in the G-I linkage

On an overall basis, the G-I linkage for the POPC reveals that the policy formulation process and the adoption of a preventive approach as advocated by the state are related to environmental reform. However, it is totally absent in the G-I linkage for the TAPC. The major difference between the POPC and the TAPC is the 'hand' played by the government in environmental reform. The POPC is accorded as a highly prioritized resource-based industry by the government with strong involvement by government agencies and government-linked companies. As such the government plays an important role in environmental reform. This is dissimilar for the TAPC as it has a dominant *laissez faire* characteristic. Thus the role of the government in environmental reform for the TAPC is very limited in nature.

9.4.2 Main Findings in the I-I Linkage

Sectoral variations in the I-I linkage

Sectoral variations exist for all four claims but there are also similarities in the I-I linkage. For two of the four claims, relatedness to better environmental performance is evidenced, however with nuances of different markets and different sub-sectors.

The claim that higher exposure to international trade is related to better environmental performance is evidenced for both the POPC and the TAPC. However, there are different nuances between the two sectors. The mere act of exporting to the major triad markets, namely the EU markets, the North American markets and the Japanese market (in East Asia) triggers the adoption of voluntary environmental initiatives. This voluntary environmental initiative is used as a preemptive measure in lieu of the prevalent notion by Malaysian manufacturers that such standards would become mandatory in the immediate or distant future. Besides that, this voluntary environmental initiative is also used as a marketing tool. Thus, the adoption of voluntary environmental initiatives reflects the EMT characteristic of (self-regulating) economic actors as social carriers to environmental reform. This is abetted by the need to seek socio-political legitimation of their products and production process. On the other hand, this is not evident for the POPC in terms of the mere act of exporting to major markets. Likewise, sectoral variations exist in terms of the imposition of environmental standards from a regional perspective. For the POPC, the regions are the West Asian and the East Asian markets whereas for the TAPC the regions are the triad economies of the EU markets, the North American markets and the Japanese market (in East Asia). For the POPC, the West Asian markets, especially India, a major importer of palm oils and fats, imposes quality standards whereas for the Japanese market, stringent quality and environmental standards have to be met. These requirements are part of the market dynamics of consumers. This is in congruence with the EMT characteristic of consumers playing an important role as social carriers in environmental reform. The standards that are imposed collectively for the two regional markets are ISO 14001, HACCP, and OHSAS 18001. For the TAPC, the imposed standards are firm-based environmental standards, Oekotex Standard 100 (human-ecology) and WRAP (human rights). The imposition of such standards is prompted mainly by TNCs (the role of TNCs will be discussed later). The adoption and convergence of such standards within a sector is in line with the EMT characteristic of harmonization of environmental practices.

Sectoral variation also exists for the level of vertical integration and environmental performance. Highly and moderately vertically integrated groups with involvement in upstream palm oil milling activity and highly and moderately vertically integrated groups with low-pollutant generating activities for the TAPC are both related to environmental reform. The evolution of both these highly and moderately vertically integrated groups is a product of history. The move either upstream or downstream or a combination of both was part of their growth strategy. Palm oil milling is the most polluting and is the weakest link in the palm oil manufacturing chain. The anti-palm oil campaigns by foreign ENGOs can adversely impact on the consumer behavior of downstream actors in the farm to fork supply chain and the interested members of the public. To counter the anti-palm oil campaigns, the strongest point would be in strengthening the weakest link in terms of environmental reform. This is part of risk management as the weakest link can lead to a domino effect within the group's vertical structure. On the other hand, for the vertically integrated groups that are involved in low-pollutant generating activities in the TAPC, the implementation of pollution abatement systems is relatively easier as large capital expenditure is not required. Their environmental focus is on meeting "human-ecological requirements", occupational safety and health measures, and human rights especially in relation to employment terms and workplace conditions. For "human-ecological" requirements, they dictate the acceptable dyes and finishes to the commissioned wet processors. Their non-involvement in wet processing leads to lower capital expenditures for environmental management. The findings above reflect the EMT characteristic of the impact of global market forces having a local effect.

Despite the absence of a relation between the level of vertical integration and environmental reform for groups or standalones involved in downstream activities of the POPC and also for groups or standalones involved in wet processing, sectoral variation, exists in the type of activity involvement in relation to pollution. Downstream activities of the POPC are relatively much cleaner compared to palm oil milling, with proven environmental technologies to effectively manage pollutants. Groups or standalones that are involved in downstream activities have sufficiently deep pockets to invest in such activities. Thus, whether the group is highly or lowly vertically integrated does not have any bearing as virtually all are environmentally clean. This stands in contrast to groups that are involved in wet processing, which have to meet the stricter Standard A requirements. The level of vertical integration does not matter as all groups, be they highly or lowly vertically integrated, have to meet this standard for treated effluent which is equivalent to reverse osmosis drinking water. The level of capital expenditure required is relatively high and this is not abetted by the shrinking margins in the global textile and apparel industry as a result of competitive pressure from China. Thus, parallels with EMT characteristics cannot be drawn.

The intensity of international relationship is evidently related to environmental performance for the TAPC. Sectoral variation exists as this is not evident for the POPC. The TNCs act as the central decision maker and also acts as the central coordinating body for the design centers, the various contract manufacturers as well as the distributive trade. These TNCs are like a central hub in an integrated network. The apparels that are created in the design centers are sent to the contract manufacturers to produce a sample to be vetted by the head office, the central hub. Once the go ahead is given, production scheduling and subsequently production will take place at the appointed contract manufacturers. Logistical arrangements will be managed by the central hub to ensure the distributive trade obtains the apparels on time. The central role of the TNCs is parallel to the EMT characteristic of TNCs acting as spiders in the economic network. These TNCs are either owners of global brands or international retail chains (with house brands) and have to protect their reputation in terms of product safety and quality, environmental concerns pertaining to their operations, and human rights issue focusing mainly on employment terms and workplace conditions. The TNCs, as a repository of knowledge, have instituted collaborative efforts via the sharing of environmental updates, sharing the development of minimum environmental requirements for products, and the development and audit of product safety and quality. The initiation of such collaborative efforts and also the imposition of environmental requirements (as discussed earlier) are part of their corporate social responsibility or corporate ethos, which is used strategically to promote and defend their brand names. This is in consonance with the EMT characteristic of protecting the reputational capital of TNCs by embarking on collaborative environmental initiatives.

Sectoral variation exists with respect to local collaborative efforts being practiced. The group culture of the GLCs in the POPC is very much influenced by state policies, inclusive of environmental policy. The GLCs are to a large extent expected to toe the government line. Moreover, the GLCs have moulded a strong group culture or policy which is strategically used for the purpose of alignment. This group culture aids in the structuring of a highly centralized organization with a strong chain of command leading to strong vertical linkage between the parent company and its subsidiaries and also between sister subsidiaries. This type of strong interfirm vertical linkage within a supply chain is known as structural embeddedness. This pervasive group culture provides the conditions for local collaborative efforts in the sharing of updates on environmental regulations and the development and audit of product safety and quality. These two measures are to ensure group compliance with environmental requirements and attaining consistent oil quality. This is in line with the EMT characteristic of geographical localization where economic interactions are moulded by extra-economic logics like social, cultural and political conditions. We don't see the collaborative efforts in the TAPC sector.

Overall comparison in the I-I linkage

On an overall basis, the I-I linkage for the POPC reveals that exposure to international trade in the form of imposition of environmental standards by the West Asian markets particularly India, and the East Asian markets particularly Japan, the level of vertical integration, and the intensity of local collaborative efforts are related to environmental performance. The I-I linkage for the TAPC reveals that exposure to international trade in the form of exporting to the triad economies and the imposition of environmental standards also by the triad economies, the level of vertical integration and the intensity of international collaborative efforts are related to environmental performance. Even though similarities occur for exposure to international trade and the level of vertical integration, sectoral variations exists in terms of the different regional markets and the type of activity involvement, respectively. A major sectoral variation is the intensity of local collaborative effort as shown for the POPC, but totally absent for the TAPC; and vice versa for intensity of international collaborative efforts.

CHAPTER 10
Conclusions and Recommendations

10.1 Introduction

The development of EMT started in the late 1980s, most notably in Germany, Netherlands and the UK. The focus of ecological modernization theorists then was on national studies in the Western European countries. As a result of these studies, the EMT offers an understanding of the dynamics, mechanisms and actors that have resulted in environmental reform, especially for West European states. From the mid 1990s and beyond, increasing attention has been paid to the global dynamics of environmental reform, as well as to national studies in non-West European states. Differences between (industrial) sectors were not given due consideration. Besides that, most studies on EMT are more qualitative by making interesting use of case study research in building a new theoretical framework. Limited quantitative research has been done till now to test the central tenets or core themes in the EMT. At the same time, no methodology has been developed yet to carry out a more substantive quantitative testing.

This study has two main objectives. The first objective is to develop a quantitative methodology for investigating the claims of successes and failures of environmental reform. This quantitative methodology focuses on the core themes of transformation in the role of the state, or what Jänicke termed as political modernization, and the increasing importance of market dynamics and economic agents in environmental reform. The second objective is to understand sectoral variations as with regard to the drivers and why some sectors are better than others in environmental performances. The POPC and the TAPC in Malaysia are the main foci of this study. The POPC is a (government initiated) high priority resource-based industry with heavy government involvement (in the form of sector-specific government agencies and government-linked companies via equity participation). The TAPC has more *laissez faire* characteristics, with limited government involvement in its economic activities.

From these two objectives, three research questions emanate. The first research question relates to how the policy and economic tenets of EMT can be operationalized into testable factors that contribute to improved environmental performances in industrial sectors. The second question relates to the factors in the policy and economic domains explaining sector variations with respect to environmental performances. The third research question pertains to the recommendations for the development of sector-based industrial development policy in Malaysia. This final chapter is to provide the answers for these research questions by drawing and reflecting on the main conclusions of this research. The second section is a reflection on the developed methodology for this quantitative research. The third section is a reflection on the applicability of EMT for the industrial sectors in non-European industrializing countries, particularly the POPC and TAPC in Malaysia. The fourth section covers the recommendations for the development of sector-based industrial policy in Malaysia. The final section focuses on the recommendations for future research.

10.2 Reflections On The Developed Methodology

The operationalization of EMT in hypotheses enables testing the validity of the EMT claims in a developing country. All the hypotheses formulated are either consistent or consonant with ecological modernization characteristics. The two selected central tenets, namely political modernization and the increasing role of market dynamics and economic actors (in the globalized world order) are the 'pillars' utilized in the context of the EMT. The central tenet of political modernization gives birth to the G-I linkage which in turn looks at the EMT characteristics of policy formulation, technology, regulatory efforts, advocacy of preventive approaches, and local communities' involvement. Likewise, the central tenet of the role of market dynamics and economic actors gives birth to the I-I linkage, which focuses on the EMT characteristics of international trade, vertical integration, international relationship, and local collaboration (localization). These characteristics in the G-I linkage and the I-I linkage are translated into independent variables and linked to hypotheses. The independent variables are stated as precisely as possible for empirical investigation. The independent variables are then statistically tested against environmental performance, operationalized as via a composition of environmental performance indicators or EPIs. Hypothesis testing provides the means to support or refute the hypothesis.

The operationalization of the dependent variables, namely the EPIs has to take into consideration the availability and thus variability of environmental data, especially reports required by DOE. Variation exists in terms of requirement for environmental reports by DOE. Some firms are required to submit environmental reports on a scheduled basis. Other firms are required to submit environmental reports as and when required by DOE. Yet other firms are not required to submit any report at all as they are deemed to be environmentally friendly. This is further complicated by the problem of some respondents not wanting to disclose at all, or only partially, DOE's environmental reports. Therefore, a common set of data over a particular period proved to be difficult to assemble for our analysis. To overcome this problem, five categories of EPIs were formulated. The EPIs in the First Category are common quantitative compliance parameters as stated in the Environmental Quality Act. Due to the variability of available data as mentioned above, four other categories were developed to overcome this shortcoming. The Second Category of EPIs in relation to environmentally friendly resource utilization, the Third Category of qualitative assessment on BOD concentration and air impurities' concentration, the Fourth Category of environmental initiatives undertaken, and the Fifth category of personal observation in terms of housekeeping, treated effluent discharge, and dark smoke emission, are all meant to further assess environmental performance. Even though the Second to Fifth Category of EPIs have certain limitations, together they are useful proxies to assess environmental performance. The major limitation, and the requirement to develop the Second to Fifth Category of EPIs, is the lack of available quantitative environmental parametric data.

The five categories of EPIs offer manifold flexibility as they can be adjusted according to circumstances. If theoretical best data do exist, especially in developed countries which have a higher level of monitoring, reporting, openness and transparency, the First, Second, Third and Fourth Category of EPIs can be used to adjudge environmental performance. The list of EPIs in these three categories can either be expanded or contracted taking into consideration the focus of the research. In addition, the assigned weights can also be adjusted to reflect on the importance or brevity of the individual EPIs. In situations where the existence of environmental compliance parametric data are highly variable and do not allow a common data map to be built for the purpose of analysis, all five categories of EPIs can be utilized to compensate for data limitation. This research falls within the latter category and as such I have used and combined all five categories. In the worst case scenario of non-availability or high level of ambivalence in terms of accuracy of environmental compliance parametric data, the First Category of EPIs has to be dropped in its entirety with the foci being on the Second to Fifth Category of EPIs in evaluating environmental performance. This situational-based flexibility is very useful in developing regions where high variability of data or a lack of monitoring, reporting, openness and/or transparency of environmental data exists.

As hypothesis testing via statistical data analysis is required for this research, the independent and dependent variables are operationalized in a measurable form. The advantage of quantification is generalizability. On the other hand, the disadvantage of quantification is that concepts which cannot be operationally translated are not allowed in hypothesis formulation. This in itself can limit theory development and the power to generalize (Bailey 1978). Therefore, for future research, the quantitative approach can be complemented and supplemented with the qualitative case study approach for richer analysis and evaluation that can lead to theory development.

The general rule is that a sample which exceeds 5 percent of the population is considered a small sample population. Based on this general rule, both the POPC and the TAPC samples are considered to have a small population if the minimum sample size of 30 respondents is used as the benchmark for statistical accuracy. Therefore, the small population sample size formula is used to compute the sample size for both the POPC and the TAPC. The sample size computed also takes into consideration the time and resource constraint as well as the coverage of two sectors by the researcher. The minimum sample size based on this formula for both the POPC and the TAPC are 35 and 36 respondents respectively. If the sample size for both the POPC and the TAPC would have been larger, the sample error would be reduced, thereby resulting in a higher level of accuracy. This was considered but judiciously not adopted due to the afore-mentioned reasons. However, for future researches, a larger sample size can be considered for each sector.

Stratified random sampling, or more specifically disproportionate stratified random sampling, was adopted for this research. The primary purpose is that stratified random sampling is much more efficient statistically as compared to simple random sampling, and in the worst scenario is equal to it. Other sampling methods such as systematic random sampling or cluster sampling (also known as area sampling) could be carried out, but accuracy would not be as high as stratified random sampling. The strata for both the POPC and the TAPC sectors are mutually exclusive or in other words, non-overlapping in characteristic. Via stratification, and statistical testing, generalizations can be drawn from the stratum or sub-sector and population for both the POPC and the TAPC which also allow for comparative analysis to determine sectoral variations. Expected environmental pollution is the delineating factor for denoting strata. The POPC is delineated into two strata, namely the upstream palm oil milling sub-sector, the most polluting activity in the POPC and the downstream manufacturing sub-sector. On the other hand, the TAPC likewise, is also delineated into two strata, namely the high pollutant generating sub-sector with wet processing as the anchor activity and the low-pollutant generating sub-sector. Disproportionate stratified random sampling is used mainly due to the greater variability in the manufacturing processes and the problem of getting sufficient cases for adequate analysis for the downstream manufacturing sub-sector in the POPC and the high pollutant generating sub-sector for the TAPC.

Kendall's tau-b , a non-parametric test is most appropriate for this research as it is subjected to less stringent requirements than parametric tests. However, if this study is to be replicated elsewhere, if possible with refined scales and larger samples, it would be useful to make a research design aimed at parametric testing and multivariate analysis.

This study is a one-off research. The fieldwork is carried out at a single periodic point in time. The basic advantage of this approach is that data can be compared as they are not affected by changes over time. This is especially important when comparative analysis is carried out to determine sub-sectoral and sectoral variations. However, one limitation is that trend analysis cannot be carried out. Thus, the advantage of a longitudinal study which is carried out over an extended period of time covering different points in time has the advantage of examing and studying trends.

My research shows that two out of five hypotheses are statistically significant in the G-I linkage for the POPC. However, none are statistically significant in the G-I Linkage for the TAPC. This is mainly due to the fact that the POPC is designated as a high priority industry by the government. Thus political modernization has taken roots in the POPC. In the I-I linkage, three out of four hypotheses are statistically significant for both the POPC and the TAPC. This also signifies the impact of the increasing importance of market dynamics and economic actors in ecological reform. However, if this research is hypothetically replicated in totality in the developed regions, especially Western Europe, more hypotheses may be statistically significant. This is mainly due to the fact that the governments in Western Europe adopt a steering role in a regulated market economy with a relatively efficient public service delivery. Enforcement of environmental regulations will be more stringent and intense due to the more efficient environmental agencies. At the same time, community involvement, either as environmental non-government organizations or individuals in environmental reporting to the government institutional structure can be expected to be much more effective due to better accountability and public service delivery.

In conclusion, this research methodology can be replicated wholly or with adjustment. For the independent variables formulated and operationalized in the hypothesis, the list can be expanded or contracted to test ecological modernization characteristics. In developing regions, the dependent variables can be replicated wholly and in the worst case scenario, the First Category of EPIs can be omitted with the application of the Second to Fifth Category of EPIs. In developed countries, the First, Second, Third and Fourth Category of EPIs can be adopted with adjustment, taking into context the research objectives, research foci and situational factors. However, if the independent and dependent variables can be operationalized into wholly interval scales, statistical tools in the domain of parametric testing should be given due consideration as they offer higher accuracy. The sample size can be maintained if time and resource constraints are faced by the researcher. However, a larger sample size would be better as it reflects higher accuracy. Stratified random sampling should be maintained for reasons of accuracy besides allowing for a study on sub-sectoral and sectoral variations. The statistical tool of Kendall's tau-b can be maintained if there are many tied ranks in a non-parametric setting. However, in the absence of many tied ranks, other statistical tools need to be considered.

10.3 Reflections On The Applicability Of EMT

This section focuses on the applicability of the EMT in the context of the main findings of this study and thus answers the second research objective and the second research question.

As the EMT is in its third phase of development and maturation, the geographic scope has been extended beyond the highly developed OECD countries, to Central and Eastern Europe, Latin America and newly industrializing countries in Asia. Studies in China, Vietnam and Thailand showed limited applicability of EMT. The main findings of this research on Malaysia, a developing economy in Southeast Asia proves in some way better. Two central tenets of EMT, namely political modernization and the increasing importance of market dynamics and economic actors are applicable to the POPC. However, for the TAPC, the central tenet of the increasing importance of market dynamics and economic actors is applicable whereas the central tenet of political modernization is diametrically opposite. This shows at least the partial applicability of EMT in contemporary Malaysia, a newly industrializing country in Asia. However, this has to be viewed in the context of the two industrial sectors selected for this study, both highly export-oriented. In that sense, this study is similar to the ecological modernization-inspired study of Sriwichailamphan (2007), who studied environmental reforms in export-oriented food industries in Thailand.

A facet that has to be considered is the refinement of the EMT in the context of localized conditions and institutional developments in Malaysia. One of the central tenets of EMT is the claim that environmental reforms are stimulated and triggered by transformations in environmental governance. The role of the state has been transformed from a hierarchical command-and-control form of government to participatory, consensual, cooperative and interactive form of governance. This has proven to be the case for the POPC in which the branch associations (for example, MPOA, POMA, PORAM, MEOMA and MOMG) are a part of the policy formulation process. The role of the state has been turned towards contextual steering. This is made possible with the existence of modernized, sector-specific, government related institutions like MPOB and MPOC. The background of the oil palm and palm oil sector accorded as a high priority resource-based industry by the state, and the heavy investment by government agencies and government- linked companies in this sector, have to be taken into consideration. On the other hand, the TAPC has a more *laissez faire* character with no or at the most minimal investment by government agencies or government-linked companies. The state seems to have less vested interest for the well-being of the sector. The TAPC also lacks sector-specific government related institutions. Despite the fact that there are government committees in which the TAPC sector is represented, this type of committees lacks the political clout and influence in the policy formulation process. These committees, even though they may meet on a fairly regular basis, lack the institutional structure and staffs like the MPOB and MPOC to formulate, promulgate, implement and monitor policies, including environmental policies like the OER which has attained measurable success. So even with respect to the 'political modernization' hypotheses we see sectoral differences rather that national harmonization.

The role of modern science and technology, acting as principal institutions in environmental reform was evident in the 1970s in response to palm oil milling as being the most polluting industry in Malaysia. However, the government's innovative policy of technology development and technology transfer, as hypothesized by ecological modernization scholars, shows a muted response. The highly bureaucratic and time-consuming application process acts as deterrence in such technological collaborative efforts. This is also not aided by the poor public service delivery as mentioned by many players from both the POPC and the TAPC. In addition, a number of economic actors in the POPC has voiced unhappiness with the cess paid (per ton of CPO) to fund MPOB activities and at the same time having to pay for MPOB's indigenously developed technologies.

Due to the poor enforcement of environmental regulations by both direct and indirect environmental government agencies, environmental regulations are not seen as the main driver in environmental reform. This is not in line with the findings of Baylis et al.,(1998a, 1998b) of regulations as one of the main drivers of environmental reform DOE, the main environmental government agency, is said to be grossly understaffed and does not have sufficient manpower to enforce environmental regulations effectively. As such, environmental regulations have not been a precursor to the development and implementation of innovative environmental technology at this point in Malaysia.

The EMT characteristics of preventive measures and self-regulation are evident in the POPC but not the TAPC in Malaysia. Preventive measures in the form of the various ISO certifications have become part of the standard operating procedures. Government ministries and departments are in varying stages of certification and this has been extended to government agencies like Felda and GLCs. As such, the adoption of the various ISO and other certifications are given high priority by this group of dominant economic actors as they have to toe the government line. As mentioned above, the TAPC has a more *laissez faire* characteristic. In addition, the state's stake of very little or no equity interest in the TAPC, does not provide the push or catalyst to toe the government line. In essence, there is an absence of both *carrot* and *stick.*

The role of civil society in environmental reform, which is very much in evidence in EMT literature, is to a large extent absent for the local communities in Malaysia. The environmental dimension has yet to become sufficiently important in the worldview of the local communities. The environment is not a major part of the national psyche or has yet to be articulated as a socio-political voice. The role of the local communities in environmental monitoring via the government institutional structure for both the POPC and the TAPC has yet to materialize into a force to be reckoned with. This is of course different from the international NGOs that have so successfully pressured the POPC sector with respect to deforestation and biodiversity maintenance.

Another central tenet of EMT which is related to this research is the increasing importance of market dynamics and economic agents in environmental reform. Both the POPC and TAPC are highly export-oriented and as a result, the impact of globalization is felt. For the POPC, the market actors in the farm to fork supply chain have adopted environmental standards like ISO14000 standards, HACCP and OHSAS18000 standards to meet the stringent environmental and quality requirements of the Japanese market in East Asia and also the quality requirements of the West Asian markets. For the TAPC (and not for the POPC), the mere act of exporting to the EU markets, the North American markets and the Japanese market in East Asia acts as a trigger to adopt environmental standards. This voluntary move is a preemptive measure in case environmental standards are imposed by the above markets in the near or distant future and also for the purpose of marketing. In addition, the above markets also impose environmental standards like firm-based environmental standards, Oeko-Tex Standard 100 certification and WRAP certification on either the contract or licensed textile and apparel manufacturers in Malaysia. The adoption of environmental certifications has contributed to the harmonization of environmental practices which is an EMT characteristic.

TNCs, acting as spiders in the economic network, also impose firm-based environmental standards that can exceed national and local environmental requirements in order to meet the regulatory requirements of all the markets they are involved in. These TNCs apply the firm-based environmental standards on the global supply chain which also includes the contract or licensed manufacturers (suppliers) of the TAPC in Malaysia. Thus, via their centrally powerful position in the economic webs the TNCs act as a stimulus in triggering environmental reform in supplier companies. However, the role of the TNCs is not merely imposing their requirements but also collaborating by helping the supplier companies to meet the environmental standards that they have set. On the other hand, this is not the case for the POPC as the foreign downstream customers have not initiated any collaborative effort to meet environmental requirements.

The impact of global market forces has a local effect. Local vertically integrated groups with palm oil milling activity, especially the GLCs in the POPC, are part of the global supply chain. The anti-palm oil campaigns and their influence on downstream customers of the global supply chain have exerted pressure on the oil palm and palm oil sector. The local vertically integrated groups with palm oil milling activity, especially the GLCs, have made efforts in accommodating such pressures. The strong corporate culture or philosophy imbued with the environmental dimension as possessed in particular by the GLCs is used as a capstone to meet market requirements as well as to toe the government line. Through local collaboration, they are able to cascade good environmental management systems and practices within the entire group. This structural embeddedness provides the means for environmental collaborative efforts within a vertically integrated group. The refinement in the EMT has to take into consideration the local condition of a strong pervasive corporate culture within GLCs and also the heavy influence of the government on the GLCs. On the other hand, the vertically integrated groups that are involved in low pollutant generating activities in the TAPC, have made efforts in complying with environmental requirements as the investment cost is relatively low as opposed to wet processing. Thus, environmental reform in the TAPC is also dictated by local cost condition.

In "exploring and proving" the central tenets of EMT, most empirical studies have been carried out via qualitative case studies on a limited number of industries or one particular sector. This has resulted in some debate as to whether these case studies can be a representation for a particular industry or sector. The development and application of a quantitative methodology to test the EMT, as has been the subject of this study, enables to move this debate further. This, by no means imply that it cannot be further improved. Refinements and improvements, as well as steps for further research, will be discussed in greater detail in the final section.

An underdeveloped theme which has gained currency is that of sectoral variation in the EMT. Most studies on a comparative basis have been between nations and not within a nation. In this regard, the findings of Baylis et al., (1998a) and Van de Woerd et al., (2000) are interesting as sectoral variations are proven to exist. This study also adds to this literature of sectoral variations in EMT, agreeing with the existing studies on the relevance to study industrial sectors for understanding environmental reform patterns in industry.

10.4 Recommendations For The Development Of Sector-based Industrial Policy In Malaysia.

Based on the finding as reported above, this section covers recommendations for the development of sector-based industrial policy (answering the third research question). One of the lessons that can be learnt from the preceding section is the major role played by the state and sector-specific government related institutions in policy formulation, which can lead to environmental reform. The identification of the oil palm and palm oil sector as a high priority resource-based industry has an important bearing in the policy formulation process. The transformation of the role of the state by allowing the industry to cooperate and participate in the policy formulation process, buttressed by the sector-specific government related institutions (also with branch associations' participation), have provided a synergistic government-industry linkage leading to a strong relationship with environmental reform. Inversely, the lack of 'strong' sector-specific government related institutions' industry involvement in the policy formulation process for the TAPC has resulted in no significant relationship with environmental reform. A strategic cornerstone is the onerous role played by the state in the identification of high priority industrial sectors. In tandem, the development of sector specific, government related institutions with participation of economic actors should be highly encouraged. These institutions provide the means to formulate, promulgate, implement and monitor environmental policies.

MPOB, a sector specific government-related institution in the oil palm and palm oil sector, should allocate a certain percentage of its budget to the advancement of both preventive and curative technologies. At present, indigenous technologies developed from research and development efforts by the MPOB are sold to any interested parties based on certain specific terms and conditions outlined by MPOB. This has been criticized by industry players who have to contribute cess (per ton of CPO) to fund the activities of MPOB. The suggestion is that advanced preventive and curative environmental technologies should be provided on a *pro bono* basis to all cess contributors as these technologies are meant for the good of the commonwealth. As Malaysia is a developing country and many economic actors in the POPC do not possess advanced technology or have a research and development culture, this measure may fast-track environmental initiatives as investment is limited to machinery, equipment and the training of personnel.

Another lesson that can be learnt from the preceding section is the increasing importance of market dynamics and economic agents in environmental reform. The adoption of environmental standards and certifications should be highly encouraged as this is a form of self-regulatory practice. Attaining the pioneer or the first environmental certification, especially ISO 14000 standards, is relatively easy but maintaining the certification on a long term basis proves much harder as the concept of *kaizen* or gradual improvement is an in-built component of many such certification programs. Tax incentives on a graduated scale can be provided for the adoption of environmental certifications as these have both economic and environmental benefits. This preventive measure complements and supplements the environmental enforcement agencies in view and in lieu of their poor regulatory enforcement.

The cooperation between the government and the industry in technological development and technological transfer shows no significant relationship with environmental performance. The highly bureaucratic government agencies or quasi government agencies that are involved in technological collaboration like MPOB, technological financing and approval of tax incentives for environment-related projects or technologies by MIDA or MOF, are cumbersome and are prone to inertia in vetting applications. A fast track program should be institutionalized for the approval of technological collaboration, technological financing and the application of tax incentives for environment-related projects and technologies. If all the criteria are met and a reply is not forthcoming within a particular time-frame, the application is deemed to be approved and the onus of responsibility is on the relevant government agencies. Thus, it shifts the burden of responsibility to quickly vet the applications to the relevant government agencies in view of the bureaucratic behemoth faced by many economic actors.

10.5 Recommendations For Future Research

While this study has found a number of answers to my research questions, at least as many new questions and challenges have emerged. As the closing of this thesis I want to recommend four fields of further study.

The first recommendation is to continue research along the existing lines. This research is carried out on an ad-hoc basis (at a particular point in time) and has provided results in terms of the applicability of the EMT in a newly industrializing country in Southeast Asia. By expanding this study on a timeline basis towards longitudinal research, the applicability of EMT and its endurance can be further tested. In doing so a larger sample size based on the small population sample size formula as illustrated in Chapter 6 is recommended, to obtain a better representation of the population of the selected industrial sectors.

The second recommendation is to start a new research by focusing on more domestic-oriented industrial sectors in Malaysia. My current study focuses on two industrial sectors that are highly export-oriented. The I-I linkage for both these industrial sectors is strongly affected by globalization and has shown a strong relationship with environmental reform. It would be extremely interesting to know whether similar result can be found with respect to more domestic industries in developing Asian countries. The studies of Wattanapinyo (2006) on Thailand, Zhang (2002) on China and Dieu (2003) on Vietnam are ambivalent, but mainly based on case study research. Now that we have a more quantitative methodology available we could further develop such studies.

The third recommendation is a replication of my study in another country, most notably Indonesia. Indonesia is expected to be the largest producer of palm oils and fats in the world by 2007, overtaking the top position held by Malaysia. Many of the largest vertically integrated groups in Malaysia, inclusive of government-linked companies like Guthrie, Golden Hope, PPB-Oil and KL-Kepong have invested heavily in plantation and palm oil milling facilities in Indonesia. There is likelihood that the business models developed in Malaysia are transplanted to their Indonesian operations. However, one major difference is the lack of Indonesian government-related investments in the oil palm and palm oil sector (as was also found by a palm oil study in Thailand (Chavalparit 2006). As there are many similarities between Indonesia and Malaysia, the applicability of the EMT can be further tested.

The final recommendation is the replication of my quantitative research methodology along similar veins or with refinement and improvement in other geographic areas most notably Western Europe, but also the US, Central and Eastern Europe, Latin America and East Asia.

References

Aaker, D.A., Kumar, V. and Day, G.S. (1998). *Marketing Research*. New York: John Wiley & Sons, Inc.

Abdul Azis Ariffin. (2001). The Effect of CPO Quality Parameters (FFA, M&I, IV, PV, AV, DOBI and Colour) on the Refinery Production Efficiency. Proceedings of the 2000 National Seminar on Palm Oil Milling, Refining Technology, Quality and Environment, 3-4 July 2000, Genting Hotel, Genting Highlands. Kuala Lumpur : Malaysian Palm Oil Board (MPOB), Ministry of Primary Industries, Malaysia, pp. 79-88.

Abdul Aziz and F. Lee. Factories and Machinery Department, Palm Oil Processing Effluent Treatment, Foreseeable Technological Problems, Vol. **1**, 1974.

Afsah, S. and Vincent, J.R. (2000). Putting Pressures on Polluters: Indonesia's PROPER programme: A Case Study For The Harvard Institute For International Development 1997, Asia Environmental Economics Policy Seminar. In Angel, D.P. and Rock, M.T. (2000). *Asia's Clean Revolution: Industry, Growth and The Environment*. UK: Greenleaf Publishing.

Agresti, A. and Finlay, B. (1997). *Statistical Methods for the Social Sciences, 3rd Edition*. Upper Saddle River, New Jersey: Prentice-Hall, Inc.

Andersen, A., Sweeney, D.J. and Williams, T.A. (1990). *Statistics for Business and Economics*. *4th Edition*. St. Paul: West Publishing Company.

Angel, D.P. and Rock, M.T. (2005). Global standards and the environmental performance of industry. *Environment and Planning A* 2005, Vol. **37**, pp. 1903-1918.

Angel, D.P. and Rock, M.T. (2003). Engaging Economic Development Agencies in Environmental Protection: the case for embedded autonomy. *Local Environment*, Vol. **8**. No. 1, 45-59.

Angeline Tay and Sieh Lee Mei Ling. 2000. Textiles and Apparel Industry. In *Sieh Lee Mei Ling* (eds.) *Taking on the World: Globalization Strategies in Malaysia.* Malaysia: McGraw-Hill(M) Sdn. Bhd., pp. 185-211.

Arts, B. (1998). *The Political Influence of Global NGOs. Case Studies on the Climate and Biodiversity Conventions*. Utrecht: Van Arkel/International Books.

A.S.H. Ong, Kien Yoo Chiah, Yuen May, Choo. (1989). Oleochemicals From Palm Oil and Palm Kernel Oil. *ELAEIS* **1**(1) June 1989, pp. 31-51.

Babbie, E. (1998). *The Practice of Social Research, 8th edition*. Belmont: Wadsworth Publishing Company.

Bailey, K.D. (1978). *Methods of Social Research*. New York: The Free Press.

Bank Pembangunan Malaysia Berhad (BPMB) Online 2007a. Welcome to Bank Pembangunan Malaysia Berhad. Retrieved from http://www.bpmb.com.my on 5 March 2007.

Bank Pembangunan Malaysia Berhad (BPMB) Online 2007b. BPMB: Target Sectors. Retrieved from http://www.bpmb.com.my/High Technology.asp on 5 March 2007.

Barretts, B. (eds.) (2005). Ecological Modernization and Japan. London: Routledge.

Baum, J.C. and Dutton, J.E. (1996). Introduction: The Embeddedness of Strategy . *Strategic Management Journal* **20,** pp. 251-278.

Baylis, R., Connell, L. and Flynn, A. (1998a). Sector Variations and Ecological Modernization: Further Analysis At the Level Of The Firm. *Business Strategy and the Environment*, **7**: 150-161.

Baylis, R., Connell, L. and Flynn, A. (1998b). Company Size, Environmental Regulation And Ecological Modernization: Further Analysis At The Level Of The Firm. *Business Strategy and the Environment*, **7**: 285-296.

Beghin, J and Potier, M.(1997). Effects of trade liberalization on the environment in the manufacturing sector. *The World Economy* **20**(**4**), 1997, pp.435-456.

Bell, M. (1998). *An Invitation To Environmental Sociology*. Pine Forge Books, Thousand Oaks, CA.

Billenstein, S. and Blaschke, G. (1984). Industrial Production of Fatty Amines and their Derivatives. *Journal of Am. Oil. Chem. Soc.* **61**, No. **2**, pp. 353-357.

Blowers, A. (1997). Environmental Policy: Ecological Modernization And The Risk Society. *Urban Studies* **34**, 5-6, pp. 845-871.

Boons, F., Baas, L., Bouma, J.J., Groene, A. de., Blansch, K.L(eds.). (2000). *The Changing Nature of Business: Institutionalisation of Green Organisational Routines In The Netherlands 1986-1995*. Utretcht,The Netherlands.

Bryman, A. and Cramer,D. (2005). *Quantitative Data Analysis With SPSS 12 and 13: A Guide For Social Scientists*. London: Routledge, Taylor and Francis Group.

Burns, A.C. and Bush, R.F. (2003). *Marketing Research: Online Research Applications, International Edition, 4th Edition*. Upper Saddle River, New Jersey: Pearson Education International.

Buttel, F.H. (2000). Ecological Modernization As Social Theory. *Geoforum* **31**: 57-65.

Chavalparit, O. (2006). Clean Technology for the Crude Palm Oil Industry in Thailand. Ph.D Thesis, Wageningen University, The Netherlands.

Chow Mee Chin and A.N. Ma (1995). Environmental and Pollution Control in the Palm Oil Industry. In Narula, O.P. (eds.) PORIM in the Treatise on Fats, Fatty Acids and Oleochemicals: A Comprehensive Survey of Technologies Based on Oils and Fats, Monograph No. 1, Vol. 2.. New Delhi: Industrial Consultants (India).pp. T-7/1-T-7/7..

Christmann, P. and Taylor, G. (2001). Globalization and the Environment: Determinants of Firm Self-Regulation In China. *Journal of International Business Studies*, 2001, Vol. pp 439-458.

Christoff, P. (1996). Ecological Modernization, Ecological Modernities. *Environmental Politics*, Vol. **5**, No. **3**, Autumn 1996, pp. 476-500.

Codex. (2005). What is Codex. Retrieved from http://www.food.gov.uk/foodindustry/Codexbranch on November 23.

.Cohen, M. (1997). Risk Society and Ecological Modernization: Alternative visions for post-industrial nations. *Futures*, Vol. **29**, No. **2**, pp. 105-119, 1997.

Cooper, D.R. and Schindler, P.S. (1998). *Business Research Methods*, 6th edition. Singapore: McGraw-Hill Book Co.

Corbett, C.J. (2002). Diffusion of ISO9000 and ISO14000 Certifications through Global Supply Chains. Working Paper, Andersen School of Management, University of California at Los Angeles, Los Angeles, CA.

Darcin, M.T., Ventresca, M.J. and Beal, B.D. (1999). The Embeddedness Of Organizations: Dialogues and Directions. *Journal of Management* **25**, pp. 317-356.

Dass, M.J. (2007). People to be 'eyes and ears' of DOE. *The Sun*, January 16.

DOE. (1985). Malaysia: Environmental Quality Report 1985-86. Kuala Lumpur: DOE.

DOE. (1991). Malaysia: Environmental Quality Report 1990. Kuala Lumpur: DOE.

DOE. (1996). Malaysia: Environmental Quality Report 1995. Kuala Lumpur: DOE.

DOE. (1996). Malaysia: Environmental Quality Report 1996. Kuala Lumpur: DOE.

DOE. (1997). Malaysia: Environmental Quality Report 1997. Kuala Lumpur: DOE.

DOE. (1998). Malaysia: Environmental Quality Report 1998. Kuala Lumpur: DOE.

DOE. (1999a). Malaysia: Environmental Quality Report 1999. Kuala Lumpur: DOE.

Department of Environment (DOE). (1999b). *Industrial Processes And The Environment (Handbook No. 3) : Crude Palm Oil Industry*. Kuala Lumpur: DOE.

Department of Environment (DOE). 2000. *Industrial Processes & The Environment (Handbook No. 4): Textile and Apparel Industry*. Kuala Lumpur: DOE, Ministry of Science, Technology and The Environment, Malaysia.

Department of Environment (DOE). (2002). National Policy On The Environment. *Impak* No. 4/2002 Quarterly Bulletin Of the Department Of Environment (DOE), Malaysia.

Department of Environment (DOE). (2003). Environmental Quality Council. Retrieved from http://www.jas.sains.my/doe/eqeqc.htm on 23 September 2003.

DOE. (2005). Malaysia: Environmental Quality Report 2004. Kuala Lumpur: DOE.

Department of Occupational Safety and Health (DOSH). (2007). Message from DG: Ir Zainuddin bin Abdullah. Retrieved from http://dosh.mohr.gov.my?e-web/e-welcome.htm on 16 March 2007

Department of Statistics (DOS). (2006). Malaysia Economic Statistics Series 2005. Putrajaya: DOS.

Dickens, P. (1998). *Global Shift: Transforming the Global Economy*. New York: Guildord Press.

Ditz, D. and Ranganathan, J. (2000). Measuring Up: Toward a common framework for tracking corporate environmental performance. In Angel, D.P. and Rock, M.T. (2000). *Asia's Clean Revolution: Industry, Growth and The Environment*. UK: Greenleaf Publishing.

Dryzek, J.S. (1997). *The Politics of the Earth*. Oxford University Press.

ESCAP (2001). Integrating Environmental Considerations Into The Economic Decision-Making Process: State of Environment in Malaysia: Overview of National Development Policies-Vision 2020.

http://www.unescap.org/drpad/pub3/integra/volume3/malaysia/3my01b03.htm. Available Online 04/05/2001.

Esty,D.C. (1994). *Greening the GATT: Trade, Environment, and the Future.* WashingtonD.C: Institute for International Economics 1994.

Evans, P. (1995). *Embedded Autonomy: States and Industrial Transformation*. New Jersey: Princeton University Press.

Factories and Machinery Department , Palm Oil Processing Effluent Treatment, Vol. **1**, p. 5-7 in Mahinder Santokh Singh (1981). *Environmental Issues and The Malaysian Industrial Policy In Consumers Association of Penang (CAP). Development and the Environmental Crisis: a Malaysian Case*. pp 236-249.

Farah Naz Karim. (2006). BN reps told to identify environmental threats. *New Straits Times (Prime News)*. 29 June, pp. 8.

Farris, R.D. (1979). Methyl Esthers in the Fatty Acid Indsutry. *J. Am. Oil. Chem. Soc*. **56**, pp. 770A-773A.

Felda. (2007). FELDA: Background. Retrieved from http://www.net.my/felda/English/fel_latarbelakang.asp. On 14 March 2007.

Felda . (2006). FELDA Corporate Profile. Retrieved on 20 September 2006 from http://www.felda.nt.my/holdings/about/about.htm.

Felda. (2004a). Felda Oil Products Sdn. Bhd's Export Market. *Retrieved on July 9, 2004 from* http://www.felda.net.my/news/Arkib/2004/01-2004/12_0104BI.htm.

Felda. (2004b). Felda Oil ISO 9001: 2000 For Felda Bulkers. Retrieved on July 9, 2004 from http://www.felda.net.my/news/Arkib/2004/02-2004/17_0204BI.htm.

Felda. (2004c). FJB Handles Bulking Terminals For Palm and Vegetable Oil. *Retrieved on July 9, 2004 from* http://www.felda.net.my/news/Arkib/2004/03-2004_0304BI.htm.

Felda. (2004h). Felda Marketing Services Sdn. Bhd: Accreditation to MS ISO 9001: 2000. *Retrieved on July 9, 2004 from* http://www.felda.net.my/news/Arkib/2004/06-2004/06-0304BI.htm.

Fold, N. (2000). Oiling The Palms: Restructuring Of Settlement Schemes in Malaysia And The New International Trade Regulations. *World Development*, Vol. **28**. No. 3. pp. 473-486.

Frijns,J., Phung Thuy Phuong and Mol, A.P.J. (2000). Ecological Modernization Theory and Industrializing Economies: The Case of Vietnam, *Environmental Politics*, **9**(1): 257-294.

Freedman, B., Pryde, E.H. and Mounts, T.L. (1984). Variables Affecting The Yields of Fatty Esters From Transesterified Vegetable Oils. *J. Am. Oil Chem. Soc*. **61**, No. **10**, 1638-1643.

Gearing up for challenges next year, Starbiz, The Sun, 13 December 2006: B4).

Gereffi, G. (2002). The International Competitiveness of Asian Economies In The Apparel Commodity Chain. February 2002. Asian Development Bank, ERD Working Paper, No. 5.

Goh Ban Lee. (2006). The hubris of power. *The Sun*, October 17.

Granovetter, M. (1985). Economic Action and Social Structure: The Problem Of Embeddedness. *American Journal of Sociology* **91**, pp. 481-510.

Gunstone, F.D. (2001). Basic Oleochemicals, Oleochemical Products and New Industrial Oils. In Gunstone, F.D. and Hamilton, R.J. (2001). *Oleochemical Manufacture and Applications*. (pp.1-22) Sheffield: Sheffield Academic Press.

Gulati, R. (1998). Alliances and Networks. *Strategic Management Journal* **19**, pp. 293-317.

Hajer, M.A. (1995). *The Politics of Environmental Discourse. Ecological Modernization and the Policy Process*, Oxford: Clarendon.

Hajer, M.A. (1996). Ecological Modernization As Cultural Politics. From Lash, S., Szerszynski, B., and Wynee, B. (eds.) *Risk, Environment & Modernity*. London: Sage. Pp. 246 – 269**.**

Hamirin Kifli, T.L. Ooi and Salmiah Ahmad. (1996). Progress in Research and Development for the Malaysian Oleochemical Industry. *Palm Oil Technical Bulletin*, January, pp. 2-6.

Hanim Adnan. 2004. Approval for more duty-free CPO exports. *The Star, Starbiz*, October 1.

Hanim Adnan. 2004. Felda aims to be global industry benchmark. *StarBiz*, June 18.

Hanim Adnan. 2006. Talks Intensify On Parties Bid For Pan Century Complex. *StarBiz*, June 30.

Harcharan Singh Khera. (1976). *The Oil Palm Industry of Malaysia: An Economic Study*. Kuala Lumpur: Penerbit Universiti Malaya.

Hills, P.R., Welford, R.J. and Roberts, P. (2003). Editorial: Ecological Modernization, Environmental Reform And The Transformation Of Production And Consumption. *The International Journal of Environment and Sustainable Development*, Vol. **2**, No. **3**. pp. 231-236.

Hinton, P.R., Brownlow, C., McMurray, I., Cozens, B. (2004). *SPSS Explained*. London: Routledge, Taylor and Francis Group.

Holiday, C.O.. JR., Schmidheiny S and Watts, P. (2002). *Walking The Talk: The Business Case for Sustainable Development.* United Kingdom: Greenleaf Publishing Limited.

Huber, J. (1991). Ecological modernization: away from scarcity, soberness and bureaucracy. Translation from J.Huber, " Ecologische modernisering: weg van schaarste, soberheid en bureaucratie". In Mol, A.P.J., Spaargaren, G. en Klapwijk, A. (eds.), *Technologie en Mileubeheer. Tussen sanering en ecologishe modernisering*. Den Haag: SDE., 167-183.

Huber, J. (2000). Towards Industrial Ecology: Sustainable Development as a Concept of Ecological Modernization. *Journal of Environmental Policy and Planning*, **2**, 269-285 (2000).pp. 269-285. From Redclift, M.R. and Woodgate, G. (eds.) (2005). *New Developments in Environmental Sociology*. Cheltenham, UK: An Elgar Reference Collection. pp. 251-267.

Hugo Hays. (2004). Growers for Sustainable Agriculture. *Global Oils and Fats.* Vol. **1** (3), pp. 18-19.

International Development Center of japan. (1993). *Local Dimension of Environmental Management - Analysis of Malaysian Institutions and Cases*. Tokyo: The Ministry of Foreign Affairs, The Government of Japan.

International Law Book Services (ILBS). (2004). *Environmental Quality Act 1974 (Act 127) & Subsidiary Legislation (As At 1st September 2004).* Selangor: ILBS.

Jamaluddin Md. Jahi. (1999). Striking a Balance Between Environment and Development: Is Malaysia Prepared To Manage The Environment to Face Challenges In The Next Millenium. Bangi, Selangor: Environmental Management Programme, Centre for Graduate Studies, Universiti Kebangsaan Malaysia.

Jamilah Ariffin. (1986). Health and Safety Problems Among Women Workers In The Manufacturing Industries. In Sahabat Alam Malaysia (SAM). 1986. Hazardous Industries And Workers Health. Proceedings of the National Seminar on Workers Health and Safety Problems in Malaysia. Organized by SAM from 8-9 December, 1984, pp. 59-69.

Jänicke, M. (1985). Preventive Environmental Policy As Ecological Modernization And Structural Policy. Department of Political Science, Free University, Berlin.

Janicke, M. (1995). Green Industrial Policy And The Future Of "Dirty Industries". (unpublished paper). EMT Reader, Environmental Policy Group, Wageningen University, The Netherlands.

Jänicke, M. (2000). Ecological Modernization: Innovation and Diffusion of Policy and Technology. FFU-report 00-08. Forchungsstelle Fur Unweltpolitik, Free Universitat Berlin.

Jänicke, Martin./Binder, Manfred /Monch, Harald: "Dirty Industries": Patterns of Change in Industrial Countries. In *Environmental and Resource Economics*, Vol. **9** (1997), No. **4,** pp. 467-491.

Jänicke, M. and Weidner, H. (1995). Successful Environmental Policy: An Introduction. In Janicke, M. and Weidner, H.(eds.) 1995. *Successful Environmental Policy: A Critical Evaluation of 24 Cases*. Germany: WZB, 10-25.

Kellens, M. (2000). Oil Modification Processes in Hamm, W and Hamilton, R.J. (Eds.). *Edible Oil Processing*. pp. 129-173. England: Sheffield Academic Press.

Kolk, A. (2000). *Economics of Environmental Management*. Essex, United Kingdom: Prentice-Hall/Pearson Education.

Kreutzer, U.R. (1984). Manufacture of Fatty Alcohols Based on Natural Fats and Oils. *J. Am. Oil. Chem. Soc*. **61**, No. **2**, pp. 343-348.

Krut, R. and Gleckman, H.(1998). *ISO14001: A Missed Opportunity For Sustainable Global Industrial Development*. London: Earthscan Publications Ltd.

Laws of Malaysia. (2004). *Factories and Machinery Act with Regulations: All Amendments Up To August 2004.* Kuala Lumpur: MDC Publishers Sdn. Bhd.

Le Van Khoa. (2006). Greening Small and Medium-Sized Enterprises Evaluating Environmental Policy in Viet Nam. Ph.D. Thesis, Wageningen University, The Netherlands.

Lim Ai Leen and MaryAnn Tan. 2004. No more quotas. *The Edge, Malaysia*. November 1.: 72.

Lin, Nan. (1978). *Foundations of Social Research*. New York: McGrawHill.

Liu Yi. (2005). Phosphorous Flows in China: Physical Profiles and Environmental Regulations, PhD Thesis, Wageningen University, The Netherlands.

Loehman, K and Valentin, G. Malaysia: Facing Up to the Cost Conundrum. Special Report Malaysia, *Business International*, February 2002, pp. 24-25.

Malaysian Knitting Manufacturers' Association (MKMA) 1995. *Malaysian Knitting Manufacturers Association 20 years 1975-1995*. Johor, Malaysia: MKMA

Malaysian Knitting Manufacturers' Association (MKMA). 2003. *MKMA Members' Directory 2003-2005*. Johor, Malaysia: MKMA

Malaysian Oleochemical Manufacturers Group (MOMG) Section – News March 15, 2003 In ASEAN Oleochemical Manufacturers Group, Retrieved from http://www.aomg.org.my/p_ne_it.asp?NewsID-291&ThemeID-255&From-Theme on 5 November 2004.

Malaysian Palm Oil Board (MPOB). (2006). Amendments and Additions To The Licensing Conditions For The Palm Oil Millers and Fresh Fruit Bunches Traders Categories (Translated from Bahasa Malaysia). Retrieved on 5 September 2006 from http://161.142.157.2/pnp/sekatan.htm.

Malaysian Palm Oil Board (MPOB). (2001). *Review of the Malaysian Oil Palm Industry 2000*. Selangor: MPOB, Ministry of Primary Industries, Malaysia.

Malaysian Palm Oil Board (MPOB). (2002). *Review of the Malaysian Oil Palm Industry 2001, 21st Edition.* Selangor: MPOB, Ministry of Primary Industries, Malaysia.

Malaysian Palm Oil Board (MPOB). (2003). *Review of the Malaysian Oil Palm Industry 2002, 22nd Edition.* Selangor: MPOB, Ministry of Primary Industries, Malaysia.

Malaysian Palm Oil Board (MPOB). (2004). *Review of the Malaysian Oil Palm Industry 2003, 23rd Edition.* Selangor: MPOB, Ministry of Primary Industries, Malaysia.

Malaysian Palm Oil Board (MPOB). (2005). *Review of the Malaysian Oil Palm Industry 2004, 24th Edition.* Selangor: MPOB, Ministry of Primary Industries, Malaysia.

Malaysian Palm Oil Board (MPOB). (2003). Malaysia Oil Palm Statistics 2002, 22nd Edition. Selangor: MPOB.

Malaysian Palm Oil Board (MPOB). (2004). Malaysia Oil Palm Statistics 2003, 23th Edition. Selangor: MPOB.
Malaysian Palm Oil Board (MPOB). (2005). Malaysia Oil Palm Statistics 2004, 24th Edition. Selangor: MPOB.
Malaysian Palm Oil Association (MPOA). (2002). MPOA Annual Report 2002. Kuala Lumpur: MPOA.
Malaysian Palm Oil Association (MPOA). (2004). MPOA: Elected Council Members For The Year 2004-2006 With Effect From 27 April 2004. Retrieved from on October 20, 2004.
Malaysian Palm Oil Board (MPOB) (2004). Corporate Information. Retrieved from http://www.mpob.gov.my/corporate/broc_management.htm on October 20, 2004.
Malaysian Palm Oil Board (MPOB) (2006). Amendments and Additional Conditions For Palm Oil Mills and Fresh Fruit Bunches Traders. (Translation from Bahasa Malaysia). Retrieved from http://161.142.157/pnp/sekatan.htm on 5 September 2006.
Malaysian Palm Oil Promotion Council (MPOPC). (2004). Industry Related Organisations. Retrieved from http://www.mpopc.org.my/abtiro.htm on October 20, 2004.
Malaysian Palm Oil Promotion Council (MPOPC) and Jora-Aki Technology (2003). *Malaysia Palm Oil Directory, 4th Edition*, 2003-2004. Kuala Lumpur: MPOPC and Jora-Aki Technology.
Malaysia. (1966). *First Malaysia Plan 1966-1970*. Kuala Lumpur: Government Printers.
Malaysia. (1971). *Second Malaysia Plan 1971-1975*. Kuala Lumpur: Government Printers.
Malaysia. (1976). *Third Malaysia Plan 1976-1980*. Kuala Lumpur: Government Printers.
Malaysia. (1981). *Fourth Malaysia Plan 1981-1985*. Kuala Lumpur: National Printing Department.
Malaysia. (1986). *Fifth Malaysia Plan 1986-1990*. Kuala Lumpur: National Printing Department.
Malaysia. (1991). *Sixth Malaysia Plan 1991-1995*. Kuala Lumpur: National Printing Department.
Malaysia. (1996). *Seventh Malaysia Plan 1996-2000*. Kuala Lumpur: Percetakan National Malaysia Berhad.
Malaysia. (2001). *Eighth Malaysia Plan 2001-2005*. Kuala Lumpur: Percetakan National Malaysia Berhad.
Malaysia. (2006). *Ninth Malaysia Plan 2006-2010*. Kuala Lumpur: Percetakan National Malaysia Berhad.
Malaysia. *The First Outline Perspective Plan. (1971 -1990)*. Kuala Lumpur: National Printing Department.
Malaysia. *The Second Outline Perspective Plan. (1991-2000)*. Kuala Lumpur: National Printing Department.
Malaysia. *The Third Outline Perspective Plan. (2001-2010).* Putrajaya: National Printing Department.
Malaysia: Industrial Surveys 1985. Kuala Lumpur: Department of Statistics.
Malaysia: Monthly Statistical Bulletin, December 1991. Kuala Lumpur: Department of Statistics.
Malaysia: Monthly Statistical Bulletin, December 1996. Kuala Lumpur: Department of Statistics.
Malaysia: Monthly Statistical Bulletin, December 2001. Kuala Lumpur: Department of Statistics.
Malaysia: Monthly Statistical Bulletin, December 2005. Kuala Lumpur: Department of Statistics.
Malaysia:. (2004). Monthly Manufacturing Statistics, November 2003. Malaysia: Department of Statistics.
Malaysia: External Trade Summary, December 1996. Kuala Lumpur: Department of Statistics.
Malaysia: External Trade Statistics: Tables and Summaries 2001. Kuala Lumpur: Department of Statistics.
Malaysia. 2005. External Trade Statistics: Tables and Summaries 2004. Kuala Lumpur: Department of Statistics.

Malaysian Standards :Handbook On Environmental Management Systems-Environmental Auditing (MSISO14000 Series). (2000). Selangor: SIRIM Publications.

Malaysian Standards MS 1514:2001. Department of Standards Malaysia.

Malaysian Textile Manufacturers Association (MTMA). (2003). MTMA Members Directory 2003-2005. Kuala Lumpur, Malaysia: MTMA.

Malaysian Industrial Development Authority (MIDA). (2003). Malaysia Investment In The Manufacturing Sector: Policies, Incentives and Facilities. Kuala Lumpur: MIDA.

Malaysian Industrial Development Finance (MIDF).(2007a). Banking. Retrieved from http://cms.midf.com.my/website/banking.php. on 5 March 2007.

Malaysian Industrial Development Finance (MIDF).(2007b). Development Finances. Retrieved from http://cms.midf.com.my/developmentfinances.php. on 5 March 2007.

Malaysian Technology Development Corporation (MTDC). (2007a). About MTDC. Retrieved from http://www.mtdc.com.my/corp.php On 5 March 2007.

Malaysian Technology Development Corporation (MTDC). (2007b). MTDC Technology Innovation Centre. Retrieved from http://www.mtdc.com.my/incubator.php. On 5 March 2007.

Malaysian Technology Development Corporation (MTDC). (2007c). Government Grants. Retrieved from http://www.mtdc.com.my/grants.php On 5 March 2007.

Manheim, J. (2001). The Death Of a Thousand Cuts: Corporate Campaigns and the Attack on the Corporation (Lawrence Erlbaum Associate, Malwah, NJ).

Marcus, A., Gefen, D.A., and Sexton, K. (2002). Business-Government Cooperation in Environmental Decision-Making. *Corporate Environmental Strategy*, Vol **9**, No. 4 (2002).: 345-355.

Markandya, A. and Shibli, V. (1995). Industrial Pollution Control Policies in Asia: How Successful Are The Strategies. *Asian Journal of Environmental Management*, **3** (**2**). pp. 87-117.

Mason, R.D., Lind, D.A. and Marchal, W.G. (2000). *Statistical Techniques in Business and Economics, International Edition, 10th Edition*. Singapore: McGraw-Hill Book Co.

Ministry of International Trade and Industry (MITI). About MITI. Retrieved from http://www.miti.gov.my on October 20, 2004.

MIDF. (2007a). Investment Banking. Retrieved from http://c,s.midf.com.my/investmentbanking.php on 5 March 2007.

MIDF. (2007b). Investment Banking. Retrieved from http://c,s.midf.com.my/investmentfinance.php on 5 March 2007.

Ministry of Natural Resources and Environment (MNRE. (2005). Retrieve from http://www.nre.gov.my/English Version/fungsi.htm on 11 November 2005.

Ministry of Plantation Industries and Commodities (MPIC). (2004). Retrieved from the Official Site of Ministry of Plantation Industries and Commodities http://www.kpk.gov.my/cgi-bin/index.p?action=overview=profile+vision on July 26, 2004.

Mills will lose license if oil extraction rate falls below 18pc. (2002b). *New Sunday Times*. 22 December.

Moving Offshore: Now its Malaysia's turn to choose. Special Report Malaysia, *Business International*, February 2002, pp. 36-38.

MPOA. 2006. Response by MPOA on 26 July 2005 to the report by CSPI entitled Cruel Oil : How Palm Oil Harms Health, Rainforest and Wildlife. Retrieve from http //www.cspinet.org/new/pdf/palm.oil.final-5-27-05.pdf on 5 September 2006.

Malaysian Palm Oil Board (MPOB). 2006. Amendments and Additions to the Licensing Conditions For The Palm Oil Millers and Fresh Fruit Bunches Traders Categories. Translated from *Pindaan dan Tambahan Syarat Lesen Bagi Kategori Kilang Buah Kelapa Sawit dan Peniaga Buah Kelapa Sawit (Bahasa Malaysia)*. Retrieved from http://161.142.157.2/pnp/sekatan.htm. on 5 September 2006.

Mol, A.P.J. and Spaargaren, G. (1993). Environment, Modernity and the Risk Society: The Apocalyphic Horizon of Environmental Reform. *International Sociology* (8) 4: pp. 431-459.

Mol, A.P.J. (1995). *The Refinement of Production: Ecological Modernization Theory and the Chemical Industry*. Utrecht: Jan van Arkel/International Books.

Mol, A.P.J. (1997). Ecological Modernization: Industrial Transformations and Environmental Reform. From Michael Redclift and Graham Woodgate (eds), The international handbook of environmental sociology. Cheltenham: Edward Elgar, 138-150.

Mol, A.P.J. (2000). "The environmental movement in an era of ecological modernization," *Geoforum*, **31**: 45-56.

Mol, A.P.J. (2001). *Globalization and Environmental Reform: The Ecological Modernization of the Global Economy*. Cambridge, Massachusetts: The MIT Press.

Mol, A.P.J. (2002). Ecological Modernization and the Global Economy. *Global Environmental Politics*, **2 (2**), May. pp. 92-115.

Mol, A.P.J. (2006). Environment and Modernity in Transitional China: Frontiers of Ecological Modernization. *Development and Change* **37**(**1**): 29-56.

Mol, A.P.J., Lauber, V., and Liefferink, D. (2000). The Voluntary Approach To Environmental Policy : Joint Environmental Policy-making in Europe. New York: Oxford University Press.

Mol, A.P.J. and Spaargaren, G. (2000). "Ecological Modernisation Theory In Debate: A Review", *Environmental Politics* Vol. **9**, No. 1: 17-49.

Mol, A.P.J. and Sonnenfeld, D.A. (2000). "Ecological Modernisation Around The World: An Introduction". In Mol, A.P.J. and Sonnenfeld, D.A. (eds) (2000) *Ecological Modernization Around The World: Perspective and Critical Debates*. London, Portland: Frank Cass, 3-16.

Mol, A.P.J. and Spaargaren, G. (2002). Ecological Modernization And The Environmental State. In Mol, A.P.J. and Buttel, F. (2002). *The Environmental State Under Pressure*. Vol. **10.** UK: Elsevier Science Ltd. 33-53.

Moll, H.A.J. (1987). *The Economics of Oil Palm: Economics of Crops in Developing Countries* No. 2. Wageningen, The Netherlands: Centre for Agricultural Publishing and Documentation (Pudoc).

Murphy, J. (2000). Editorial: Ecological Modernization. *Geoforum* 31. pp. 1-8.

Murphy, J. and Gouldson, A. (2000). Environmental policy and industrial innovation: integrating environment and economy through ecological modernization. *Geoforum* **31** (2000): 33-44.

Nahapiet, J. and Ghoshal, S. (1998). Social Capital, Intellectual Capital and the Organizational Advantage. *Academy of Management Review* **23**, No. 2, pp. 242-266.

New rules help clear backlog of palm oil cargoes. *The Malay Mail*, 10 September 2003.

Ng Say Bock and M.R. Chandran. (2004). Food Safety: Standards for Palm Oil. *Global Oils and Fats.* Vol. **1** (3), pp. 11-15.

Norusis, M.J. (2004). *SPSS 12.0 Guide to Data Analysis*. Upper Saddle River, New Jersey: Prentice-Hall, Inc.

Norusis, M.J. (2003). *SPSS 12.0 Statistical Procedure Companion.*. Upper Saddle River, New Jersey: Prentice-Hall, Inc.

O' Rourke, D. (2002). Motivating A Conflicted Environmental State: Community Driven Regulation in Vietnam. In Mol, A.P.J. and Buttel, F.H. (eds.) (2002). The Environmental State Under Pressure, *Research in Social Problems and Public Policy*, Vol. **10**. United Kingdom: Elsevier Science Ltd. pp. 221-244.

Palm oil industry's rivals behind smear campaign. (2002a) *New Sunday Times* 22 December 2002a.

Palm Oil Research Institute of Malaysia (PORIM). (1998). *Oil Palm And The Environment*. Kuala Lumpur: PORIM.

Palm Oil Registration and Licensing Authority PORLA. (1988). *Oil Palm Industry in Malaysia*. Kuala Lumpur: PORLA, Ministry of Primary Industries.

Planters yield to improve. *StarBiz* 31 July 2006.

Palm Oil Refiners Association of Malaysia (PORAM). (2004). Retrieved from http://www.poram.org.my/structure.html on October 20, 2004.

PORAM Technical Brochure (year unknown). Kuala Lumpur: PORAM.

Peninsular Malaysia: Monthly Statistical Bulletin of Peninsular Malaysia, December 1981. Kuala Lumpur: Department of Statistics.

Peninsular Malaysia: Monthly Statistical Bulletin of Peninsular Malaysia, December 1986. Kuala Lumpur: Department of Statistics.

PORLA. (1981). Annual Report 1980. Kuala Lumpur: Economic and Planning Division, PORLA.

PORLA. (1981). Palm Oil Statistical Handbook 1980. Kuala Lumpur: Economic and Planning Division, PORLA.

PORLA. (1986). Palm Oil Statistics Supplement 1985, Kuala Lumpur: Economic and Planning Division, PORLA.

PORLA. (1989). Palm Oil Statistical Handbook 1988, PORLA Statistics No. 8. Kuala Lumpur: Economic and Planning Division, PORLA.

PORLA. (1992). Palm Oil Statistical Handbook 1991, PORLA Statistics No. 11. Kuala Lumpur: Economic and Planning Division, PORLA.

PORLA. (1994). Palm Oil Statistical Handbook 1993, 13th Edition. Kuala Lumpur: Economic and Planning Division, PORLA.

PORLA. (1996). Palm Oil Statistical Handbook 1995, 15th Edition. Kuala Lumpur: Economic and Planning Division, PORLA.

PORLA (1998). Review of the Malaysian Palm Oil Industry 1997. Kuala Lumpur: PORLA, Ministry of Primary Industries, Malaysia.

Porter, M. and C. van de Linde. (1995). Green and Competitive: Ending The Stalemate, *Harvard Business Review*, September-October, 120-134.

Punch, K.F. (2005). *Introduction to Social Research: Quantitative and Qualitative Approaches, 2nd Edition*. London: Sage Publications Ltd.

Ramachandran. 1986. Hazards In The Textile Industry. In Sahabat Alam Malaysia (SAM). 1986. Hazardous Industries And Workers Health. Proceedings of the National Seminar on Workers Health and Safety Problems in Malaysia. Organized by SAM from 8-9 December, 1984, pp. 93-105.

Ramatex. (2004). *Vertical Integration*. Retrieved from http://www.ramatex.com.my/integration.htm. on 25 November 2004.

Refinery of Palm Oil. Retrieved on September 8, 2006, from http://www.andrew.cmu.edu/user/jitkangl/palm%20Oil/Refinery%20of%20pal%20oil/htm.

Revell, A. and Rutherfoord, (2003). UK Environmental Policy and the Small Firms: Broadening The Focus. *Business Strategy and the Environment* **12**(**1**), pp. 26-35.

RISDA. (2007). Strategic Plan. (Translated from Bahasa Malaysia: Rancangan Strategik). Retrieved from http://www.risda.gov.my/v2/index. php?option =com_contents & task=view&id=35%.tenid.62 on 9 April.

Roberts, J.T. (1998). Emerging global environmental standards: Prospects and Perils. *Journal of Developing Societies* **14**, no. ***1***: 144-165.

Rock, M.T. (2002). Pathways To Industrial Environmental Improvement In The East Asian Newly Industriailizing Economies. *Business Strategy and the Environment*, 11, 90-102.

Salleh Buang. 2006. Throw environmental offenders in jail. *New Straits Times*, 15 April.

Sarawak Land Consolidation and Rehabilitation Authority (SALCRA). (2007). Retrieved from http://www.salcra.gov.my/salcra/intro_core%20business.htm) on 9 April 2007.

Sham Sani. (1997). *Environmental Quality Act 1974: Then and Now, Institute for Environment and Development*. Bangi, Selangor: Universiti Kebangsaan Malaysia.

Simonis, U.E. (1989). Ecological modernization of industrial society: three strategic elements. *International Social Science Journal*, No. **121**, 1989, pp. 347-361.

Siow Hon Cheong, President of the Malaysian Knitting Manufacturers Association. Confidence in Malaysian Products. Special Report Malaysia, *Business International*, February 2002, pp. 26-28.

Small and Medium Industries Development Corporation (SMIDEC). (2002). *SMI Development Plan (2001-2005)*. Petaling Jaya: SMIDEC.

Small and Medium-scaled Enterprises (SME) Bank. (2007). Welcome to Malaysia's SME Bank. Retrieved from http//www.smebank.com.my on 5 March 2007.

Smink, C.K. (2002). Modernisation of Environmental Regulations: End-of-Life Vehicle Regulations In The Netherlands and Denmark. Aalborg University, Department of Development and Planning.

Socio-Economic Environmental Research Institute (SERI). 2002. Economic Briefing To The Penang State Government: Textile and Garment Industry in Penang, Is It Sunset Or A Rising Star? Volume **4**, Issue 8, August.

Sonnenfeld, D.A. and Mol, A.P.J. (2002). Globalization and the Transformation of Environmental Governance: An Introduction. *American Behavioral Scientist*, Vol. 45, No. ((May). Sage Publications. pp. 1-20.

Sonntag, N.O.V. (1984). New Development in the Fatty Acid Industry in America. *J. Am. Oil. Chem. Soc*. **61**, No. **2**, pp. 229-232.

Spaargaren, G. (2000). Ecological Modernization Theory and the Changing Discourse on Environment and Modernity. In Spaargaren, G., Mol, A.P.J. and Buttel, F.H. (eds.) (2000). *Environment and Global Modernity*. London: Sage. Pp. 41-73.

Spaargaren, G. and Mol, A.P.J. (1992). Sociology, Environment, and Modernity: Ecological Modernization as a Theory of Social Change. *Society and Natural Resources,* Volume **5,** pp. 323-344.

Spaargaren, G. and van Vliet, B. (2000). Lifestyles, Consumption and the Environment: The Ecological Modernization of Domestic Consumption. *Environmental Politics **9** (2000)*. pp 50-77.

Sriwichalamphan, T. (2007). Global Food Chains and Environment: A Case Study of Agro-Food Industries in Thailand. PhD Thesis, Wageningen University, The Netherlands.

Standards Industrial Research Institute of Malaysia (SIRIM). (2004). Annual Report 2004. Selangor: SIRIM.

Suan, L.O. and Ho, K.P. (1985). Processing for Industrial Fatty Acids II. *Journal of American Oil Chem, Soc*. **62**, No. 2. pp. 348-351A.

S.S. Chen and K.G. Berger. (1984). The Emerging Oleochemical Industry in Malaysia. *Palm Oil Developments*, No. 1, PORIM, June, pp. 1-3.

Suzanna Mohamed Isa. (2006). *Environmental Law in Malaysia*. Bangi, Selangor: Penerbit Universiti Kebangsaan Malaysia.

Syabas! Kepada Felda Palm Industries Sdn. Bhd. di atas kejayaan melaksanakan:
Sistem Pengurusan Keselamatan dan Kesihatan OHSAS 18001.
Sistem Pengurusan Alam Sekitar MS ISO14001.
Sistem Pengurusan Kualiti MS ISO9001.
Dan Sistem Pengurusan Makmal MS ISO17025. StarBiz 18 July 2004: 10.

Thang Thin Sue. (2005). Processing of Palm Kernels. In Yusof Basiron, Ariffin Darus, Ma Ah Ngan and Chan Kook Weng (eds.). (2005). *Palm Kernel Products: Characteristics and Applications*. Kuala Lumpur: MPOB, MPIC, pp. 19-69.

Tang, T.S. and Teoh, P.K. (1985). Palm kernel oil extraction – the Malaysian experience. *J of Amer. Oil Chem. Soc*. **62**: 254-258.

Teoh Cheng Hai. (2002). The Palm Oil Industry in Malaysia: From Seed to Frying Pan. Prepared for WWF Switzerland, November.

Teoh Cheng Hai and Martin Abraham (eds.) (1996). Towards Corporate Environmental Excellence: The Role of Sustainable Development with Reflections of the Future – A Photoessay by Mark Edwards. Kuala Lumpur, Malaysia: Global 500 Forum and Golden Hope Plantations Berhad Malaysia.

Textile and the Environment. Welcome at Oeko-Tex_com.htm . Retrieved on 29 November 2005.

Textile On Line. Retrieved from http://www.e4s.org.uk/textilesonline/content/6library/report3/fibre.production.htm on 13 November 2006.

Textile: Cotton: From Field to Fabric. Retrieved from (www.cotton.org/pubs/cottoncounts/fieldtofabric/yarn.cfm). on 13 November 2006.

The Palm Oil Refiners Association of Malaysia (PORAM). Kuala Lumpur.

Timberlake, I. (1989). The Role of Scientific Knowledge In drawing up the Brundtland Report. In Andersen, S. and Ostreng, W. (eds.) *In International Resource Management.* London: New York: Belhaven Press.

TopGlove aims to reach all corners of the world. *New Straits Times* 18 February 2003.

Tran Thi My Dieu. (2003). *Greening Food Processing Industry in Vietnam. Putting Industrial Ecology To Work*, Wageningen, The Netherlands: Wageningen Unviersity (dissertation).

Tunku Shamsul Bahrain and Lee, B.T. (1980). FELDA – 3 Decades of Evolution, Kuala Lumpur.

UNEP IE Document "Cleaner Production in the Asia and Pacific Economic Corporation (APEC) Region. From www.p2pays.org/ref/11/10924.htm. Retrieved on 11 April 2005.)

Van de Woerd, K.F., de Wit, C.M., Kolk,A., Levy, D.L., Vellinga, P., and Behlayarova, V. (2000). Dutch National Research Programme on Global Air Pollution and Climate Change: Diverging Business Strategies Towards Climate Change: An USA-Europe comparison for four sectors of industry. Institute for Environmental Studies Amsterdam, Institute for Environmental Management, The Netherlands, University of Massachusetts, USA.

Van Tatenhove, Arts, B. and Leroy, P. (2000) Political Modernisation. In Van Tatenhove, Arts, B. and Leroy, P. (eds.) (2000). *Political Modernization and the Environment: The Renewal of Environmental Policy Arrangements*. The Netherlands: Kluwer Academic Publishers.

VanKoppen, C.S.A (Kris) and Mol, A.P.J. (2002). Ecological Modenization of Industrial Ecosystems. In Lens, P., L.W. Hushoff Pol, P. Wilderer and T. Asano (eds.). Water *Recycling and Resource Recovery in Industry: Analysis, Technologies and Implementation.* IWA Publishing.

Veal, A.J. (1997). *Research Methods for Leisure and Tourism: A Practical Guide, 2nd edition*. London: Pearson Education Limited.

Vincent, J.R. and Rozali Mohamed Ali with Khalid Abdul Rahim. (2000). Water Pollution Abatement In Malaysia. In Angel, D.P. and Rock, M. (eds.) (2000). *Asia's Clean Revolution: Industry Growth and the Environment*. UK: Greenleaf Publishing .

Wattanapinyo, A. (2006). Sustainability of Small and Medium-sized Agro-Industries in Northern Thailand. Ph.D Thesis, Wageningen University, The Netherlands.

Weale, A. (1992). *The New Politics of Pollution*. Manchester: Manchester University Press.

West Malaysia: Monthly Statistical Bulletin of West Malaysia, December 1971. Kuala Lumpur: Department of Statistics.

West Malaysia: Monthly Statistical Bulletin of West Malaysia, December 1976. Kuala Lumpur: Department of Statistics.

What is Codex. Retrieved from http://www.food.gov.uk/foodindustry/Codexbranch on 31 October 2005.

Winitex. (2004). Winitex Sdn. Bhd., Johore, Malaysia.

Worldwide Responsible Apparel Production (WRAP). (2005). Content. Retrieved from http:/www.wrapapparel.org/modular.php?name.content&pa=showpage&pid=18pag. on 26 April 2005.

Woodgate, G. and Redclift, M.R. (2005). Introduction. From Redclift, M.R. and Woodgate, G. (eds.) (2005). *New Developments in Environmental Sociology*. Cheltenham, UK: An Elgar Reference Collection. pp. xv – xxvi.

World Bank. (1997). Environmental Management Systems and ISO14000 Pollution Prevention and Abatement Handbook, World Bank, 1997 Retrieved from Environmental%20Management%20Sytems%20and%20ISO%2014000.htm On 31 January 2007.

Yang, L.F. (2005). Embedded autonomy and ecological modernization in Taiwan. *International Journal of Environment and Sustainable Development*, Vol. **4**, No. **3**, pp. 310-330.

Yusof Basiron. 2006. Palm Oil: Do we still have to defend it? *New Straits Times*, September 22, 2006. Letters pp 25.

Yusof Basiron and Ariffin Darus. (1996). Targeting Zero Waste in Oil Palm. In Teoh Cheng Hai and Ward Abraham (eds.) (1996). *Towards Corporate Environmental Excellence: The Role of Business in Sustainable Development With Reflections Of the Future- A Photoessay* by Mark Edwards.

Yusof Basiron, Jalani Sukaimi, Ariffin Darus, Ma Ah Ngan, Hamirin Kifli, Ab. Aziz Md Yusof (eds.) (1998). Oil Palm and Environment. Kuala Lumpur: Palm Oil Research Institute of Malaysia (PORIM).

Yusof Basiron, N. Balu, D. Chandramohan. (2004). *Oil Palm Industry Economic Journal*, Vol. **4**, (1/2004), pp.1-10.

Yusof Basiron and Chan Kook Weng. (2004). The Role of Research and Development Strategies in Food Safety and Good Agricultural, Manufacturing and Distribution Practices in the Malaysian Palm Oil Industry. Paper presented at the EUREPGAP Asia 2004 Conference at Mutiara Hotel, Kuala Lumpur on 8-9 June 2004.

Yusof Basiron. (2006). A distortion of facts, by palm oil critics. *New Straits Times, Saturday Forum*, May 27, pp. 19.

Yusof, B. and Ariffin, D. (1996) Targeting zero waste in oil palm. Towards Corporate Environmental Excellence (Teoh, C.H. and Abraham, M. (eds.). *Global 500 Forum and Golden Hope Plantations Berhad*. pp. 41-48.

Zaidi Isham Ismail. 2003a. Cut in India's processed palm oil duty augurs well for Malaysia, *New Straits Times*, 5 May 2003.

Zaidi Isham Ismail. 2003b. Guthrie taking steps to meet European standard, *Business Times*, 24 June 2003.

Zhang, L. (2002). Ecologizing Industrialization in Chinese Smalll Towns. Ph.D. Thesis, Wageningen University, The Netherlands.

APPENDIX 1

Terms and Conditions for the Various Manufacturing Incentives Offered by MIDA

1. INCENTIVES FOR HIGH TECHNOLOGY COMPANIES

Pioneer Status for High Technology Companies
A company enjoying pioneer status has tax exemption of 100% of its statutory income for the duration of 5 years
Or
Investment Tax Allowance for High technology Companies
A company enjoying this allowance is given a provision of 60% of incurred qualifying capital expenditure within the 5 years the first qualifying expenditure is incurred. The unutilized portion of the allowance can be carried forward to the subsequent years until the full amount is fully utilized. This allowance can be offset against 100% statutory income for the year of assessment.

The high technology company for the above two incentives must also fulfill the following criteria

- A minimum of 1% of R & D expenditure to gross sales on an annual basis within 3 years from its date of operation
- A minimum of 7% of the company's workforce must be scientific and technical staff with degrees/diplomas and a minimum of 5 years related working experience.

2. INCENTIVES FOR ENVIRONMENTAL PROTECTION

Pioneer Status for Environmental Protection
A company enjoying this incentive has tax exemption of 70% of its statutory income for the duration of 5 years. Applications from the Eastern Corridor of Peninsular Malaysia, that is the states of Kelantan, Trengganu, and Pahang, and the District of Mersing in the Johor State, and the States of Sabah and Sarawak (East Malaysia) benefit from a tax exemption of 85%of its statutory income for the duration of 5 years
Or
Investment Tax Allowance for Environmental Protection
A company enjoying Investment Tax Allowance is provided with an allowance of 60% on qualifying capital expenditure for a 5-year period starting on the date the first qualifying expenditure is incurred. This allowance can be used to offset against 70% of annual statutory income for the 5-year duration. The unutilized portion of the allowance can be carried forward to the subsequent years until the full amount is fully utilized.

Applications from the Eastern Corridor of Peninsular Malaysia, namely the states of Kelantan, Trengganu, and Pahang, and the District of Mersing in the Johor State, and the States of Sabah and Sarawak (East Malaysia) benefit from an allowance of 80% on incurred qualifying capital expenditure. This allowance can be used to offset against 85% of annual statutory income for the 5-year duration. The unutilized portion of the allowance can be carried forward to the subsequent years until the full amount is fully utilized.

3. INCENTIVES FOR RESEARCH AND DEVELOPMENT

Investment Tax Allowance for Research and Development Company
A company that provides Research and Development services to its related company or companies, be it in the form of a subsidiary or associate company is eligible for Investment Tax Allowance of 100% on qualifying capital expenditure incurred within 10 years. This allowance can be offset against 70% of statutory income of the year of assessment. However, if the Research and Development company opt not to apply for this incentive, the recipients of the Research and Development services can apply for Double Deduction for research and Development where such a claim must be submitted to the Internal Revenue Board, an agency under the Ministry of Finance.

The Research and Development company must also abide by the following criteria:

- The undertakings in Research and Development must be aligned to the needs of the country and be beneficial to the economy.
- A minimum of 70% of the income of the Research and Development company must be derived from Research and Development activities
- A minimum of 50% of the workforce must be qualified staff performing Research and Development functions for a manufacturing-based research and Development company

Investment Tax Allowance for In-house Research
A company undertaking in-house Research and Development activities can apply for Investment Tax Allowance of 50% on qualifying capital expenditure incurred within 10 years. This allowance can be offset against 70% of statutory income for the year of assessment.

APPENDIX 2

ALLOWANCES ALLOWED BY THE INTERNAL REVENUE BOARD

1. Reinvestment Allowance

Manufacturing companies that have been in operation for a minimum of 12 months and at the same time having incurred qualifying capital expenditure for the expansion of production capacity, modernisation and upgrading production facilities, product diversification and automation of production facilities are eligible to apply for Reinvestment Allowance.

Reinvestment Allowance is based on 60% of qualifying capital expenditure incurred by the company where it can be offset against 70% of statutory income for the year of assessment. Any unutilised allowances can be carried forward to the subsequent year or years until full utilisation.

However, a company can offset the Reinvestment Allowance against 100% statutory income for the year of assessment based on any one of the criteria below:

- The company undertakes reinvestment in the state of Sabah, Sarawak and the designated Esatern Corridor in Peninsular Malaysia.
- The company achieves a productivity level that exceeds the standard set by the Ministry of Finance for the specific manufacturing sectors

The Reinvestment Allowance is to be given for a period of 15 consecutive years starting with the year the first reinvestment is undertaken. Company can only start to claim Reinvestment Allowance only upon completion of the qualifying project like for example the expansion of production capacity where the machinery and equipment are commissioned and fully operational. Assets acquired for this purpose cannot be disposed off during the first 2 years beginning from the time of reinvestment.

A company that intends to reinvest prior to the expiration of the Pioneer Status incentive can surrender the Pioneer Status for cancellation and in turn be eligible for reinvestment Allowance effective from 21 September 2002.

2. Accelerated Capital Allowance

After the maturation of the Reinvestment Allowance that runs consecutively for 15 years, companies that continue to reinvest in the manufacture of promoted products are eligible to apply for Accelerated Capital Allowance. Accelerated Capital Allowance for qualifying capital expenditure can be fully utilised within 3 years where an initial allowance of 40% is followed by an annual allowance of 20%. Applications for Accelerated Capital Allowance are to be submitted to the Internal Revenue Board accompanied by a letter from the Malaysian Industrial Development Authority certifying that an applicant is involved in the manufacturing of promoted product or products.

3. Double Deduction for Research and Development

A company is eligible for double deduction on its non-capital expenditure for research undertaken and approved by the Ministry of Finance. Payment for utilization of services by approved research institutes, Research and Development companies, contract Research and Development companies qualifies for double deduction. This is also applicable to cash contribution to approved research institutes.

4. Accelerated Capital Allowance for Environmental Protection Projects

Accelerated Capital Allowance for qualifying capital expenditure on related machinery and equipment can be fully utilised within 3 years where an initial allowance of 40% is followed by an annual allowance of 20%. This incentive is eligible for a company that must abide by the following criteria:

- The company is a waste generator and will undertake the establishment of facilities to store, treat and dispose of their own wastes, either on-site or off-site.
- The company must undertake waste recycling activities

However, for companies that incurs qualifying capital expenditure for conserving energy consumption, the write-off period is accelerated to one year effective from the year of assessment 2003

5. Accelerated Capital Allowance for the Use of Environmental Protection Equipment

Companies that incur qualifying capital expenditure in the form of environmental protection equipment are eligible for an initial allowance of 40% and an annual allowance of 20% of capital expenditure. As such, the full amount can be written off in 3 years.

6. Donations for Environmental Protection

Donations to approved organisations exclusively involved in the protection and conservation of the environment qualify for a single deduction.

APPENDIX 3
Questionnaire for the POPC

Dear Valued Respondent

I am a lecturer in the School of Social, Development and Environmental Studies, Faculty of Social Sciences and Humanities, Universiti Kebangsaan Malaysia, Bangi, Selangor, Selangor. Currently, I am pursuing my Ph.D program in Wageningen University, The Netherlands. My research is entitled " A Quantitative Methodology To Test Ecological Modernization Theory In The Malaysian Context". Attached to this is also a letter pertaining to the research from my supervisor.

Your kind cooperation in giving me and/or my research assistants an interview to fill in the questionnaire is highly appreciated. Alternatively, I would appreciate it very much if you could kindly fill in the questionnaire and remit it in the enclosed stamped self-addressed envelope to:

Er Ah Choy
Environmental Policy Group
Department of Social Sciences
Wageningen University
6706 KN Wageningen
The Netherlands

OR
89 Taman Senawang Jaya
70450 Seremban
Malaysia.
e-mail: Er-Ah.Choy@wur.nl

Your kind cooperation is highly appreciated.

Yours sincerely

Er Ah Choy

General Instructions to Respondents

1. Please note that the questions encompass the activities of your company over the last 3 years.
2. Please tick the box that is closest to your opinion.
3. If you hesitate, please tick the box that first comes to your mind, as this mostly represents your closest opinion.

H1

1. Is your company/group being directly invited by the Federal/State government to any of the national/state councils/committees? (Please tick the relevant box as indicated in Table 1).

Table 1

	Tick where relevant (/)	Instructions
Yes (a*) Able to identify the council(s) or committee(s) and policy (ies) involved.		If yes, please continue with Question 2 to Question 6 and then proceed to Question 18 onwards.
Yes (b**) Have knowledge of the influence of your company but not able to identify specific council(s) or committee(s) and governmental policy (ies).		If yes, please proceed to Question 18 onwards.
Yes (c***) Have knowledge that no influence is wielded by the company/group on governmental policy(ies) but not able to identify specific council(s)/committee(s) and governmental policy (ies).		If yes, please proceed to Question 18 onwards
No		If no, please continue with Question 6 onwards
Don't know		If don't know, please continue with Question 6 onwards

2. Please tick the relevant national/state councils/committees that your company/group participated in. (Refer to Table 2).
Instruction:
You may tick more than one response.

Table 2

Councils/Committees	Tick where relevant (/)
National	
Malaysian Palm Oil Board (MPOB) Board	
Malaysian Palm Oil (MPOC) Board of Trustees	
Technical Committee of Standards and Industrial Research Institute of Malaysia (SIRIM)	
State	
Others. Please specify	

3 (i). Please tick (/) in Table 3 the policies that your company/group, invited directly by the Federal/State government to the national/state councils/committees, has participated in the policy formulation process.
(ii) Please write down the name(s) of the relevant national/state councils/committees that your company/group, invited directly by the Federal/State government to the national/state councils/committees, has participated in the policy formulation process. (Refer to Table 3)

Table 3

	Tick where relevant (/)	**Names of relevant national/state councils/committees (As in Table 2)**
Sector Specific Policies		
Oil Extraction Rate (OER) 18%	☐	
Value Added Downstream Policy	☐	
Promotion of Palm Oils and Fats In The International Market	☐	
Task Force on Environment	☐	

4. How active is the participation of your company/group in the national/state councils/committees with regard to the policy decision-making process? (Refer to Table 4)
Instruction:
Please write down the name(s) of the council(s) or committee (s) and next indicate the degree of activeness based on the following:-
  Very Active=5
  Active=4
  Moderately Active=3
  Inactive=2
  Not Active At All =1

Table 4

	Name of the council(s)/committee(s)														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Oil Extraction Rate (OER) 18%															
Value Added Downstream Policy															
Promotion Of Palm Oils And Fats In The International Market															
Task Force on the Environment															

5. How influential is your company/group in the national/state councils/ committees with regard to the policy decision-making process? (Refer to Table 5).
   Instructions:
   Please write down the name(s) of the council(s) or committee(s) and next indicate the degree of influence based on the following.
   Very Influential=5
   Influential=4
   Moderately influential=3
   Little Influential=2
   Not Influential At All=1

Table 5

	Name of the council(s)/committee(s)														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Oil Extraction Rate (OER) 18%															
Value Added Downstream Policy															
Promotion Of Palm Oils And Fats In The International Market															
Task Force on the Environment															

6. Does your company/group, elected as a representative for any of the sub-sectoral groupings/associations, participate in the national/state council(s) or committee(s) for policy formulation? (Refer to Table 6).

Table 6

	Tick where relevan t (/)	**Instructions**
Yes (a*) Able to identify the grouping(s)/ association(s); council(s) or committee(s) and policy (ies) involved.		If yes, please continue with Question 7onwards
Yes (b**) Have knowledge of the influence of the grouping(s)/association(s) on governmental policy(ies) but not able to identify specific council(s) or committee(s) and governmental policy (ies).		If yes, please go to Question 7 and then proceed with Question 12 onwards
Yes (c***) Have knowledge that no influence is wielded by the grouping(s)/ association(s) on governmental policy(ies), but not able to identify the council(s) or committee(s) and governmental policy (ies) involved.		If yes, please go to Question 7 and then proceed with Question 12 onwards
No		If no, please continue with Question 12 onwards
Don't know		If don't know, please continue with Question 12 onwards

7. Please tick the sub-sectoral groupings/associations that your company/group has been elected as a representative. (Refer to Table 7).
Instruction.
Please tick the relevant box(es).

Table 7

Sub-sectoral Groupings/Associations	**Tick where relevant (/)**	
	Company	**Group**
1. Malaysian Palm Oil Association (MPOA)		
2. Palm Oil Millers' Association of Malaysia (POMA)		
3. Palm Oil Refiners' Association of Malaysia (PORAM)		
4. Malaysian Edible Oil Manufacturers' Association (MEOMA)		
5. Malaysian Oleochemical Manufacturers' Group (MOMG)		
6. Others. Please specify.		

8 (i). Please tick(/) in Table 8 the relevant national/state council(s)/committee(s) that your company/group, acting as a representative for a particular sub-sectoral grouping/association, participated in.
(ii) Please write down the name(s) of the sub-sectoral grouping(s)/association(s) (as in Table 7) that your company/group has been elected as a representative. (Refer to Table 8).

Table 8

Councils/Committees	**Tick where relevant (/)**	**Names of sub-sectoral groupings/associations (Number 1-7 as in Table 7)**
National		
Malaysian Palm Oil Board (MPOB) Board	☐	
Malaysian Palm Oil Council (MPOC) Board of Trustees	☐	
Others. Please specify.	☐	

9 (i) Please tick (/) in Table 9 the policy/policies in which your company/group, acting as a representative for a particular sub-sectoral grouping/association in the national/state council(s)/committee(s), participated in the policy formulation process.
(ii) Please write down the name(s) of the relevant national/state council(s)/committee(s) that your company/group, acting as a representative for a particular sub-sectoral grouping)/association, participated in the policy formulation process. (Refer to Table 9).

Table 9

	Tick where relevant (/)	**Name(s) of relevant national/state council(s)/committee(s) (As indicated in Table 8)**
Sector Specific Policies		
Oil Extraction Rate (OER) 18%	☐	
Value Added Downstream Policy	☐	
Promotion of Palm Oils and Fats In The International Market	☐	
Task Force on Environment	☐	

10. How active is your company/group, acting as a representative for a particular sub-sectoral grouping/association, in the national/state council(s)/committee(s) with regard to the policy decision-making process? (Refer to Table 10).
Instruction:
Please write down the name(s) of the sub-sectoral grouping(s)/association(s), the names of the council(s) and committee(s) and next indicate the degree of activeness based on the following:
Very Active=5
Active=4
Moderately Active=3
Inactive=2
Not Active At All=1

Table 10

	Name(s) of the sub-sectoral grouping(s)/association (s) (As indicated in Table 8) **Name(s) of the council(s) or committee(s) (As indicated in Table 9)**														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Oil Extraction Rate (OER) 18%															
Value Added Downstream Policy															
Promotion of Palm Oils and Fats In The International Market															
Task Force on the Environment															

11. How influential do you think your company/group is, acting as a representative for a particular sub-sectoral grouping/association, in the national/state council(s)/committee(s) with regard to the policy decision-making process? (Refer to Table 11).
Instructions:
Please write down the name of the sub-sectoral grouping(s)/association(s); name(s) of the council(s) or association(s), and next indicate the degree of influence based on the following:
Very Influential=5
Influential=4
Moderately Influential=3
Little Influential=2
Not Influential =1

Table 11

	Name(s) of the sub-sectoral grouping(s)/association (s) (As indicated in Table 8) Name(s) of the council(s) or committee(s) (As indicated in Table 9)														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Oil Extraction Rate (OER) 18%															
Value Added Downstream Policy															
Promotion of Palm Oils and Fats In The International Market															
Task Force on the Environment															

12. If your company/group is not elected as a representative in any of the sub-sectoral groupings/associations, does an elected member of a particular sub-sectoral grouping/association in the national/state council(s)/committee(s) represent you? (Please tick the relevant box as indicated in Table 12).

Table 12

	Tick where relevant (/)	**Instructions**
Yes (a*) Able to identify the grouping(s)/ association(s); council(s) or committee(s) and policy (ies) involved.		If yes, please continue with Question 13 onwards
Yes (b**) Have knowledge of the influence of the grouping(s)/association(s) on governmental policy(ies) but not able to identify specific council(s) or committee(s) and governmental policy (ies).		If yes, please go to Question 13 and then proceed with Question 18 onwards
Yes (c***) Have knowledge that no influence is wielded by the grouping(s)/ association(s) on governmental policy(ies), but not able to identify the council(s) or committee(s) and governmental policy (ies) involved.		If yes, please go to Question 13 and then proceed with Question 18 onwards
No		If no, please continue with Question 18 onwards
Don't know		If don't know, please continue with Question 18 onwards

13. Please tick the relevant sub-sectoral grouping(s)/association(s) of the representative of your company/group. (Refer to Table 13).
Instructions:
Please tick the relevant box(es).

Table 13

Sub-sectoral Groupings/Associations	Tick where relevant (/)	
	Company	Group
1. Malaysian Palm Oil Association (MPOA)		
2. Palm Oil Millers' Association of Malaysia (POMA)		
3. Palm Oil Refiners' Association of Malaysia (PORAM)		
4. Malaysian Edible Oil Manufacturers' Association (MEOMA)		
5. Malaysian Oleochemical Manufacturers' Group (MOMG)		
6. Others. Please specify.		

14. Please tick (/) the relevant national/state councils/committee(s) that your elected representative(s) is (are) involved in. (Refer to Table 14).

Table14:

Councils/Committees	Tick where relevant (/)	Names of sub-sectoral grouping(s)/association(s) that your representatives are in: (Number 1-7 as in Table 13)
National		
Malaysian Palm Oil Board (MPOB) Board	☐	
Malaysian Palm Oil Council (MPOC) Board of Trustees	☐	
Others. Please specify.	☐	

15 (i) Please tick (/) the policy/policies in which your representative(s) participated in the policy formulation process.
(ii) Please write down the name(s) of the relevant national/state council(s)/committee(s) that your representative(s) participated in the policy formulation process. (Refer to Table 15).

Table 15

	Tick where relevant (/)	Name(s) of relevant national/state council(s)/committee(s) (As indicated in Table 14)
Sector Specific Policies		
Oil Extraction Rate (OER) 18%	☐	
Value Added Downstream Policy	☐	
Task Force on the Environment	☐	

16. How active is (are) your company's/group's representative(s) in the national/state council(s)/committee(s) with regard to the policy decision-making process? (Refer to Table 16)
Instructions:
(i) Please write down the name(s) of the sub-sectoral grouping(s)/association(s); the names of the council(s) or committee(s) and next indicate the degree of activeness of the company's representatives based on the following.
Very Active=5
Active =4
Moderately Active =3
Inactive=2
Not Active At All=1

Table 16:

	Name(s) of the sub-sectoral grouping(s)/association(s) (As indicated in Table 14); Names of the council(s) or committee(s). (As indicated in Table 15).														
	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1
Sector Specific Policies															
Oil Extraction Rate (OER) 18%															
Value Added Downstream Policy															
Promotion of Palm Oils and Fats In The International Market															
Task Force on the Environment															

17. How influential is (are) the representative(s) of the sub-sectoral grouping(s)/ association(s) in the national/state council(s)/association(s) with regard to the policy decision-making process? (Refer to Table 17).

Instructions:

(i) Please write down the name(s) of the sub-sectoral grouping(s)/ association(s); the names of the national/state council(s)/committee(s) and next indicate the degree of influence based on the following.

Very Influential=5
Influential=4
Moderately Influential=3
Little Influential=2
Not Influential At All=1

Table 17

	Names of the sub-sectoral grouping(s) or association(s) (As indicated in Table 14); Name(s) of the national/state council(s) or committee (s) (As indicated in Table 15)														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Oil Extraction Rate (OER) 18%															
Value Added Downstream Policy															
Promotion of Palm Oils and Fats In The International Market															
Task Force on the Environment															

H2

18. Have you adopted any of the technologies that are developed by MPOB? (Refer to Table 18).

Instruction.

Please tick the relevant box and follow the instruction below.

Table 18

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 19 onwards
No		If no, please continue with Question 21 onwards.
Don't know		If don't know, please continue with Question 21 onwards.

19. Please name the technology(ies) that has (have) been adopted from the research and development efforts of Malaysian Palm Oil Board (MPOB) and indicate the status of the technology transferred as shown below.(Refer to Table 19).
Instruction.
Please write the name(s) of the technology adopted and please tick the relevant box(es) based on the following.
Developed by company/group= 5
Shared technologies provided by MPOB = 4
Exclusive Technology already taken up and not available for transfer) = 3.
Non-Exclusive (Technology taken up but may still be given to more companies) = 2.
Available (Technologies available) = 1.

Table 19

Name Of Technology(ies)	Status of Technology				
	5	4	3	2	1

20. How would you rate the level of cooperation between MPOB and your company for the acquisition of the above technology(ies) based on the following criteria? (Refer to Table 20a, Table 20b, Table 20c).
(a). What is the length of the negotiation period prior to the acquisition of the technology(ies)? (Refer to Table 20a).
Instruction.
(i) Please write down the name(s) of the technology(ies) acquired and please tick the relevant box based on the following.
Negotiation Period **(Less than 6 months)=5**
Negotiation Period (6 months to a year)=4
Negotiation Period (A year plus to 2 years)=3
Negotiation Period (2 years plus to 3 years)=2
Negotiation Period (More than 3 years)=1

Table 20a

Name(s) Of Technology(ies) Acquired (Technology(ies) As Indicated in Table 8)	5	4	3	2	1

b) What is the post-acquisition speed for the turnaround time for the transfer of technology? (Refer to Table 20b).
Instruction.
Please write down the name(s) of the technology(ies) acquired and please tick the relevant box(es) based on the following.
Turnaround Time (Less than 6 months)=5
Turnaround Time (6 months to a year=4)
Turnaround Time (A year plus to 2 years)=3
Turnaround Time (2 years plus to 3 years)=2
Turnaround Time (More than 3 years)=1

Table 20b

Names Of Technology(ies) Transferred	5	4	3	2	1

(c.) What do you think about the price you pay for the acquisition of the technology(ies)? (Refer to Table 20c).
Instruction.
Please write down the name(s) of the technology(ies) acquired and please tick the box(es) based on the following.
Free-of-charge=6
Very Cheap =5
Cheap=4
Moderate =3
Expensive=2
Very Expensive=1

Table 20c

Names Of Technology(ies)	6	5	4	3	2	1

21. Have you participated in any of the technological development programmes that are being implemented by the various governmental agencies/statutory bodies (other than MPOB)? (Refer to Table 21).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 21

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 22 onwards
No		If no, please continue with Question 23onwards.
Don't know		If don't know, please continue with Question 23 onwards.

22. Please indicate in your opinion as to the effectiveness of the technological development programme(s) that your company has in collaboration with the relevant Ministry(ies) and/or Governmental agency(ies)? (Refer to Table 22).
Instruction.
Please tick (/) the relevant box(es) based on the following:
Very Highly =5
Highly =4
Moderate=3
Highly Ineffective=2
Not Effective At All=1

Table 22

TECHNOLOGICAL DEVELOPMENT PROGRAMME(S) FROM THE ASSOCIATED MINISTRY(IES) OR GOVERNMENTAL AGENCY(IES)	5	4	3	2	1
1. Industrial Technical Assistance Fund (ITAF) from SMIDEC (Small and Medium Industries Development Corporation)					
2. Technology Acquisition Fund from Malaysian Technological Development Corporation (MTDC)					
3. Development Financing From Malaysian Industrial Development Finance (MIDF)					
4. Technology Related Loans From The Development Banks Owned By The MOF					
5. Others. Please specify.					

23. Does your company face any impediments in collaborating with MPOB or other governmental agency(ies) in terms of technology transfer/technological development programmes? (Refer to Table 23).
Instruction.
Please tick the relevant box(es) and follow the instruction below.

Table 23

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 24 onwards
No		If no, please continue with Question 25 onwards.
Don't know		If don't know, please continue with Question 25 onwards.

24. To what extent does your company experience these impediments when collaborating with MPOB or other governmental agency(ies) on technology transfer/technological development programmes. (Refer to Table 24).
Instruction
Please tick the relevant box(es) based on the following.
Not At All =5
Hardly=4
Moderate =3
Frequently=2
Very Frequently=1

Table 24

Impediment Factors	5	4	3	2	1
Too many procedures to follow (Red tape)					
Slow in decision making					
Lack of staff training and development after the transfer of technology/technological development programme					
Lack of technological assistance in-situ (factory) during technology transfer					
Lack of technological assistance after the transfer of technology					
Others. Please specify.					

25. Does your company enjoy any of the incentives that are provided by the Ministry of International Trade and Industry (MITI) via Malaysian Industrial Development Authority (MIDA) or Ministry Of Finance (MOF) in the adoption of technological innovation? (Refer to Table 25).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 25

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 26 onwards
No		If no, please continue with Question 27 onwards.
Don't know		If don't know, please continue with Question 27 onwards.

26. Please tick the incentives provided by MITI via MIDA and/or MOF that your company enjoys. (Refer to Table 26.

Table 26

Incentives provided by the government	Incentives enjoyed by your company (Please tick where relevant) (/)	Incentives enjoyed by your group (Please tick where relevant) (/)
(i) Incentives For The Manufacturing Sector		
(i) Incentives For High Technology Companies	☐	☐
(a) Pioneer Status	☐	☐
(b) ITA	☐	☐
(ii) Incentives For Environmental Protection	☐	☐
(a) Pioneer Status For Environmental Protection or	☐	☐
(b) Investment Tax Allowance for Environmental Protection	☐	☐
II. Incentives For Research and Development		
(i) Investment Tax Allowance For Research And Development	☐	☐
(ii) Investment Tax Allowance for In-house Research	☐	☐
MOF		
III. Inland Revenue Board of Malaysia (IBRM)		
(i) Reinvestment Allowance For The Manufacturing Sector	☐	☐
(ii) Accelerated Capital Allowance	☐	☐
(iii) Double Deduction For Research and Developmentr	☐	☐
(iv) Accelerated Capital Allowance for Environmental Projects and Equipment	☐	☐
(v) Incentive for Implementation of RosettaNet	☐	☐
V. Others. Please Specify		

27. Does your company face any impediments in collaborating with the MITI via MIDA and/or MOF in the application of governmental incentives? (Refer to Table 27 (i) and (ii)) respectively).
    Instruction.
    Please tick the relevant box and follow the instruction below.

Table 27(i) MIDA

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 28 onwards
No		If no, please continue with Question 29 onwards
Don't know		If don't know, please continue with Question 29 onwards

Instruction.
Please tick the relevant box and follow the instruction below.

Table 27(ii) MOF

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 28 onwards
No		If no, please continue with Question 29 onwards
Don't know		If don't know, please continue with Question 29 onwards

28. Please tick the level of impediments faced by your company when applying for such governmental incentives. (Refer to Table 28).
    Instruction.
    Please tick the relevant box(es) based on the following.
    No Impediment At All=5
    Weak Impediment=4
    Moderate Impediment=3
    Strong Impediment=2
    Very Strong Impediment=1

Table 28

	MIDA					MOF				
Impediment Factors	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Too many procedures to follow (Red tape)										
Slow in decision making										
Too many conditions/criteria to fulfill										
Others. Please specify.										

H3

29. Please tick the relevant Act(s) and related regulations or standard(s) that apply to your company. (Refer to Table 29).

Table 29

Types of Acts	Tick where relevant (/)
I. Environmental Quality Act (EQA) 1974	
II. Occupational Safety and Health Act (OSHA) 1994 and related regulations cum Factories and Machinery Act (FMA) and related regulations	
III. DOE Guidelines on the Siting and Zoning of Industries, 1976 (revised 1994)	
IV. Malaysian Code on Corporate Governance, 2001	
V. Others. Please specify. (e.g. Town council license, Fire Department License, Customs excise duty, etc.)	
a. Town Council License	
b. Fire Department Approval	
c. Customs Excise Duties	
d. Machineries Department Approval	

30. How often do Department of Environment (DOE), the local authorities and Department of Safety and Health (DOSH) respectively visit your factory on the average over the last 3 years? (Refer to Table 30).

Table 30

Frequency of visits	DOE	Local Authorities	DOSH
Seven times or more a year			
Five to six times a year			
Three to four times a year			
Once to two times a year			
Once in 3 years or less			
Not at all			

31. How stringent are DOE, the local authorities and DOSH in the inspection of factory operation with regard to the EQA and related regulations, the local by-laws and OSHA and related regulations cum FMA and related regulations respectively? (Refer to Table 31).

Table 31

The level of stringency in inspection	DOE	Local Authorities	DOSH
Intense scrutiny by state DOE officers/local authorities' officers /DOSH officers			
Close scrutiny by state DOE officers/local authorities' officers /DOSH officers			
Scrutiny plus self-regulation			
Lack scrutiny and self-regulation			
No scrutiny and self-regulation by the company			

32. Are you required to carry out follow-up activities after the DOE's, local authorities' and DOSH's scheduled visits? (Refer to Table 32).

Table 32

The level of follow-up activities	DOE	Local Authorities	DOSH
75% and above of the scheduled visits			
50-74% of the scheduled visits			
25-49% of the scheduled visits			
Less than 25% of the scheduled visits			
Never			

33. To what extent do DOE, the local authorities and DOSH institute follow-up inspections if there is a requirement to carry out remedial work? (Refer to Table 33).

Table 33

The level of follow-up inspections	DOE	Local Authorities	DOSH
75% and above of the remedial work			
50-74% of the remedial work			
25-49% of the remedial work			
Less than 25% of the remedial work			
Never			

H4

34a. To what extent are these environmental policies as indicated in Table 34 enforced by the government towards your company?

Instruction

Please tick the relevant box(es) and the intensity of enforcement based on the following.

Very Highly=5
Highly =4
Moderately=3
Weakly=2
Very Weakly=1

Table 34

Environmental Policies	**5**	**4**	**3**	**2**	**1**
Complying with the Environmental Quality Act and related regulations					
Complying with Occupational Safety and Health Act (OSHA) and related regulations cum Factories and Machinery Act (FMA) and related regulations					
Complying with DOE Guidelines on the Siting and Zoning of Industries, 1976 (revised 1994)					

34b. What motivates your firm to adopt this/these certifications?

____

____

35. To what extent do the various ministries and/or governmental agencies advocate the following ISO series towards your company? (Refer to Table 35).

Instruction.

Please tick the degree of advocacy based on the following.

Very Highly=5
Highly=4
Moderately=3
Weakly=2
Very Weakly=1

Table 35

ISO Series Advocated By The Ministries and/or Governmental Agencies	**5**	**4**	**3**	**2**	**1**
ISO 9000 standards					
ISO 14000 standards					
ISO 18000 standards					
ISO 22000 standards (HACCP)					
Others. Please specify.					

H5

36. Are there any institutional relations (formal or informal) between the local communities and relevant government authorities with regard to environmental monitoring?
Formal institutional relations are expressed in the form of seminars, workshops, dialogues and official channel of communication between both parties. Informal relations are expressed in the form of phone calls, office visits and letters by the representatives of the local communities or interested individuals to air environmental violations (Refer to Table 36).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 36

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 37onwards
No		If no, please continue with Question 38 onwards
Don't know		If don't know, please continue with Question 38 onwards

37. Please tick the relevant formal and informal institutional relations between the local communities like the Resident Associations, Village Committee and Interested Individuals and relevant governmental authorities like the DOE, LA and DOSH with regard to environmental violations. (Refer to Table 37).

Table 37

	Local Communities					
	Resident Association		Village Committee		Individual	
Governmental Authorities	Formal Relations	Informal Relations	Formal Relations	Informal Relations	Formal Relations	Informal Relations
Department of Environment (DOE)						
Local Authorities (LA)						
Department Of Safety and Health (DOSH)						
Others. Please state.						

38. Do the above governmental authorities utilize the local communities as eyes and ears with regard to environmental violations? (Refer to Table 38)
Instruction
Please tick(/) the relevant box(es) based on the following.
Very Often =5
Often =4
Moderate=3
Hardly =2
Not At All=1

Table 38

Government Authorities	5	4	3	2	1
Department Of Environment (DOE)					
Local Authorities					
Department of Safety and Health					
Others. Please specify.					

39. How often do the local communities complain to the governmental authorities over the last 3 years? (Refer to Table 39).
Instruction.
Please tick the relevant box(es) based on the following.
Complaining almost all of the environmental violations=5
Complaining most of the environmental violations=4
Complaining approximately half of the environmental violations=3
Complaining a very small number of the environmental violations=2
Not At All =1

Table 39

Local Communities	5	4	3	2	1
Resident association					
Village Committee					
Non-Governmental Organizations (NGOs)					
Individual					

H6

40. Do you export products that are produced by your company? (Refer to Table 40).
    Instruction.
    Please tick the relevant box and follow the instruction below.

Table 40

	Tick where relevant (/)	**Instructions**
Yes		If yes, please continue with Question 41 onwards
No * (a) The products are sold in the domestic market		If no, please continue with Question 44 onwards
No **(b) The products are sold to exporting agents or buying offices.		Please name the countries concerned and then proceed with Question 44 onwards. **Countries:**
Don't know		If don't know, please continue with Question 44 onwards

41 (i) Please tick in Table 41(i), (ii) and (iii) the types of products that are produced by your company for the past 3 years i.e. 2001-2003.
(ii) Please number the 3 main markets in term of its importance for each of the products for the past 3 years i.e.2001-2003.
Instruction.
Please indicate the importance of the 3 markets identified as shown below.
The Most Important=3
The Second Most Important=2
The Third Most Important=1

(iii) Please state the percentage of sales for these 3 respective markets for the past 3 years i.e.2001-2003.

Table 41(i) 2003

Palm Oil Products	Markets									
	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
▪ **A. Palm Oil Milling**											
▪ Crude Palm Oil											
▪ Palm Kernel											
▪ **B. Palm Kernel Crushing**											
▪ Crude Palm Kernel Oil (CPKO)											
▪ Palm Kernel Cake											
▪ **C. Refined Products**											
▪ RBD Palm Oil											
▪ RBD Palm Olein											
▪ RBD Palm Stearin											
▪ RBD Palm Kernel Oil											
▪ HPK Olein											
▪ **D. Oleochemical**											
▪ Fatty Acids											
▪ Fatty Alcohol											
▪ Methyl Ester											
▪ Glycerine											
▪ Soap Noodles											

	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
▪ **Palm Oil Finished Products (Basically from specialty fats)**											
▪ Shortening											
▪ Vegetable Ghee/ ▪ Vanaspati											
▪ Cocoa butter substitute/ replacer/ ▪ Equivalent											
▪ Vegetable/ dough fats											
▪ Margarine											
▪ Confectionaries											
▪ **Other Oil Palm Products**											
▪ Sludge Oil											
▪ Industrial Grade Palm Oil											
▪ Palm Fatty Acid Residue											
▪ Pitch Oil											
▪ High FFA Acid Oil											
▪ Mixed Acid Oil											
▪ Mixed Vegetable Acid Oil											

Table 41(ii) 2002

Palm Oil Products	Markets									
	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
▪ **A. Palm Oil Milling**											
▪ Crude Palm Oil											
▪ Palm Kernel											
▪ **B. Palm Kernel Crushing**											
▪ Crude Palm Kernel Oil (CPKO)											
▪ Palm Kernel Cake											
▪ **C. Refined Products**											
▪ RBD Palm Oil											
▪ RBD Palm Olein											
▪ RBD Palm Stearin											
▪ RBD Palm Kernel Oil											
▪ HPK Olein											
▪ **D. Oleochemical**											
▪ Fatty Acids											
▪ Fatty Alcohol											
▪ Methyl Ester											
▪ Glycerine											
▪ Soap Noodles											

	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
▪ **Palm Oil Finished Products (Basically from specialty fats)**											
▪ Shortening											
▪ Vegetable Ghee/ ▪ Vanaspati											
▪ Cocoa butter substitute/replacer/ ▪ Equivalent											
▪ Vegetable/ dough fats											
▪ Margarine											
▪ Confectionaries											
▪ **Other Oil Palm Products**											
▪ Sludge Oil											
▪ Industrial Grade Palm Oil											
▪ Palm Fatty Acid Residue											
▪ Pitch Oil											
▪ High FFA Acid Oil											
▪ Mixed Acid Oil											
▪ Mixed Vegetable Acid Oil											

Table 41(iii) 2001

Palm Oil Products	Markets										
	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
▪ **A. Palm Oil Milling**											
▪ Crude Palm Oil											
▪ Palm Kernel											
▪ **B. Palm Kernel Crushing**											
▪ Crude Palm Kernel Oil (CPKO)											
▪ Palm Kernel Cake											
▪ **C. Refined Products**											
▪ RBD Palm Oil											
▪ RBD Palm Olein											
▪ RBD Palm Stearin											
▪ RBD Palm Kernel Oil											
▪ HPK Olein											
▪ **D. Oleochemical**											
▪ Fatty Acids											
▪ Fatty Alcohol											
▪ Methyl Ester											
▪ Glycerine											
▪ Soap Noodles											

	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
▪ **Palm Oil Finished Products (Basically from specialty fats)**											
▪ Shortening											
▪ Vegetable Ghee/ ▪ Vanaspati											
▪ Cocoa butter substitute/ replacer/ ▪ Equivalent											
▪ Vegetable/ dough fats											
▪ Margarine											
▪ Confectionaries											
▪ **Other Oil Palm Products**											
▪ Sludge Oil											
▪ Industrial Grade Palm Oil											
▪ Palm Fatty Acid Residue											
▪ Pitch Oil											
▪ High FFA Acid Oil											
▪ Mixed Acid Oil											
▪ Mixed Vegetable Acid Oil											

(Note: these three tables: change the years: 2004, 2003, 2002 or the most recent year, the second most recent year, the third most recent year)?

42. Do your export market(s) have environmental standards/regulations for market access. Please tick the market(s) that have environmental standards/regulations for market access. (Refer to Table 42).

Table 42

PRODUCTS	**Markets**										
	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
A. Palm Oil Milling											
Crude Palm Oil											
Palm Kernel											
B. Palm Kernel Crushing											
Crude Palm Kernel Oil (CPKO)											
Palm Kernel Cake											
C. Refined Products											
RBD Palm Oil											
RBD Palm Olein											
RBD Palm Stearin											
RBD Palm Kernel Oil											
HPK Olein											
D. Oleochemical											
Fatty Acids											
Fatty Alcohol											
Methyl Ester											
Glycerine											
Soap Noodles											

	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
Palm Oil Finished Products (Basically from specialty fats)											
Shortening											
Vegetable Ghee/ Vanaspati											
Cocoa butter substitute/ replacer/ Equivalent											
Vegetable/ dough fats											
Margarine											
Confectionaries											
Other Oil Palm Products											
Sludge Oil											
Industrial Grade Palm Oil											
Palm Fatty Acid Residue											
Pitch Oil											
High FFA Acid Oil											
Mixed Acid Oil											
Mixed Vegetable Acid Oil											

43. Please name the environmental standards/regulations for the above market(s). (Refer to Table 43).

Table 43

Name of Environmental Standards/ regulations	**Markets**										
	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
I. Environmental Standards/ Regulations											
ISO 14001											
OHSAS 18001											
ISO22000 (HACCP)											
Others. Please specify.											
II. Other Standards/ Regulations											
ISO9002											
GMP											
CODEX											
Others. Please specify.											

H9

44. Does your company market products to refineries, POFP manufacturing firms, oleochemical manufacturing firms or trading houses (inclusive of transnational corporations/multinational corporations) that have a domiciled operation in Malaysia? (Refer to Table 44).
    Instruction.
    Please tick the relevant box and follow the instruction below.

Table 44

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 45 onwards
No		If no, please continue with Question 49 onwards
Don't know		If don't know, please continue with Question 49 onwards

45. Please name your customers who are efineries cum POFP manufacturing firms, oleochemical manufacturing firms or trading houses (inclusive of transnational corporations/multinational corporations) that have a domiciled operation in Malaysia, their country(ies) of origin of parent company and the types of business activities that they are involved in. (Refer to Table 45).

Table 45

Name(s) of the refineries, POFP manufacturing firms, oleochemical manufacturing firms or trading houses (inclusive of transnational corporations/ multinational corporations) that have a domiciled operation in Malaysia?	Country (ies) of origin of parent company	Types of Business Activities		
		Manufacturing	Distributing/ Wholesaling	Retailing
1.				
2.				
3.				
4.				
5.				
6.				
7.				

46. Please tick the types of activities that are related to environmental collaboration, which you share with the members of the supply chain, namely the local parent company of the local customers and local customers. (Refer to Table 46).

Table 46

A. Local Parent Company Of The Local Customers	**Tick (/) where relevant**
Shares updates on environmental regulations. Why?	
Shares the development of minimum environmental requirements for products or services. Why?	
Development and audit of product safety and quality. Why?	
Others. Please specify.	

B. Local Customers	**Tick (/) where relevant**
Shares updates on environmental regulations. Why?	
Shares the development of minimum environmental requirements for products or services. Why?	
Development and audit of product safety and quality. Why?	
Others. Please specify.	

47. Do the refineries, POFP manufacturing firms, oleochemical manufacturing firms or trading houses (inclusive of transnational corporations/multinational corporations) that have a domiciled operation in Malaysia have environmental provisions in their code of conduct? (Refer to Table 47).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 47

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 48 onwards
No		If no, please continue with Question 49 onwards
Don't know		If don't know, please continue with Question 49onwards

48. To what extent do the refineries, POFP manufacturing firms, oleochemical manufacturing firms or trading houses (inclusive of transnational corporations/ multinational corporations) that have a domiciled operation in Malaysia impose environmental requirements towards your company? (Refer to Table 48).
Instruction.
Please tick the relevant box(es) and the degree of imposition based on the following.

Very Highly =5
Highly=4
Moderate=3
Weakly=2
Not At All=1

Table 48

Environmental Requirements	5	4	3	2	1
1. Minimum environmental requirements for products and services					
2. Quality					
3. Minimum standards for processes					
4. Standard environmental procedures for operations					
5. Audit and inspection protocols					
6. On-site environmental assessments					
7. Clean technology					
(i) Responsible Care Programme (RCP)					
(ii) Good Manufacturing Practices (GMP)					
(iii) Environmental Reporting					
8. Training curricula					
9. Personnel evaluation system					
10. Safety and Health					
11. Risk reduction initiatives					
12. Follow ISO9000 standards					
13. Follow ISO14000 standards					
14. Follow OHSAS 18000 standards					
15. Follow ISO22000 (HACCP) standards					
16. Others. Please specify.					

H8

49. Does your company market products to refineries, POFP manufacturing firms, oleochemical manufacturing firms, trading houses or buyers that are based overseas? (Refer to Table 49).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 49

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 50 onwards
No		If no, please continue with Question 54 onwards.
Don't know		If don't know, please continue with Question 54 onwards

50. Please name the TNC(s)/MNC(s) or buyers that are based overseas, their country(ies) of origin of parent company and the types of business activities that they are involved in. (Refer to Table 50).

Table 50

Name(s) of the refineries, POFP manufacturing firms, oleochemical manufacturing firms, trading houses or buyers that are based overseas	Country (ies) of origin of parent company	Types of Business Activities		
		Manufacturing	Distributing/ Wholesaling	Retailing
1.				
2.				
3.				
4.				
5.				
6.				

51. Please tick the types of activities that are related to environmental collaboration, which you share with the members of the supply chain, namely the parent company of the overseas customers and overseas customers. (Refer to Table 51).

Table 51

A. Parent company Of The Overseas Customers	**Tick (/) where relevant**
Shares updates on environmental regulations. Why?	
Shares the development of minimum environmental requirements for products or services. Why?	
Development and audit of product safety and quality. Why?	
Others. Please specify.	

B. Overseas Customers	**Tick (/) where relevant**
Shares updates on environmental regulations. Why?	
Shares the development of minimum environmental requirements for products or services. Why?	
Development and audit of product safety and quality. Why?	
Others. Please specify.	

52. Do the refineries cum POFP manufacturing firms, oleochemical manufacturing firms, trading houses or buyers that are based overseas, a part of the supply chain, have environmental provisions in their code of conduct? (Refer to Table 52).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 52

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 53onwards
No		If no, please continue with Question 54 onwards
Don't know		If don't know, please continue with Question 54 onwards

53. To what extent do the refineries, POFP manufacturing firms, oleochemical manufacturing firms, trading houses or buyers that are based overseas impose environmental requirements towards your company? (Refer to Table 53).
Instruction.
Please tick the relevant box(es) and the degree of imposition based on the following.
Very Highly =5
Highly=4
Moderate=3
Weakly=2
Not At All=1

Table 53

Environmental requirements imposed on the company	5	4	3	2	1
1. Minimum environmental requirements for products and services					
2. Quality					
3. Minimum standards for processes					
4. Standard environmental procedures for operations					
5. Audit and inspection protocols					
6. On-site environmental assessments					
7. Clean technology					
(i) Responsible Care Programme (RCP)					
(ii) Good Manufacturing Practices(GMP)					
(iii) Environmental Reporting					
8. Training curricula					
9. Personnel evaluation system					
10. Safety and Health					
11. Risk reduction initiatives					
12. Follow ISO9000 standards					
13. Follow ISO14000 standards					
14. Follow OHSAS 18000 standards					
15. Follow ISO22000 (HACCP) standards					
16. Others. Please specify.					

H7

54a. Please tick the type(s) of activity(ies) that your company is involved in. (Refer to Table 54).

Table 54

Activities In The Palm Oil Production Chain	Tick where relevant(/)	
	Company	Group
Commercial Nursery		
Plantation		
Palm Oil Milling		
Palm Kernel Crushing		
Refining cum Palm Oil Finished Products (POFP)		
Oleochemical		
Palm Oil-Based Finished Food Products with the exception of consumer oils		
Palm Oil-Based Finished Non-Food Products		
Biomass-based Products		
Integrated Farming		
Bulking Terminal		
Recycling Plant		
Local Distribution Chain		
Exporting To Developing Markets		
Exporting To Developed Markets		
Foreign Distribution Chains To Developing Markets		
Foreign Distribution Chains To Developed Markets		
Biomass power plant		

54b. Does the number of levels affect environmental management?

___

___

55. What are the methods of waste disposal and management? (Refer to Table 55).

Table 55

Methods of Waste Disposal And Management	
Palm Oil Production Chain	**Tick where relevant (/)**
I.Palm Oil Mills	
(i) Treated Palm Oil Mill Effluent (POME) (a) 5000 ppm - for cropland application (b) 100 ppm – can be discharged into the waterways	
(ii) Empty Fruit Bunches (EFBs) (a) mulching in plantation (b) solid fuel for boiler (c) incinerated into bunch ash	
(iii) Shell and Fiber - Solid fuel for boiler	
(iv) Spent oil – sent to Kualiti Alam Facilities at Bukit Nenas	
(v) Others. Please specify.	
II. Palm Kernel Crushers	
(i) Wastewater is used for housekeeping.	
(ii) Treated wastewater is discharged into the storm drains	
(iii) Others. Please specify.	
III. Refineries	
(i) Treated Palm Oil Refinery Effluent (PORE) (a) for housekeeping (b) discharge into storm drains	
(ii) Sludge Oil – use as boiler fuel	
(iii) Bunds for tankers -Yes - No	
(iv) Spent Oil - sent to Kualiti Alam facilities at Bukit Nenas	
(v) Spent Bleaching Earth - for oil recovery and recycling	
(vi) Spent Nickel Catalyst (a) for recycling (b) send to Kualiti Alam's Bukit Nenas facilities	
v. Others. Please specify.	
IV. Palm Oil Finished Products Manufacturing	
(i) Wastewater is used for housekeeping.	
(ii) Treated wastewater is discharged into the storm drains	
(iii) Others. Please specify.	

V. Oleochemicals	
(i) Oleochemical Industrial Effluent (OIE) a. for housekeeping b. discharge into storm drains	
(ii) Solid Waste (a) Spent activated carbon – granulated pure carbon (b) Effluent sludge – dried effluent waste (c) Filter cake – dried cake	
(iii) Spent catalyst	
(a) for recycling	
(b) sent to Kualiti Alam's Bukit Nenas facilities	
(iv). Others. Please specify.	

56. To what extent does your company use biomass/biomass waste as an input in the creation of new products? (Refer to Table 56).
Instruction.
Please tick the relevant box based on the following.
Very High Usage =5
High Usage = 4
Moderate Usage = 3
Little Usage = 2
No Usage At All = 1

Table 56

Use of biomass/biomass waste	5	4	3	2	1
Please state the types and percentage(%) of biomass/ biomass waste used					

57. Please tick and/or name the types of new biomass-based products produced by your organization. (Refer to Table 57).

Table 57

New Biomass-Based Products	Tick where relevant(/)
Composite Boards:	
o Blockboard	
o Particleboard	
o Chipboard	
o Medium Density Fibreboard (MDF)	
Plywood	
Furniture	
Cosmetic products	
Pharmaceutical Products	
Nutraceutical Products	
Others. Please specify.	

58. What is the trend for the oil extraction rate and utilization of resources per unit/unit tonne of production over the last 3 years, i.e. 2001-2003? (Refer to Table 58a and 58b).
Instruction.
Please tick the relevant boxes based on the following.
Increasing=3
Constant=2
Decreasing=1

Table 58a

Oil Extraction Rate per unit Tonne	3	2	1
Oil Extraction Rate for Fresh Fruit Bunches (%)			
Oil Extraction Rate for Palm Kernel (%)			
Extraction Rate for Palm Kernel Crushing (%)			

Table 58b

Instruction.

Please tick the relevant boxes based on the following.

Decreasing=3
Constant=2
Increasing=1

Resource Utilization Per Unit/Unit Tonne Of Production	**3**	**2**	**1**
Raw Materials			
Crude Palm Oil			
Palm Kernel			
Crude Palm Olein			
Crude Palm Kernel Oil			
RBD Palm Olein			
RBD Palm Stearin			
Fatty Acids			
Water			
Amount of water			
Amount of recycled water			
Energy			
Amount of Diesel			
Amount of Electricity/Energy from the national grid			
Amount of Self-Generated Electricity/Energy			
Amount of Liquified Natural Gas			
Renewable Energy			
Biomass Energy Sources			

59. What is the trend for discharges, emissions, and wastes for the past 3 years i.e. 2001-2003? (Refer to Table 59).
Instruction.
Please tick the relevant boxes based on the following.
Decreasing=3
Constant=2
Increasing=1

Table 59

TYPES OF DISCHARGES, EMISSIONS AND WASTES	3	2	1
Discharges to Waterways			
Appearance			
pH			
BOD (mg/l)			
COD (mg/l)			
Total Solids			
Total Suspended Solids			
Total Nitrogen			
Ammoniacal Nitrogen			
Oil and Grease			
Temperature (^{o} C)			
Air Emissions			
Boiler			
Dust Content (g/Nm_3)			
Sulphur Oxides, as SO3 equivalent (ug/m^3)			
Nitrogen Oxides, as SO3 equivalent (ug/m^3)			
Ambient Air			
Total Suspended Particulates (TSP) (ug/m^3 or ppm)			
Sulphur Dioxide (ug/m^3 or ppm)			
Nitrogen Dioxide (ug/m^3 or ppm)			
Particulate Matter (PM_{10})			
Black Smoke Emission (Ringlemann Chart)			
Noise			
Level of dBA for operating machinery and equipment			
Noise mapping			
Level of dBA at the factory perimeter			
Odour			
Level of odour			
Waste			
Amount of scheduled waste			
Amount of scheduled waste sent to Bukit Nenas			

60. Do you have the following measures instituted in your company/group over the last 3 years i.e. 2001-2003? (Refer to Table 60)

Instruction.

Please tick the relevant box(es) with regard to the current status in your company.

Table 60

Measures Instituted	Company		Group	
	Tick (/) where relevant.	Year Obtained /Established	Tick (/) where relevant.	Year Obtained /Established
Obtained and maintaining ISO9001 certification.				
Implementing prior to obtaining ISO9001 certification				
Obtained and maintaining ISO14001 certification				
Implementing prior to obtaining ISO14001 certification				
Obtained and maintaining OHSAS18001 certification.				
Implementing prior to obtaining OHSAS 18001 certification				
Obtained and maintaining HACCP certification				
Implementing prior to obtaining HACCP certification				
Environmental policy				
Implementation of Corporate Environmental Auditing and Reporting in Annual Report				
Have existing facilities for the treatment and disposal of POME/PORE/OIE/SPIE				
Have existing facilities for the storage and disposal of scheduled waste				
Bunds for tanks				
Other. Please specify				

61. What is the level of your company's compliance on a continuous basis for the last 3 years with regard to air quality, water quality and noise level under the EQA and related regulations and the DOE Guidelines on the Siting and Zoning of Industries? (Refer to Table 61).

Instruction:

Please tick the relevant box based on the following:

Comply fully = 5
Comply mostly =4
Comply partially =3
Comply some of the time =2
Comply just now and then =1

Table 61

	5	4	3	2	1
Compliance with air quality under the Environmental Quality Act (EQA)					
Compliance with water quality under the Environmental Quality Act (EQA)					
Compliance with noise level under the Environmental Quality Act (EQA)					
DOE Guidelines on the Siting and Zoning of Industries, 1976 (revised 1994)					

62. Can you provide data for the following? (Refer to Table 62).
Instruction.
Please fill in those that are relevant to your firm. State the amount of resources used per unit/unit tonne of production.

Table 62a

Oil Extraction Rate	2003	2002	2001
Oil Extraction Rate for Fresh Fruit Bunches (%)			
Oil Extraction Rate for Palm Kernel (%)			

Table 62b

I. Resource Utilization Per Unit Of Production	2003	2002	2001
Crude Palm Oil			
Palm Kernel			
Crude Palm Olein			
Crude Palm Kernel Oil			
RBD Palm Olein			
RBD Palm Stearin			
Fatty Acids			
Water			
Amount of Water			
Amount of Water Recycled			
Energy			
Amount of Diesel			
Amount of Electricity/Energy from the national grid			
Amount of Self-Generated Electricity/Energy			
Amount of Liquified Natural Gas			
Amount of Light Fuel Oil			
Amount of LPG			
Renewable Energy			
Biomass Energy Sources			
II. Emissions			
Air Emissions			
Boiler			
Dust Content (g/Nm_3)			
Sulphur Oxides, as SO3 equivalent (ug/m^3)			
Nitrogen Oxides, as SO3 equivalent (ug/m^3)			
Ambient Air			
Total Suspended Particulates (TSP) (ug/m^3 or ppm)			
Sulphur Dioxide (ug/m^3 or ppm)			
Nitrogen Dioxide (ug/m^3 or ppm)			
Particulate Matter (PM_{10})			
Black Smoke Emission (Ringlemann Chart)			

Discharges to waterways/storm drains/cropland application (POME/PORE/OIE)			
Appearance			
pH			
BOD (mg/l)			
(ppm)			
COD (mg/l)			
(ppm)			
Total Solids (mg/l)			
(ppm)			
Total Suspended Solids (mg/l)			
(ppm)			
Total Nitrogen (mg/l)			
(ppm)			
Ammoniacal Nitrogen (mg/l)			
(ppm)			
Oil and Grease (mg/l)			
(ppm)			
Temperature ^{0}C			
Noise			
Level of dBA for operating machinery and equipment			
Noise mapping			
Level of dBA at the factory perimeter			
Waste Generation			
Amount of scheduled waste			
Amount of scheduled waste sent to Bukit Nenas			

APPENDIX 4
Questionnaire for the TAPC

Dear Valued Respondent

I am a lecturer in the School of Social, Development and Environmental Studies, Faculty of Social Sciences and Humanities, Universiti Kebangsaan Malaysia, Bangi, Selangor, Selangor. Currently, I am pursuing my Ph.D program in Wageningen University, The Netherlands. My research is entitled " A Quantitative Methodology To Test Ecological Modernization Theory In The Malaysian Context". Attached to this is also a letter pertaining to the research from my supervisor.

Your kind cooperation in giving me and/or my research assistants an interview to fill in the questionnaire is highly appreciated. Alternatively, I would appreciate it very much if you could kindly fill in the questionnaire and remit it in the enclosed stamped self-addressed envelope to:

Er Ah Choy
Environmental Policy Group
Department of Social Sciences
Wageningen University
6706 KN Wageningen
The Netherlands

OR

89 Taman Senawang Jaya
70450 Seremban
Malaysia.
e-mail: Er-Ah.Choy@wur.nl

Your kind cooperation is highly appreciated.

Yours sincerely

Er Ah Choy

General Instructions to Respondents

1. Please note that the questions encompass the activities of your company over the last 3 years.
2. Please tick the box that is closest to your opinion.
3. If you hesitate, please tick the box that first comes to your mind, as this represents mostly your closest opinion.

1. Is your company/group being directly invited by the Federal/State government to any of the national/state councils/committees? (Please tick the relevant box as indicated in Table 1).

Table 1

	Tick where relevant (/)	Instructions
Yes (a*) Able to identify the council(s) or committee(s) and policy (ies) involved.		If yes, please continue with Question 2 to Question 6 and then proceed to Question 18 onwards.
Yes (b**) Have knowledge of the influence of your company but not able to identify specific council(s) or committee(s) and governmental policy (ies).		If yes, please proceed to Question 18 onwards.
Yes (c***) Have knowledge that no influence is wielded by the company/group on governmental policy(ies) but not able to identify specific council(s)/committee(s) and governmental policy (ies).		If yes, please proceed to Question 18 onwards
No		If no, please continue with Question 6 onwards
Don't know		If don't know, please continue with Question 6 onwards

2. Please tick the relevant national/state councils/committees that your company/ group participated in. (Refer to Table 2).
Instruction: You may tick more than one response.

Table 2

Councils/Committees	**Tick where relevant (/)**
National	
Standards Committee of Department of Standards Malaysia (DSM)	
MITI-Industry Dialogue	
Others. Please specify.	

3(i). Please tick (/) in Table 3 the policies that your company/group, invited directly by the Federal/State government to the national/state councils/committees, has participated in the policy formulation process.

(ii) Please write down the name(s) of the relevant national/state councils/committees that your company/group, invited directly by the Federal/State government to the national/state councils/committees, has participated in the policy formulation process. (Refer to Table 3)

Table 3

I. Industrial Policies	**Tick where relevant (/)**	**Names of relevant national/state councils/committees (As in Table 2)**
Sector Specific Policies		
Standards for textile and apparel	☐	
Industry Competitiveness	☐	
Others. Please specify.	☐	

4. How active is the participation of your company/group in the national/state councils/committees with regard to the policy decision-making process? (Refer to Table 4)

Instruction:

Please write down the name(s) of the council(s) or committee (s) and next indicate the degree of activeness based on the following:-

Very Active=5
Active=4
Moderate=3
Inactive=2
Not Active At All=1

Table 4

	Name of the council(s)/committee(s)														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Standards for textile and apparel															
Industry Competitiveness															
Others. Please specify.															

5. How influential is your company/group in the national/state councils/committees with regard to the policy decision-making process? (Refer to Table 5).

Instructions:

Please write down the name(s) of the council(s) or committee(s) and next indicate the degree of influence based on the following.

Very Influential=5
Influential=4
Moderately influential=3
Little Influential=2
Not Influential At All=1

Table 5

	Name of the council(s)/committee(s)														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Standards for textile and apparel															
Industry Competitiveness															
Others. Please specify.															

6. Does your company/group, elected as a representative for any of the sub-sectoral groupings/associations, participate in the national/state council(s) or committee(s) for policy formulation? (Refer to Table 6).

Table 6

	Tick where relevant (/)	Instructions
Yes (a*) Able to identify the grouping(s)/ association(s); council(s) or committee(s) and policy (ies) involved.		If yes, please continue with Question 7onwards
Yes (b**) Have knowledge of the influence of the grouping(s)/association(s) on governmental policy(ies) but not able to identify specific council(s) or committee(s) and governmental policy (ies).		If yes, please go to Question 7 and then proceed with Question 12 onwards
Yes (c***) Have knowledge that no influence is wielded by the grouping(s)/ association(s) on governmental policy(ies), but not able to identify the council(s) or committee(s) and governmental policy (ies) involved.		If yes, please go to Question 7 and then proceed with Question 12 onwards
No		If no, please continue with Question 12 onwards
Don't know		If don't know, please continue with Question 12 onwards

7. Please tick the sub-sectoral groupings/associations that your company/group has been elected as a representative. (Refer to Table 7).
Instruction:
Please tick the relevant box(es).

Table 7

Sub-sectoral Groupings/Associations	Tick where relevant (/)	
	Company	Group
1. Malaysian Textile Manufacturers Association (MTMA)		
2. Malaysian Knitting Manufacturers Association (MKMA)		
3. Malaysian Garments Manufacturers Association (MGMA)		
4. Others. Please specify.		

8(i). Please tick(/) in Table 8 the relevant national/state council(s)/committee(s) that your company/group, acting as a representative for a particular sub-sectoral grouping/association, participated in.

(ii) Please write down the name(s) of the sub-sectoral grouping(s)/association(s) (as in Table 7) that your company/group has been elected as a representative. (Refer to Table 8).

Table 8

Councils/Committees	**Tick where relevant (/)**	**Names of sub-sectoral groupings/associations (Number 1-7 as in Table 7)**
National		
Standards Committee of Department of Standards Malaysia (DSM)	☐	
MITI-Industry Dialogue	☐	
Others. Please specify.	☐	

9(i) Please tick (/) in Table 9 the policy/policies in which your company/group, acting as a representative for a particular sub-sectoral grouping/association in the national/state council(s)/committee(s), participated in the policy formulation process.

(ii) Please write down the name(s) of the relevant national/state council(s)/committee(s) that your company/group, acting as a representative for a particular sub-sectoral grouping)/association, participated in the policy formulation process. (Refer to Table 9).

Table 9

	Tick where relevant (/)	**Name(s) of relevant national/state council(s)/committee(s) (As indicated in Table 8)**
Sector Specific Policies		
Standards for textile and apparel	☐	
Industry competitiveness	☐	
Others. Please specify.	☐	

10. How active is your company/group, acting as a representative for a particular sub-sectoral grouping/association, in the national/state council(s)/committee(s) with regard to the policy decision-making process? (Refer to Table 10).
    Instruction:
    Please write down the name(s) of the sub-sectoral grouping(s)/association(s), the names of the council(s) and committee(s) and next indicate the degree of activeness based on the following:
    - **Very Active=5**
    - **Active=4**
    - **Moderate=3**
    - **Inactive=2**
    - **Not Active At All=1**

Table 10

	Name(s) of the sub-sectoral grouping(s)/association (s) (As indicated in Table 8) Name(s) of the council(s) or committee(s) (As indicated in Table 9)														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Standards for textile and apparel															
Industry competitiveness															
Others. Please specify.															

11. How influential do you think your company/group is, acting as a representative for a particular sub-sectoral grouping/association, in the national/state council(s)/committee(s) with regard to the policy decision-making process? (Refer to Table 11).
    Instructions:
    Please write down the name of the sub-sectoral grouping(s)/association(s); name(s) of the council(s) or association(s), and next indicate the degree of influence based on the following:
    - **Very Influential=5**
    - **Influential=4**
    - **Moderately Influential=3**
    - **Little Influential=2**
    - **Not Influential =1**

Table 11

	Name(s) of the sub-sectoral grouping(s)/association (s) (As indicated in Table 8) Name(s) of the council(s) or committee(s) (As indicated in Table 9)														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Standards for textile and apparel															
Industry competitiveness															
Others. Please specify.															

12. If your company/group is not elected as a representative in any of the sub-sectoral groupings/associations, does an elected member of a particular sub-sectoral grouping/association in the national/state council(s)/committee(s) represent you? (Please tick the relevant box as indicated in Table 12).

Table 12

	Tick where relevant (/)	**Instructions**
Yes (a*) Able to identify the grouping(s)/ association(s); council(s) or committee(s) and policy (ies) involved.		If yes, please continue with Question 13 onwards
Yes (b**) Have knowledge of the influence of the grouping(s)/association(s) on governmental policy(ies) but not able to identify specific council(s) or committee(s) and governmental policy (ies).		If yes, please go to Question 13 and then proceed with Question 18 onwards
Yes (c***) Have knowledge that no influence is wielded by the grouping(s)/ association(s) on governmental policy(ies), but not able to identify the council(s) or committee(s) and governmental policy (ies) involved.		If yes, please go to Question 13 and then proceed with Question 18 onwards
No		If no, please continue with Question 18 onwards
Don’t know		If don’t know, please continue with Question 18 onwards

13. Please tick the relevant sub-sectoral grouping(s)/association(s) of the representative of your company/group. (Refer to Table 13).
    Instructions:
    Please tick the relevant box(es).

Table 13

Sub-sectoral Groupings/Associations	**Tick where relevant (/)**	
	Company	**Group**
1. Malaysian Textile Manufacturers Association (MTMA)		
2. Malaysian Knitting Manufacturers Association (MKMA)		
3. Malaysian Garments Manufacturers Association (MGMA)		
4. Others. Please specify.		

14. Please tick (/) the relevant national/state councils/committee(s) that your elected representative(s) is (are) involved in. (Refer to Table 14).

Table14:

Councils/Committees	**Tick where relevant (/)**	Names of sub-sectoral grouping(s)/association(s) that your representatives are in: (Number 1-7 as in Table 13)
Standards Committee of Department of Standards Malaysia (DSM)	☐	
MITI Industry Dialogue	☐	
Others. Please specify.	☐	

15(i) Please tick (/) the policy/policies in which your representative(s) participated in the policy formulation process.

(ii) Please write down the name(s) of the relevant national/state council(s)/ committee(s) that your representative(s) participated in the policy formulation process. (Refer to Table 15).

Table 15

	Tick where relevant (/)	**Name(s) of relevant national/state council(s)/committee(s) (As indicated in Table 14)**
Sector Specific Policies		
Standards for textile and apparel	☐	
Industry competitiveness	☐	
Ohers. Please specify.	☐	

16. How active is (are) your company's/group's representative(s) in the national/state council(s)/committee(s) with regard to the policy decision-making process? (Refer to Table 16)

Instructions:

Please write down the name(s) of the sub-sectoral grouping(s)/association(s); the names of the council(s) or committee(s) and next indicate the degree of activeness of the company's representatives based on the following.

Very Active=5
Active =4
Moderate=3
Inactive=2
Not Active At All=1

Table 16:

	Name(s) of the sub-sectoral grouping(s)/association(s) (As indicated in Table 14); Names of the council(s) or committee(s). (As indicated in Table 15).														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Standards for textile and apparel															
Industry competitiveness															
Others. Please specify.															

17. How influential is (are) the representative(s) of the sub-sectoral grouping(s)/ association(s) in the national/state council(s)/association(s) with regard to the policy decision-making process? (Refer to Table 17).
    Instructions:
    Please write down the name(s) of the sub-sectoral grouping(s)/association(s); the names of the national/state council(s)/committee(s) and next indicate the degree of influence based on the following.
    Very Influential=5
    Influential=4
    Moderately Influential=3
    Little Influential=2
    Not Influential At All=1

Table 17

	Name(s) of the sub-sectoral grouping(s)/association(s) (As indicated in Table 14); Names of the council(s) or committee(s). (As indicated in Table 15).														
	5	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Sector Specific Policies															
Standards for textile and apparel															
Industry competitiveness															
Others. Please specify.															

18. Have you participated in any of the programme(s) offered by MATAC? (Refer to Table 18).
    Instruction:
    Please tick the relevant box and follow the instruction below.

Table 18

	Tick where relevant (/)	**Instructions**
Yes		If yes, please continue with Question 19 onwards
No		If no, please continue with Question 21 onwards.
Don’t know		If don’t know, please continue with Question 21 onwards.

19. Please tick the programme(s) offered by MATAC that your company has participated in? (Refer to Table 19).
Instruction:
Please tick the relevant box(es).

Table 19

Names Of Programmes	Tick (/) where relevant
1. Certificate in Fashion and Clothing Manufacture (jointly with the Hong Kong Polytechnic University)	
2. Certificate in Apparel Merchandising (jointly with the Hong Kong Polytechnic University)	
3. Quality Management-Quality Control, TQM, ISO 9000 and 14000	
4. Productivity Management – Work Study and Pre-production Planning, Productivity Assessment, Apparel Costing, Green Productivity	
5. Benchmarking - Benchmarks Survey, Benchmarking Training, Benchmarking Study	
6. Interactive Multimedia Computer Aided Training – apparel manufacturing (shirts and pants sewing), spinning and weaving	
7. Computer-Aided-Design(CAD) Training – Marker Making and Grading and Pattern System	
8. Industrial Engineering Techniques – Methods-Time Measurement (M-TM)	
9. Exploration and/or Acquisition of New and Relevant Technologies	
10. Others. Please specify.	

20. How would you rate the level of cooperation between MATAC and your company for the above programmes? (Refer to Table 20).
Instruction:
Please indicate the degree of cooperation based on the following:
Deep Cooperation=5
Cooperation=4
Moderate Cooperation=3
Little Cooperation=2
No Cooperation At All=1

Table 20

Names of Programmes	5	4	3	2	1
1. Certificate in Fashion and Clothing Manufacture (jointly with the Hong Kong Polytechnic University)					
2. Certificate in Apparel Merchandising (jointly with the Hong Kong Polytechnic University)					
3. Quality Management-Quality Control, TQM, ISO 9000 and 14000					
4. Productivity Management – Work Study and Pre-production Planning, Productivity Assessment, Apparel Costing, Green Productivity					
5. Benchmarking - Benchmarks Survey, Benchmarking Training, Benchmarking Study					
6. Interactive Multimedia Computer Aided Training – apparel manufacturing (shirts and pants sewing), spinning and weaving					
7. Computer-Aided-Design(CAD) Training – Marker Making and Grading and Pattern System					
8.Industrial Engineering Techniques – Methods-Time Measurement (M-TM)					
9.Exploration and/or Acquisition of New and Relevant Technologies					
10. Others. Please specify.					

21. Have you participated in any of the technological development programmes that are being implemented by the various governmental agencies (other than MATAC, a quasi-governmental agency)? (Refer to Table 21)
Instruction:
Please tick the relevant box and follow the instruction below.

Table 21

	Tick where relevant (/)	Instruction
Yes		If yes, please continue with Question 22 onwards
No		If no, please continue with Question 23onwards.
Don't know		If don't know, please continue with Question 23 onwards.

22. Please indicate in your opinion as to the effectiveness of the technological development programme(s) that your company has in collaboration with the relevant Ministry(ies) and/or Governmental agency(ies)? (Refer to Table 22).
Instruction:
Please tick (/) the relevant box(es) based on the following:
Very Highly =5
Highly =4
Moderate=3
Highly Ineffective=2
Not Effective At All=1

Table 22

TECHNOLOGICAL DEVELOPMENT PROGRAMME(S) FROM THE ASSOCIATED MINISTRY(IES) OR GOVERNMENTAL AGENCY(IES)	5	4	3	2	1
1. Industrial Technical Assistance Fund (ITAF) from SMIDEC (Small and Medium Industries Development Corporation)					
2. Technology Acquisition Fund from Malaysian Technological Development Corporation (MTDC)					
3. Development Financing From Malaysian Industrial Development Finance (MIDF)					
4. Technology Related Loans From The Development Banks Owned By The MOF					
5. Others. Please specify.					

23. Does your company face any impediments in collaborating with Ministry(ies) or governmental agency(ies) in terms of technology transfer/technological development programmes? (Refer to Table 23).
Instruction:
Please tick the relevant box and follow the instruction below.

Table 23

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 24 onwards
No		If no, please continue with Question 25 onwards.
Don't know		If don't know, please continue with Question 25 onwards.

24. To what extent does your company experience these impediments when collaborating with the Ministry(ies) and/or governmental agency(cies) on technology transfer/technological development programmes. (Refer to Table 24).
Instruction.
Please tick the relevant box(es) based on the following.
Not At All=5
Sometimes=4
Moderate =3
Frequently=2
Very Frequently=1

Table 24

Impediment Factors	5	4	3	2	1
Too many procedures to follow (Red tape)					
Slow in decision making					
Lack of staff training and development after the transfer of technology/technological development programme					
Lack of technological assistance in-situ (factory) during technology transfer					
Lack of technological assistance after the transfer of technology					
Others. Please specify.					

25. Does your company enjoy any of the incentives that are provided by the Ministry of International Trade and Industry (MITI) via Malaysian Industrial Development Authority (MIDA) or MOF in the adoption of technological innovation? (Refer to Table 25).
Instruction:
Please tick the relevant box and follow the instruction below.

Table 25

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 26 onwards
No		If no, please continue with Question 27onwards.
Don't know		If don't know, please continue with Question 27 onwards.

26. Please tick the incentives provided by the MITI via MIDA and/or MOF that your company enjoys. (Refer to Table 26).

Table 26

Incentives provided by the government	**Incentives enjoyed by your company (Please tick where relevant) (/)**	**Incentives enjoyed by your group (Please tick where relevant) (/)**
(i) Incentives For The Manufacturing Sector		
(i) Incentives For High Technology Companies	☐	☐
(a) Pioneer Status	☐	☐
(b) ITA	☐	☐
(ii) Incentives For Environmental Protection	☐	☐
(a) Pioneer Status For Environmental Protection or	☐	☐
(b) Investment Tax Allowance for Environmental Protection	☐	☐
II. Incentives For Research and Development		
(i) Investment Tax Allowance For Research And Development	☐	☐
(ii) Investment Tax Allowance for In-house Research	☐	☐
MOF		
III. Inland Revenue Board of Malaysia (IBRM)		
(i) Reinvestment Allowance For The Manufacturing Sector	☐	☐
(ii) Accelerated Capital Allowance	☐	☐
(iii) Double Deduction For Research and Developmentr	☐	☐
(iv) Accelerated Capital Allowance for Environmental Projects and Equipment	☐	☐
(v) Incentive for Implementation of RosettaNet	☐	☐
V. Others. Please specify.		

27. Does your company face any impediments in collaborating with the MITI via MIDA and/or MOF in the application of governmental incentives? (Refer to Table 27).
Instruction:
Please tick the relevant box and follow the instruction below.

Table 27(i) MIDA

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 28 onwards
No		If no, please continue with Question 29 onwards
Don't know		If don't know, please continue with Question 29 onwards

Table 27(ii) MOF

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 28 onwards
No		If no, please continue with Question 29 onwards
Don't know		If don't know, please continue with Question 29 onwards

28. Please tick the level of impediments faced by your company when applying for such governmental incentives. (Refer to Table 28).
Instruction:
Please tick the relevant box(es) based on the following.
No Impediment At All=5
Weak Impediment=4
Moderate Impediment=3
Strong Impediment=2
Very Strong Impediment=1

Table 28

	MIDA					MOF				
Impediment Factors	**5**	**4**	**3**	**2**	**1**	**5**	**4**	**3**	**2**	**1**
Too many procedures to follow (Red tape)										
Slow in decision making										
Too many conditions/criteria to fulfill										
Others. Please specify.										

29. Please tick the relevant Act(s) and related regulations or standard(s) that apply to your company. (Refer to Table 29).

Table 29

Types of Acts	Tick where relevant (/)
I. Environmental Quality Act (EQA) 1974	
II. Occupational Safety and Health Act (OSHA) 1994 and related regulations cum Factories and Machinery Act (FMA) and related regulations	
III. DOE Guidelines on the Siting and Zoning of Industries, 1976 (revised 1994)	
IV. Malaysian Code on Corporate Governance, 2001	
V. Others. Please specify.	
Town Council/Local Authority License	
Fire Department Approval	
Customs Excise Duties	
Machineries Department Approval	
Treasury	
Water	

30. How often do Department of Environment (DOE), the local authorities and Department of Safety and Health (DOSH) respectively visit your factory on average during the last 3 years. (Refer to Table 30).

Table 30

Frequency of visits	DOE	Local Authorities	DOSH
Seven times or more a year			
Five to six times a year			
Three to four times a year			
Once to two times a year			
Once in 3 years or less			
Not at all			

31. How stringent are DOE, the local authorities and DOSH in the inspection of factory operation with regard to the EQA and related regulations, the local by-laws and OSHA and related regulations cum FMA and related regulations respectively? (Refer to Table 31).

Table 31

The level of stringency in inspection	DOE	Local Authorities	DOSH
Intense scrutiny by state DOE officers /local authorities' officers/DOSH officers			
Close scrutiny by state DOE officers /local authorities' officers/DOSH officers			
Scrutiny plus self-regulation			
Lack scrutiny and enforcement			
No enforcement : self-regulation by the company			

32. Are you required to carry out follow-up activities after the DOE's, local authorities' and DOSH's scheduled visits? (Refer to Table 32).

Table 32

The level of follow-up activities	DOE	Local Authorities	DOSH
75% and above of the scheduled visits			
50-74% of the scheduled visits			
25-49% of the scheduled visits			
Less than 25% of the scheduled visits			
Not at all			

33. To what extent do DOE, the local authorities and DOSH institute follow-up inspections if there is a requirement to carry out remedial work? (Refer to Table 33).

Table 33

The level of follow-up inspections	DOE	Local Authorities	DOSH
75% and above of the remedial work			
50-74% of the remedial work			
25-49% of the remedial work			
Less than 25% of the remedial work			
Not at all			

34. To what extent are these environmental policies as indicated in Table 34 enforced by the government towards your company?
Instruction:
Please tick the relevant box(es) and the intensity of enforcement based on the following.
Very Highly =5
Highly=4
Moderate=3
Weakly=2
Not At All=1

Table 34

Environmental Policies	**5**	**4**	**3**	**2**	**1**	
1. Complying with the Environmental Quality Act and related regulations						
2. Complying with Occupational Safety and Health Act (OSHA) and related regulations cum Factories and Machinery Act (FMA) and related regulations						
3. Complying with DOE Guidelines on the Siting and Zoning of Industries, 1976 (revised 1994)						
4. Efficient Resource Utilization						
5. Zero Burn						
6. Zero Waste						
7. Zero Discharge						
8. Energy Efficiency						
9. Renewable Energy						
10. Reducing, Reusing and Recycling Waste						
11. Complying with the Malaysian Code on Corporate Governance, 2001						

35a. To what extent do the various ministries and/or governmental agencies advocate the following ISO series towards your company? (Refer to Table 35).
Instruction:
Please tick the degree of advocacy based on the following.
Very Highly=5
Highly=4
Moderately=3
Weakly=2
Not At All=1

Table 35

Types of ISO Series Advocated By The Ministries and/or Governmental Agencies	**5**	**4**	**3**	**2**	**1**
ISO 9000 standards					
ISO 14000 standards					
ISO 18000 standards					
Others. Please specify.					

35b. What motivates your firm to adopt this/these certifications?

36. Are there any institutional relations (formal vs informal) between the local communities and relevant government authorities with regard to environmental monitoring?
Formal institutional relations are expressed in the form of seminars, workshops, dialogues and official channel of communication between both parties. Informal relations are expressed in the form of phone calls, office visits and letters by the representatives of the local communities to air environmental violations (Refer to Table 36).
Instruction:
Please tick the relevant box and follow the instruction below.

Table 36

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 37 onwards
No		If no, please continue with Question 38 onwards
Don't know		If don't know, please continue with Question 38 onwards

37. Please tick the relevant formal and informal institutional relations between the local communities and relevant governmental authorities with regard to environmental violations. (Refer to Table 37).

Table 37

	Local Communities					
	Resident Association		Village Committee		Individual	
Governmental Authorities	Formal Relation s	Informal Relation s	Formal Relation s	Informal Relation s	Formal Relation s	Informal Relation s
Department of Environment (DOE)						
Local Authorities (LA)						
Department Of Safety and Health (DOSH)						
Others. Please specify.						

38. Do the above governmental authorities utilize the local communities as eyes and ears with regard to environmental violations? (Refer to Table 38)

Instruction:

Please tick(/) the relevant box(es) based on the following:

Very Often =5
Often =4
Moderate=3
Hardly =2
Not At All=1

Table 38

Government Authorities	**5**	**4**	**3**	**2**	**1**
Department Of Environment (DOE)					
Local Authorities (LA)					
Department of Safety and Health					
Others. Please specify.					

39. How often do the local communities complain to the governmental authorities over the last 3 years? (Refer to Table 39).

Instruction:

Please tick the relevant box(es) based on the following.

Complaining almost all of the environmental violations = 5
Complaining most of the environmental violations = 4
Complaining approximately half of the environmental violations =3
Complaining a very small number of the environmental violations = 2
Not At All = 1

Table 39

Local Communities	**5**	**4**	**3**	**2**	**1**
Resident association					
Village Committee					
Non-Governmental Organizations (NGOs)					
Individual					

40. Do you export products that are produced by your company? (Refer to Table 40).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 40

	Tick where relevant (/)	**Instructions**
Yes		If yes, please continue with Question 41 onwards
No * (a) The products are sold in the domestic market		If no, please continue with Question 44 onwards
No **(b) The products are sold to exporting agents or buying offices.		Please name the countries concerned and then proceed with Question 44 onwards. **Countries:**
Don't know		If don't know, please continue with Question 44 onwards

41 (i). Please tick in Table 41(i), (ii) and (iii) the types of products that are produced by your company for the past 3 years i.e. 2001-2003.
(ii) Please number the 3 main markets in term of its importance for each of the products for the past 3 years i.e.2001-2003.
. **Instruction:**
Please indicate the importance of the 3 markets identified as shown below:
The Most Important=3
The Second Most Important=2
The Third Most Important=1

(iii) Please state the percentage of sales for these 3 respective markets for the past 3 years i.e.2001-2003.

Table 41(i) 2004

Textile Products	Markets										
	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
I. Fiber and Yarn											
A. Fiber											
B. Yarn											
II. Woven and Knitted Fabrics											
A. Woven Fabrics											
B Knitted Fabrics											
III. Woven & Non-Woven Interlining & Printing, Dyeing & Finishing											
A. Woven Interlining											
B. Non-Woven Interlining											
C. Printing, Dyeing & Finishing											
IV. Garments											

Table 41(ii) 2003

Textile Products	**Markets**										
	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
I. Fiber and Yarn											
A. Fiber											
B. Yarn											
II. Woven and Knitted Fabrics											
A. Woven Fabrics											
B. Knitted Fabrics											
III. Woven & Non-Woven Interlining & Printing, Dyeing & Finishing											
A. Woven Interlining											
B. Non-Woven Interlining											
C. Printing, Dyeing & Finishing											
IV. Garments											

Table 41(iii) 2002

Textile Products	Markets										
	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
I. Fiber and Yarn											
A. Fiber											
B. Yarn											
II. Woven and Knitted Fabrics											
A. Woven Fabrics											
B. Knitted Fabrics											
III. Woven & Non-Woven Interlining & Printing, Dyeing & Finishing											
A. Woven Interlining											
B. Non-Woven Interlining											
C. Printing, Dyeing & Finishing											
IV. Garments											

42. Please tick the export market(s) that have environmental standards/regulations for market access. (Refer to Table 42).

Table 42

Textile Products	Markets										
	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
I. Fiber and Yarn											
A. Fiber											
B. Yarn											
II. Woven and Knitted Fabrics											
A. Woven Fabrics											
B. Knitted Fabrics											
III. Woven & Non-Woven Interlining & Printing, Dyeing & Finishing											
A. Woven Interlining											
B. Non-Woven Interlining											
C. Printing, Dyeing & Finishing											
IV. Garments											

43. Please name the environmental standards/regulations for the above market(s). (Refer to Table 43).

Table 43

Name of Environmental Standards/ regulations	**Markets**										
	EU	Non-EU Europe	North America	Latin America	Middle East	Africa	Oceania	East Asia	ASEAN	West Asia	Others
I. Environmental Standards/ Regulations.											
Oekotex Standard 100											
WRAP											
Others. Please specify.											
II. Other Standards/ Regulations.											
ISO9002											
Others. Please specify.											

44. Does your company market services or products to spinning mills; weaving mills; knitting mills; dyeing, finishing and printing mills; garment manufacturers; exporting firms that have a domiciled operation in Malaysia? (Refer to Table 44).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 44

	Tick where relevant (/)	**Instructions**
Yes		If yes, please continue with Question 45 onwards
No		If no, please continue with to Question 49 onwards.
Don’t know		If don’t know, please continue with Question 49onwards

45. Please name your customers who are the spinning mills; weaving mills; knitting mills; dyeing, finishing and printing mills; garment manufacturers; local buyers and exporting firms that have a domiciled operation in Malaysia, their country(ies) of origin of parent company and the types of business activities that they are involved in. (Refer to Table 45).

Table 45

Name(s) of the spinning mills; weaving mills; knitting; dyeing, finishing and printing mills; garment manufacturers; exporting firms that have a domiciled operation in Malaysia	**Country(ies) of origin of parent company**	**Types of Business Activities**			
		Manufacturing	Distributing/ Wholesaling	Retailing	Others.
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

46. Please tick the types of activities that are related to environmental collaboration, which you share with the members of the supply chain, namely, the (local) parent company of the local customers and local customers. (Refer to Table 46).

Table 46

A. Local Parent Company Of The Local Customers	**Tick (/) where relevant**
Shares updates on environmental regulations. Why?	
Shares the development of minimum environmental requirements for products or services. Why?	
Development and audit of product safety and quality. Why?	
Others. Please specify.	

B. Local Customers	Tick (/) where relevant
Shares updates on environmental regulations. Why?	
Shares the development of minimum environmental requirements for products or services. Why?	
Development and audit of product safety and quality. Why?	
Others. Please specify.	

47. Do the spinning mills,weaving mills, knitting mills, dyeing, finishing cum printing mills, garment manufacturers, local buyers or exporting firms that have a domiciled operation in Malaysia have environmental provisions in their code of conduct? (Refer to Table 47).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 47

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 48 onwards
No		If no, please continue with Question 49 onwards
Don't know		If don't know, please continue with Question 49 onwards

48. To what extent do the spinning mills, weaving mills, knitting mills,dyeing, finishing cum printing mills, garment manufacturers, local buyers or exporting firms that have a domiciled operation in Malaysia impose environmental requirements towards your company? (Refer to Table 48).
Instruction.
Please tick the relevant box(es) and the degree of imposition based on the following.
Very Highly =5
Highly=4
Moderate=3
Weakly=2
Not At All=1

Table 48

Environmental requirements imposed on the company	5	4	3	2	1
1. Minimum environmental requirements for products and services					
2. Quality					
3. Minimum standards for processes					
4. Standard environmental procedures for operations					
5. Audit and inspection protocols					
6. On-site environmental assessments					
7. Clean technology					
(i) Responsible Care Programme (RCP)					
(ii) Good Manufacturing Practices (GMP)					
(iii) Environmental Reporting					
8. Training curricula					
9. Personnel evaluation system					
10. Safety and Health					
11. Risk reduction initiatives					
12. Follow ISO 9001 requirements					
13. Follow ISO 14001 requirements					
14. Follow ISO 18001 requirements					
15. Others. Please specify.					

49. Does your company export services or products to spinning mills, weaving mills, knitting mills, dyeing, finishing cum printing mills, garment manufacturers or buyers that are based overseas? (Refer to Table 49).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 49

	Tick where relevant (/)	Instructions
Yes		If yes, please continue with Question 50 onwards
No		If no, please continue with to Question 54 onwards.
Don’t know		If don’t know, please continue with Question 54 onwards

50. Please name the spinning mills, weaving mills, knitting mills, dyeing, finishing cum printing mills, garment manufacturers, or buyers that are based overseas, their country(ies) of origin of parent company and the types of business activities that they are involved in. (Refer to Table 50).

Table 50

Name(s) of the spinning mills; weaving mills; knitting mills; dyeing, finishing and printing mills; garment manufacturers; or buyers that are based overseas	**Country(ies) of origin of parent company**	**Types of Business Activities**			
		Manufacturing	Distributing/ Wholesaling	Retailing	Branded Marketeer
1.					
2.					
3.					
4.					
5.					
6.					

51. Please tick the types of activities that are related to environmental collaboration, which you share with the members of the supply chain, namely, the parent company of the overseas customers and the overseas customers. (Refer to Table 51).

Table 51

A. Parent Company Of The Overseas Customers	**Tick (/) where relevant**
Shares updates on environmental regulations. Why?	
Shares the development of minimum environmental requirements for products or services. Why?	
Development and audit of product safety and quality. Why?	
Others. Please specify.	

B. Overseas Customers	**Tick (/) where relevant**
Shares updates on environmental regulations. Why?	
Shares the development of minimum environmental requirements for products or services. Why?	
Development and audit of product safety and quality. Why?	
Others. Please specify.	

52. Do the spinning mills; weaving mills; knitting mills; dyeing, finishing and printing mills; garment manufacturers; or buyers that are based overseas have environmental provisions in their code of conduct? (Refer to Table 52).
Instruction:
Please tick the relevant box and follow the instruction below.

Table 52

	Tick where relevant (/)	**Instructions**
Yes		If yes, please continue with Question 53onwards
No		If no, please continue with Question 54 onwards
Don't know		If don't know, please continue with Question 54 onwards

53. To what extent do the spinning mills; weaving mills; knitting mills; dyeing, finishing and printing mills; garment manufacturers; or buyers that are based overseas impose environmental requirements towards your company? (Refer to Table 53).
Instruction:
Please tick the relevant box(es) and the degree of imposition based on the following:
Very Highly =5
Highly=4
Moderate=3
Weakly=2
Not At All=1

Table 53

Environmental requirements imposed on the company	5	4	3	2	1
1. Minimum environmental requirements for products and services					
2. Quality					
3. Minimum standards for processes					
4. Standard environmental procedures for operations					
5. Audit and inspection protocols					
6. On-site environmental assessments					
7. Clean technology					
(i) Responsible Care Programme (RCP)					
(ii) Good Manufacturing Practices(GMP)					
(iii) Environmental Reporting					
8. Training curricula					
9. Personnel evaluation system					
10. Safety and Health					
11. Risk reduction initiatives					
12. Follow ISO9000 standards					
13. Follow ISO14000 standards					
14. Follow OHSAS 18000 standards					
15. Others. Please specify.					

54a. Please tick the type(s) of activity(ies) that your company is involved in. (Refer to Table 54).

Table 54

Activities In The Textile Production Chain	Tick where relevant(/)	
	Company	Group
The production of fiber		
The production of yarn (spinning)		
Weaving		
Knitting		
Dyeing, Finishing and Printing		
The production of garments		
Recycling Plant		
Local Distribution Chain		
Exporting To Developing Markets		
Exporting To Developed Markets		
Foreign Distribution Chain To Developing Markets		
Foreign Distribution Chain To Developed Markets		
Others (e.g. Manufacturing of textile related machinery and equipment, distribution of chemicals)		
Exporting to NIEs		

54b. Does the number of levels affect environmental management?

55. What are the methods of waste disposal and management (Refer to Table 55).
Instruction.
Please tick the relevant box and follow the instruction below.

Table 55

Textile and Apparel Production Chain	
Fiber	**Tick Where relevant (/)**
i. Treated wastewater is discharged into storm drains.	
ii. Fiber waste are disposed at sanitary landfills.	
iii. Packaging wastes are sold to scrap dealers.	
iv. Packaging wastes are disposed at sanitary landfill.	
v. Others. Please specify.	

Spinning	**Tick where relevant (/)**
i. Treated wastewater is discharged into storm drains.	
ii. Fibre wastes are disposed at sanitary landfills.	
iii. Sized yarn wastes are disposed at sanitary landfills.	
iv. packaging wastes are disposed at sanitary landfills.	
v. Packaging wastes are sold to scrap dealers.	
vi. Others. Please specify.	

Weaving	**Tick where relevant (/)**
i. Treated wastewater is discharged into storm drains.	
ii. Yarn wastes are disposed at sanitary landfills.	
iii. Fabric scraps are disposed at sanitary landfills.	
iv. Off-spec fabrics are disposed at sanitary landfills.	
v. Off-spec fabrics are sold to scrap dealers.	
vi. Others. Please specify.	

Knitting	Tick where relevant (/)
i. Yarn wastes are disposed at sanitary landfills.	
ii. Fabric scraps are disposed at sanitary landfills.	
iii. Fabric scraps are sold to scrap dealers.	
iv. Off-spec fabrics are disposed at sanitary landfills.	
v. Off-spec fabrics are sold to scrap dealers.	
vi. Others. Please specify.	

Dyeing Cum Finishing cum Printing	Tick where relevant (/)
i. The treated wastewater is discharged into storm drains.	
ii. The sludge from the wastewater, classified as N281 scheduled waste is sent to Kualiti Alam for disposal.	
iii. Fuel for boiler. *(State the type of fuel used)*	
iv. Waste cloth/fabric which are dyed not properly are sold as stock lots to garment manufacturers.	
v. Waste cloth are reprocessed.	
vi. Piece cuts are sold to scrap dealers.	
vii. Others. Please specify.	

Garment	Tick where relevant (/)
i. Waste cloth/fabric sold to scrap dealers	
ii. Others. Please specify.	

56. To what extent does your company use textile or apparel related solid waste as an input in the creation of new products? (Refer to Table 56).
Instruction.
Please tick the relevant box based on the following.
Very High Usage =5
High Usage = 4
Moderate Usage = 3
Little Usage = 2
No Usage At All = 1

Table 56

Use of textile or apparel related solid waste	5	4	3	2	1
Please state the types and percentage(%) of solid waste used.					

57. Please name the type(s) of new recycled product(s) based on textile or apparel related solid waste, produced by your company. (Refer to Table 57).

Table 57

Types of waste	Name(s) of New Recycled Product(s) based on Textile or Apparel Related Solid Waste

58. What is the trend for the utilization of resources per batch/per kg/per 1000 kg of production over the last 3 years i.e. 2001-2003? (Refer to Table 58).
Instruction.
Please tick the relevant boxes based on the following.
Decreasing=3
Constant=2
Increasing=1

Table 58

Resource Utilization per batch/per kg/per 1000kg of production	Name of the inputs used	3	2	1
Raw Materials				
Man –made fibers				
Natural fibers				
Yarn				
Unfinished cloth / Greige Goods				
Finished Cloth				
Washing agents				
Desizing enzymes for desizing				
Alkaline solutions for scouring				
Solvents solutions for scouring				
Bleaching agents for scouring				
Stabilizers				
Caustic soda for alkaline				
Dyes for dyeing				
Pigments for printing				

Chemical finishes for finishing				
Lubricants for knitting yarn				
Salts for textile wet processing (= alkaline)				
Hydrogen peroxide				
Acidic				
Soda Ash (alkaline)				
Sodium Sulphate				
Environmentally Friendly Inputs as per				
EU requirement. Please specify.				
USA requirement. Please specify				
Others. Please specify.				
Water				
Amount of water				
Amount of recycled water				
Energy				
Amount of Diesel				
Amount of Electricity				
Amount of Light Fuel Oil				
Amount of LPG				
Amount of Liquified Natural Gas				
Renewable Energy				
Biomass Energy Sources				

59. What is the trend for discharges, emissions, and wastes for the past 3 years i.e. 2001-2003? (Refer to Table 59).
Instruction.
Please tick the relevant boxes based on the following.
Decreasing=3
Constant=2
Increasing=1

Table 59

TYPES OF DISCHARGES, EMISSIONS AND WASTES	3	2	1
Discharges to Waterways			
Appearance			
pH			
BOD (mg/l)			
COD (mg/l)			
Total Solids			
Suspended Solids			
Total Nitrogen			
Ammoniacal Nitrogen			
Oil and Grease			
Temperature (^{o} C)			
Heavy Metals (specify):			
(i) Mercury			
(ii) Cadmium			
(iii) Chromium			
(iv) Arsenic			
(v) Cyanide			
(vi) Lead			
(vii) Chromium III			
(viii) Copper			
(ix) Manganese			
(x) Nickel			
(xii) Tin			
(xiii) Zinc			
(xiv) Boron			
(xv) Iron			
(xvi) Phenol			
(xvii) Chlorine			
(xviii) Sulphide			
Air Emissions			
Boiler:			
Dust Content (g/Nm^3)			
Sulphur Oxides as SO_3 equivalent (g/Nm^3)			
Nitrogen Oxides as SO_3 equivalent (g/Nm^3)			
Ambient Air			
Total Suspended Particulate (TSP) [(ug/m^3) or ppm]			
Sulphur Dioxide [(ug/m^3) or ppm]			
Nitrogen Dioxide [(ug/m^3) or ppm]			
Particulate Matter (PM_{10})			
Black Smoke (Ringlemann Chart)			
Noise			
Level of dBA for operating machinery and equipment			
Noise mapping			
Level of dBA at the factory perimeter			
Odour			
Level of odour			
Waste Generation			
Amount of scheduled wastes			
Amount of scheduled wastes sent to Bukit Nenas			

60. Do you have the following measures instituted in your company over the last 3 years i.e. 2001-2003? (Refer to Table 60).
Instruction
Please tick the relevant box(es) with regard to the current status in your company.

Table 60

Measures Instituted	Company		Group	
	Tick (/) where relevant.	Year Obtained /Established	Tick (/) where relevant.	Year Obtained /Established
Obtained and maintaining ISO9001 certification.				
Implementing prior to obtaining ISO9001 certification				
Obtained and maintaining ISO14001 certification				
Implementing prior to obtaining ISO14001 certification				
Obtained and maintaining OHSAS18001 certification.				
Implementing prior to obtaining OHSAS 18001 certification				
Obtained and maintaining Oekotex Standard 100				
Implementing prior to obtaining Oekotex Standard 100				
Environmental policy				
Implementation of Corporate Environmental Auditing and Reporting in Annual Report				
Have existing facilities for the treatment and disposal of effluent				
Have existing facilities for the storage and disposal of scheduled waste				
Bunds for tanks				
Others. Please specify.				

61. What is the level of your company's compliance with regard to air quality, water quality and noise level under the EQA and related regulations, and the DOE Guidelines on the Siting and Zoning of Industries? (Refer to Table 61).
Instruction:
Please tick the relevant box based on the following.
Comply fully = 5
Comply mostly =4
Comply partially =3
Comply some of the time =2
Comply just now and then =1

Table 61

	5	4	3	2	1
Compliance with air quality under the Environmental Quality Act (EQA)					
Compliance with water quality under the Environmental Quality Act (EQA)					
Compliance with noise level under the Environmental Quality Act (EQA)					
DOE Guidelines on the Siting and Zoning of Industries, 1976 (revised 1994)					

62. Can you provide data for the following? (Refer to Table 62).
Instruction.
Please fill in those that are relevant to your company. State the amount of resources used per batch/per kg/per 1000 kg of production.

Table 62

I. Resource Utilization (please tick(/) the relevant unit of measurement) ❑ per batch ❑ per kg/ ❑ per 1000 kg of production	**Name of the inputs used** (please state where relevant)	**2004**	**2003**	**2002**
Man –made fibres				
Natural fibres				
Yarn				
Unfinished cloth / Greige Goods				
Finished Cloth				
Washing agents				
Alkaline solutions for scouring (liquid) or				
Caustic soda for alkaline (solid)				
Stabilizers				
Dyes for dyeing				
Pigments for printing				
Chemical finishes for finishing				
Lubricants for knitting yarn				
Hydrogen peroxide				
Acetic Acidic				
Soda Ash (alkaline)				
Sodium Sulphate				
Environmentally Friendly Inputs as per				
EU requirement. Please specify.				
USA requirement. Please specify				
Others. Please specify.				
Water				
Amount of Water				
Amount of Water Recycled				
Energy				
Amount of Diesel				
Amount of Electricity				
Amount of Light Fuel Oil				
Amount of LPG				
Amount of Liquified Natural Gas				

Renewable Energy				
Biomass Energy Sources				
II. Emissions				
Discharges to waterways				
Appearance				
pH				
BOD (mg/l)				
COD (mg/l)				
Total Solids				
Total Suspended Solids				
Total Nitrogen				
Ammoniacal Nitrogen				
Oil and Grease				
Temperature (^{o} C)				
Heavy Metals (specify):				
(i) Mercury				
(ii) Cadmium				
(iii) Chromium				
(iv) Arsenic				
(v) Cyanide				
(vi) Lead				
(vii) Chromium III				
(viii) Copper				
(ix) Manganese				
(x) Nickel				
(xii) Tin				
(xiii) Zinc				
(xiv) Boron				
(xv) Iron				
(xvi) Phenol				
(xvii) Chlorine				
(xviii) Sulphide				
Air Emissions				
Boiler:				
Dust Content (g/Nm^3)				
Sulphur Oxides as SO_3 equivalent (g/Nm^3)				
Nitrogen Oxides as SO_3 equivalent (g/Nm^3)				
Ambient Air				
Total Suspended Particulate (TSP) [(ug/m^3) or ppm]				
Sulphur Dioxide (ug/m^3) or ppm]				
Nitrogen Dioxide [(ug/m^3) or ppm]				
Particulate Matter (PM_{10})				
Black Smoke (Ringlemann Chart)				

Noise				
Level of dBA for operating machinery and equipment				
Noise mapping				
Level of dBA at the factory perimeter				
Waste Generation				
Amount of scheduled wastes				
Amount of scheduled wastes sent to Bukit Nenas				

APPENDIX 5
Questionnaire For The Relevant Government Ministries And Government Agencies

1. To what extent is the role of environmental management integrated into the policies formulated?
2. What are the major policies that have been formulated and how effective are they? Which of these policies have environmental management as a central concern?
3. Which governmental representatives are involved with your Ministry/Agency/Statutory Body with regard to policy implementation in the palm oil production chain (POPC) and textile and apparel production chain (TAPC)? Are representatives from the industry invited or present in the policy implementation or monitoring sessions?
4. What are the major policies that have been implemented and how effective are they? Which of these policies have environmental management as a central concern?
5. How often do have meetings on a per annum basis?
   a. Regularly, i.e. bi-monthly, quarterly, half-yearly or yearly basis
   b. Regularly but on an ad-hoc basis
   c. Surfacing of critical basis
   d. Combination of the above. Please state_____________________________.
6. How active is the industry's participation in the environmental programmes as initiated by the government?
7. Are there any incentives provided by the government for the industry in the adoption of technological innovations?
8. Are there any impediments faced by the industry in the adoption of technological innovations?
   a. Government actions.
   i. Elaborate.____
   b. Financial constraints.
   i. Elaborate.____
   c. Technological constraints.
   i. Elaborate.____
   d. Other reasons.
   i. Elaborate.____

9. Does your Ministry/Agency/Statutory Body help to advocate these various standards.

	Very Highly	Highly	Moderately	Lowly	Very Lowly
ISO 9000 standards					
ISO 14000 standards					
ISO 18000 standards					
ISO 22000 standards					

FOR MPOB

10. What is the number of technological innovations (name them) as a result of the R&D activities at this point in time? Name them and discuss the role these technological innovations play.
11. How many of these technological innovations (name them) are adopted by the industry? Name the effective technological innovations and the roles they play.
12. Are there any incentives for the industry to adopt these technological innovations?
13. Are there any impediments for the industry to adopt these technological innovations?

FOR MIDA/MITI

14. How many firms apply for investments in green technology under the Investments Promotions Act 1986 to enhance environmental management?

FOR DOE

15. State which of the 15 regulations and industry specific regulations under the EQA were violated? Indicate the number of violations for each regulation.
16. Indicate the number of officers involved in monitoring and enforcement visits for factory operations over the past 5 years.
17. What is the conviction rate for legal cases over the past 5 years?
18. Are there follow-up visits for the offenders?
19. Are there any institutional framework between the local communities and relevant government authorities with regards to environmental concerns and violations?
20. Does the relevant government authorities utilize the local communities as eyes and ears with regard to environmental monitoring?
21. Do the local communities report environmental violations to the local authorities and DOE?

APPENDIX 6
List of Respondent Companies: POPC

Company	Principal Activties	Products
A	Refining	Shortening, Cooking Oil, Margarine, Vegatable Ghee
B	Refining cumPOFP manufacturing	Cooking Oil, Shortening, Vegetable Ghee, Margarine
C	Refining cum POFP	Processed Palm Oil, Processed Palm Kernel Oil, Finished Oil
D	Refining cum POFP manufacturing	Margarine, Shortening, Dough Fats, Cooking Oil, Red Palm Oil, Red Cooking Oil, Salad Oil
E	Refining cum POFP manufacturing	Dough Fats, Margarine, Shortening, Vegetable Ghee
F	Refining cum POFP manufacturing	Rbd Super Olein, RBD Olein, RBD Palm Oil, RBD Stearin, PFAD, Fatty Acids, Glycerine, Soap Noodle, TPSA, RGSA, HPFAO, C16, DFA, SOAP Blend 80/20, CPKFA, DTPKFA, HEBOS, HRBDPO
G	Refining cum POFP manufacturing	Dough Fats, Shortening, Vegetable Ghee, Cocoa Butter Substitute
H	Refining	RBD Palm Oil, RBD Palm Olein, RBD Palm Stearin and Palm Fatty Acid Distillate
I	Oleochemical Manufacturing	Oleochemicals (Fatty Acids, Glycerine)
J	Oleochemical Manufacturing	Oleochemicals (Fatty Acids, Glycerine, Soap Noodle, TPSA, TGSA< HPFAO, C16, DFA, Soap Blend 80/20, CPKFA, DTPKFA, HRBDS, HRBDPO, PFAD
K	Oleochemical Manufacturing	Oleochemicals (Capric Acid, Caprylic Acid, Lauric Acid, Myristic, Palmitic Acid, Stearic Acid, TPSA, RGSA< Distilled Palm Coconut F.A., Palm Kernel, Oleic Acid and Glycerine
L	Oleochemical Manufacturing	Oleochemicals (Fatty Acids, Glycerine, Fatty Alcohol)
M	Palm Oil Milling	Crude Palm Oil (CPO)
N	Palm Oil Milling	Crude Palm Oil (CPO)
O	Palm Oil Milling	Crude Palm Oil (CPO)
P	Palm Oil Milling	Crude Palm Oil (CPO)
Q	Palm Oil Milling	Crude Palm Oil (CPO)
R	Palm Oil Milling	Crude Palm Oil (CPO)
S	Palm Oil Milling	Crude Palm Oil (CPO)
T	Palm Oil Milling	Crude Palm Oil (CPO)
U	Palm Oil Milling	Crude Palm Oil (CPO)
V	Palm Oil Milling	Crude Palm Oil (CPO)
W	Palm Oil Milling	Crude Palm Oil (CPO)
X	Palm Oil Milling	Crude Palm Oil (CPO)
Y	Palm Oil Milling	Crude Palm Oil (CPO)
Z	Palm Oil Milling	Crude Palm Oil (CPO)

Company	Principal Activties	Products
AA	Palm Oil Milling	Crude Palm Oil (CPO)
AB	Palm Oil Milling	Crude Palm Oil (CPO)
AC	Palm Oil Milling	Red Palm Oil and Kernel
AD	Palm Oil Milling	Crude Palm Oil (CPO)
AE	Palm Oil Milling	Crude Palm Oil (CPO)
AF	Palm Oil Milling	Crude Palm Oil (CPO)
AG	Palm Oil Milling	Crude Palm Oil (CPO)
AH	Palm Oil Milling	Crude Palm Oil (CPO),
AI	Palm Kernel Crushing	Crude Palm Kernel Oil (CPKO), Palm Kernel Cake (PC)
AJ	Palm Kernel Crushing	Palm Kernel Cake (PKC)
AK	Palm Kernel Crushing	Palm Kernel, Crude Palm Kernel Oil
AL	Palm Oil Milling	Crude Palm Oil (CPO)
AK	Palm Oil Milling	Crude Palm Oil (CPO)

APPENDIX 7
List of Respondent Companies: TAPC

Company	Principal Activities	Products
A	Fiber	Polyester Staple Fibre
B	Manufacture of Yarn, Knitted and Dyed Fabric, Dyed Yarn, Garment	Staple Fibre Yarn: Cotton Yarn, Viscose Rayon Staple, Polyester Spun Yarn, O.E. Cotton Yarn, Polyester Spun Yarn,. Blend Fibre Yarn: T/C/ Yarn, Polyester/Cotton Core Yarn, O.E. Yarn Knitted Fabric: Cotton, PE, T/C, CVC Garment: Childern's Wear, Ladies' Wear, Men's Wear
C	Fabric Knitting	Fabric: Cotton. T/C, Polyester, LaCoste, Rib, Interlock, Single Jersey
D	Spinning	Yarn
E	Garment	Shirts and Knit Shirts
F	Garment Manufacturing	Casual and sportswear (all range of knitted and woven garments) and sleepwear
G	Garment Manufacturing	Ladies blouses, dresses and skirts, men's hirts, T-shirts, jackets and children's wear
H	Garment Manufacturing	T-shirt, Cap, Cotton Bags, Apron, etc.
I	Garments (Manufacture of Knitted and Woven Garment and Products, Manufacture of Infants Wear, Manufacture of Kids Wear, Manufacture of Adults Wear	Knitted and Woven Apparels (Infants Wear: Romper, Cardigan, Tops, Pants, Shorts, Thermal Wear and Dungaree Set; Kidswear: Boy/Girl 2pc and 3-pc Set; Girl Dress and Jumper, Costume, Pants, Shrots, Tops and Sportswear; Adults Wear: Sportswear, Jogging Suits, Polo Shirt and Jacket
J	Garment Contract Manufacturing	Garment
K	Garment Manufacturing	All ranges of infants, children, men's and women's wearing apparels including pyjamas, jackets, tracksuits, blouses, polo shirts, under garments and witner clothing.
L	Garment Manufacturing	Knitted Items: T-Shirt, Sweatshirts, Pullover, Jogging Suits Knitted and Woven items: Sleepwear, Blouses, Dresses and Skirts
M	Garment Manufacturing	Workwear (overalls, skirts, shirts, blouses, trousers)
N	Garment Manufacturing	Garments
O	Garment Manufacturing	Garments,
P	Manufacturer + Exporter of Jackets and Warm-up Suits	Garment
Q	Warp Knitting, Circular Knitting, Garment Manufacturing	Fabric: Circular Knitted Fabric, Tricot Stitch Garment: Safety Garment, T-Shirt

Company	Principal Activities	Products
R	Fabric Knitting, Garment Manufacturing	Knitted Fabric: Polyester (PE), Polyester/Cotton (T/C), Cotton/Polyester (CVC), etc. Garment: men's wear
S	Fabric Knitting and Dyeing	Fabric: Cotton, T/C, Polyester, Jacquard, Interlock, Flat Knit, Rib, Single Jersey
T	Manufacturing of tubular knitted fabrics; Commission knitting, dyeing and finishing of all types of fabrics	Fabric
U	Manufacturer of Yarn, Knitted and Dyed Fabric, Dyed Yarn, Garment (Woven Sportswear)	Staple Fibre Yarn: Cotton Yarn, Viscose Rayon Staple, Polyester Spun Yarn, O.E. Cotton yarn, Polyester Spun Yarn. Blend Fibre Yarn: T/C Yarn, Polyester/Cotton Core Yarn, O.E. Yarn Knitted Fabric: Cotton, PE, T/C, CVC Garment: Children's Wear, Ladies' Wear, Men's Wear
V	Sewing Thread Manufacturing, Dyeing	Thread
W	Manufacturing of Sewaing Thread-A&E Spun Polyester Sewing Thread	Thread
X	Garment Manufacturing Dyeing cum Printing	Garment
Y	Dyeing +Finishing of Fabrics	
Z	Fabric Dyeing +Finishing Foaming Garment Manufacturing, Trading and Retailing	Fabric
AA	Dyeing +Finishing of Fabrics	
AB	Dyeing +Finishing, Setting and Printing	
AC	Dyeing +Finishing, Setting and Printing	
AD	Dyeing +Finishing of Fabrics	Fabric: Cotton, Toweling, Rib, T/C Flat Knit, Jacquard, Polyester, Tricot, Interlock, Single Jersey
AE	Printing	
AF	Silk screen printing	
AG	Dyed yarn, dyed knitted fabric, collar and cuffs, drawstring and knitted tape, knitted elastic tape	Knitted Fabric: Cotton, Polyester (PE), Nylon Fibre (PA), Polyester/Cotton (T/C), Cotton/Polyester (CVC), etc. Knitted Product: Flat Knit Textile Accessories: Non-Elastic Braid, Drawstring
AH	Fabric Knitting, Dyeing of Knitted Fabric, Garment Making	Garment: Children's Wear, Ladies' Wear, Men's Wear Knitted Fabric: Cotton, Cotton/Polyester (CVC)
AI	Knitting, Dyeing, Garment Manufacturing	Fabric: Cotton, T/C, Jacquard, Interlock. Garment: men, Ladies and Children Wear
AJ	Spinning of Yarn; Knitting of Fabric Dyeing of Knitted Fabric Printing of Knitted Fabric Finishing of Knitted Fabric	Yarn: 100% Cotton, T/C, CVC Fabric: Cotton, T/C, Polyester, Jacquard, Interlock, Flat Knit, Rib, Single Jersey, Fleece, Terry, Eyelet, Double Knit

Company	Principal Activities	Products
AK	Printing, Dyeing and Finishing	Fabrics of Cotton, Polyester, Polyester/Cotton
AL	Manufacturer of Home Textiles Jacquard and Dobby Weaving Finishing Yarn + Fabric Dyeing Printing Embroidery Hemming + Make-up	Plain Weave, Drill/Twill, Yarn Dyed Fabric, Industrial Textiles +Jacquard, Cotton, Polyester (PE), Polyester/Cotton (T/C), Polyester/Rayon (T/R) 100% Cotton (Hankerchief, Table Cloth + Napery, Inflight Material, Woven Fabric)

SUMMARY

The rapid economic development accompanied by increasing manufacturing output in Malaysia for the past two decades is not balanced with sufficient environmental management. Although pollution control measures have been formulated and implemented by the Malaysian government, the improvements and achievements in environmental performance vary from one industrial sector to another. This raises the question on the reasons for the differences in environmental performances of industrial sectors in one country. In addition, most of the studies using Ecological Modernization Theory – a prevailing theory for analyzing and understanding environmental reform in western countries - have a national character, in the sense that the studies do not differentiate between sectors in analyzing and explaining environmental management and performance. And these Ecological Modernization Theory studies have prevailed up till now in Western OECD countries, and hardly in Asian developing economies. Moreover, most studies in the Ecological Modernization Theory tradition are more qualitative by making interesting use of case study research in analyzing environmental reform and further building theory. Limited quantitative research has been done up till now to test the central tenets laid down in Ecological Modernization Theory and no methodology has been developed yet to carry out a more substantive quantitative testing. Against this background, the current study aims to make a scientific contribution.

This study aims to understand the differences in sectoral environmental performance in Malaysian industries by applying Ecological Modernization Theory. In investigating sectoral performances, the study has two objectives. The first objective is to develop a quantitative methodology for investigating the claims of successes and failures of environmental reform as hypothesized by Ecological Modernization Theory. This quantitative methodology focuses on two central tenets of Ecological Modernization Theory. The first central tenet pertains to the claim that environmental reforms are stimulated and triggered by transformations in environmental policy, also known as political modernization. The second central tenet relates to the increasing importance of market dynamics and economic agents in successful industrial environmental management in the era of globalization. The second objective of this study is to understand sectoral variations with regard to the drivers for environmental reform and to understand why a particular sector is better than another in environmental performance.

The palm oil production chain (POPC) and the textile and apparel production chain (TAPC) in Malaysia are the foci of this study. The POPC in Malaysia is a high priority resource-based industry with heavy government involvement, whereas the TAPC has more *laissez faire* characteristics with limited government involvement in its economic activities. Based on the two objectives, three research questions emanate. The first research question relates to how the policy and economic tenets of Ecological Modernization Theory can be operationalized into testable factors that contribute to improved environmental performances in industrial sectors. The second question relates to the factors in the policy and economic domains explaining sector variations with respect to environmental performance. The third research question pertains to the recommendations for the development of sector-

based industrial development policy in Malaysia, most notably the POPC and the TAPC.

The development of a quantitative methodology starts with the operationalization of Ecological Modernization Theory into hypotheses to enable the validity of the Ecological Modernization Theory claims to be tested in a developing country. All the hypotheses formulated are either consistent or consonant with ecological modernization characteristics. The central tenet of political modernization gives birth to the Government-Industry (G-I) linkage which in turn looks at the Ecological Modernization Theory characteristics of policy formulation, technology, regulatory efforts, advocacy of preventive approaches, and local communities' involvement. Likewise, the central tenet of the role of market dynamics and economic actors gives birth to the Industry-Industry (I-I) linkage, which focuses on the Ecological Modernization Theory characteristics of international trade, vertical integration, international relationship, and local collaboration (localization). Each characteristic in the G-I linkage and the I-I linkage is translated into an independent variable and linked to hypotheses. Each of the independent variables is then statistically tested against environmental performance, operationalized as a composition of Environmental Performance Indicators (EPIs) or alternatively known as dependent variables. Hypothesis testing provides the means to support or refute the hypothesis. As hypothesis testing via statistical data analysis is required, the independent and dependent variables are operationalized in a measurable form. To overcome the problem of data limitations for the dependent variables - quite common in developing countries, five categories of EPIs were formulated and merged into one final environmental performance variable. The basic five categories of EPIs offer the advantage of robustness in compensating for data variability and limitation.

A minimum of 35 and 36 companies for the POPC and the TAPC respectively were selected via disproportionate stratified random sampling, making over 5% of the population in each sector. The primary purpose of adopting disproportionate stratified random sampling is that it is much more efficient statistically as compared to simple random sampling and in the worst scenario is equal to it. Kendall's tau-b, a non-parametric test, is used as it is the most appropriate tool in view of data characteristics and less stringent requirements. Data were collected at the company sites of each company via interviewing, at the statistical offices of Malaysia, at the offices of the environmental authorities in the districts the sampled companies were located, and with (academic) experts.

This research shows that two out of five hypotheses are statistically significant in the G-I linkage for the POPC. However, none are statistically significant in the G-I Linkage for the TAPC. This is mainly due to the fact that the POPC is designated as a high priority industry by the government. Thus political modernization has taken roots in the POPC. In the I-I linkage, three out of four hypotheses are statistically significant for both the POPC and the TAPC. This also signifies the impact of the increasing importance of market dynamics and economic actors in ecological reform in Malaysia palm oil and textile production chains.

Studies using Ecological Modernization Theory in China, Vietnam and Thailand showed limited applicability of Ecological Modernization Theory in these countries. The main findings of this research on Malaysia, a developing economy in Southeast

Asia, prove in some way better. As mentioned above, the two central tenets of Ecological Modernization Theory, namely political modernization and the increasing importance of market dynamics and economic actors, are to some extent applicable to the POPC. However, for the TAPC, the central tenet of the increasing importance of market dynamics and economic actors is applicable whereas the central tenet of political modernization could not be proven. This shows at least the partial applicability of Ecological Modernization Theory in contemporary Malaysia, a newly industrializing country in Asia.

A facet that has to be considered is the refinement of the Ecological Modernization Theory in the context of localized conditions and institutional developments in Malaysia. The central tenet that environmental reforms are stimulated and triggered by transformations in environmental governance shows that the role of the state has turned towards contextual steering for the POPC. This is made possible with the existence of modernized, sector-specific, government related institutions like the Malaysian Palm Oil Board (MPOB) and Malaysian Palm Oil Council (MPOC). However, this claim is not valid for the TAPC as it has more *laissez faire* characteristics. The government's innovative policy of technology development and technology transfer, as hypothesized by ecological modernization scholars, shows a muted response for both the POPC and the TAPC. The highly bureaucratic and time-consuming application process, together with poor public service delivery, act as a deterrence in such technological collaborative efforts. Likewise, poor enforcement of environmental regulations by both direct and indirect environmental government agencies leads to environmental regulations not being main drivers in environmental reform for both the POPC and the TAPC. The Ecological Modernization Theory characteristics of preventive measures and self-regulation are evident in the POPC, but not the TAPC. Preventive measures in the form of the various ISO certifications, strongly advocated by the state, have become part of the standard operating procedures of government agencies like Felda and government-linked companies in the POPC. As mentioned above, the TAPC has a more *laissez faire* characteristic and as such there is no push or catalyst to toe the government line. The role of civil society in environmental reform, which is very much in evidence in Ecological Modernization Theory literature, is to a large extent absent for the local communities in Malaysia. The environmental dimension has yet to become sufficiently important in the worldview and in the political opportunity structures of the local communities.

The central tenet of the increasing importance of market dynamics and economic agents in environmental reform demonstrates a great impact on both the POPC and the TAPC. These two sectors are highly export-oriented and the reverberations of globalization are felt. For the POPC, the market actors in the farm to fork supply chain have adopted environmental standards like ISO 14000. On the other hand, for the TAPC the mere act of exporting to the developed markets acts as a trigger to adopt environmental standards. The adoption of environmental standards has contributed to the harmonization of environmental practices. For the TAPC, transnational corporations (TNCs) in their centrally powerful position in the economic webs, act as a stimulus in triggering environmental reform in supplier companies. However, the role of the TNCs is not merely imposing their requirements but also collaborating by helping the supplier companies to meet the firm-based environmental standards that they have set. On the other hand, the foreign downstream customers of the POPC have not initiated any collaborative effort to meet environmental requirements. The impact of global market forces has a local effect. Local vertically integrated groups with palm oil milling activity, especially the government linked companies (GLCs) in the POPC, have made efforts in accommodating environmental pressures. The strong corporate culture imbued with the environmental dimension, is used as a cornerstone in meeting market requirements as well as toeing the government line. Through local collaboration, they are able to cascade good environmental management systems and practices within the entire group via structural embeddedness. On the other hand, the vertically integrated groups that are involved in low pollutant generating activities in the TAPC, have made efforts in complying with environmental requirements as the investment cost is relatively low as opposed to wet processing. Thus, environmental reform in the TAPC is dictated by local cost condition.

The study concludes with recommendations. The first recommendation for the development of sector-based industrial policy is the formation of sector specific, government related institutions with participation of economic actors. These institutions provide the means to formulate, promulgate, implement and monitor environmental policies. The experiences in the POPC show that allowing the industry to cooperate and participate in the policy formulation process, buttressed by the sector-specific government related institutions, has provided a synergistic government-industry linkage leading to a strong relationship with clear environmental reforms. The second recommendation is that advanced preventive and curative environmental technologies should be provided on a *pro bono* basis to all industries as these technologies are meant for the good of the commonwealth. Currently, the indigenous technologies developed by MPOB are sold to any interested parties based on certain specific terms and conditions. The third recommendation is that the adoption and maintaining of environmental standards and certifications should be highly encouraged, as this proves to be a workable form of self-regulatory practice. Attaining the pioneer or the first environmental certification, especially ISO 14000 standards, is relatively easy but maintaining the certification on a long term basis proves much more difficult. Tax incentives on a graduated scale can be provided for the adoption and maintaining of environmental certifications as these have both economic and environmental benefits. This preventive measure complements and supplements the environmental enforcement agencies in view and in lieu of their poor regulatory enforcement. The fourth recommendation is that a fast track program should be institutionalized for the approval of technological collaboration, technological financing and the application of tax incentives for environment-related projects and technologies by relevant government agencies. This fast track program is to overcome the highly bureaucratic and time consuming application process by relevant government agencies.

SAMENVATTING

Maleisië heeft in de afgelopen twee decennia een snelle economische ontwikkeling doorgemaakt die gepaard ging met een grote toename van de industriële productie. Deze groei ging echter niet hand in hand met een evenredige inspanning op het gebied van milieubeheer. Weliswaar heeft de Maleisische overheid diverse maatregelen tegen milieuverontreiniging geformuleerd en geïmplementeerd, maar de resultaten daarvan en de milieuprestaties van bedrijven variëren sterk tussen de ene industriesector en de andere. Dit roept de vraag op welke redenen ten grondslag liggen aan verschillen in milieuprestaties tussen industriesectoren binnen hetzelfde land. De meeste onderzoeken die gebruik maken van de theorie van ecologische modernisering - een prominente theorie bij het analyseren en verklaren van milieugerichte hervormingen in Westerse landen - hebben zich echter geconcentreerd op het nationale niveau en hebben niet of nauwelijks gedifferentieerd tussen verschillende sectoren in het bestuderen van milieubeleid, milieumanagement en milieuprestaties. Ook zijn deze ecologische-moderniseringsonderzoeken tot nu toe hoofdzakelijk gericht geweest op Westerse OESO-landen en nauwelijks op de ontwikkelende economieën van Azië. Bovendien zijn de meeste studies in de onderzoekstraditie van ecologische modernisering kwalitatief van karakter in hun gebruik van case study-onderzoek ter analyse en theoretische duiding van milieugerichte hervormingen. Slechts in zeer beperkte mate zijn de centrale stellingen van de ecologische moderniseringstheorie getoetst in kwantitatief onderzoek. Een methodologie voor dit doel is nog niet uitgewerkt. Het onderhavige onderzoek wil een bijdrage leveren aan het vullen van deze leemtes.

Het onderzoek streeft ernaar de verschillen in milieuprestaties tussen industriesectoren in Maleisië te verklaren op basis van de theorie van ecologische modernisering. Met het onderzoek naar de milieuprestaties van sectoren heeft de studie twee doelen. Het eerste doel is het ontwikkelen van een kwantitatieve methodologie voor het onderzoeken van de claims ten aanzien van succes- en faalfactoren in milieuhervorming, zoals deze worden gedaan in de theorie van ecologische modernisering. Deze kwantitatieve methodologie richt zich met name op twee centrale stellingen van ecologische modernisering. De eerste stelling behelst de claim dat milieuhervormingen worden gestimuleerd en geïnitieerd door de transformaties in milieubeleid die ook bekend staan als politieke modernisering. De tweede stelling betreft de toenemende invloed van marktdynamiek en economische actoren op het succes van milieumanagement in een tijdperk van globalisering. Het tweede doel van deze studie is het verklaren van sectorale variaties met betrekking tot de drijfveren van milieuhervorming en het verhelderen waarom de ene specifieke sector beter presteert op gebied van milieu dan de andere.

De palmolie-productieketen (Palm Oil Production Chain, POPC) en de textiel- en kleding-productieketen (Textile and Apparel Production Chain, TAPC) vormen de empirische focus van deze studie. De POPC is in Maleisië een op natuurlijke hulpbronnen gebaseerde industrie van prioritair belang en de overheid is intensief bij deze sector betrokken. De TAPC, aan de andere kant, heeft meer een *laissez faire* karakter, met relatief weinig overheidsinterventie in de economische activiteiten. Uitgaande van de twee eerder geformuleerde doelen zijn er drie onderzoeksvragen.

De eerste betreft de vraag hoe de genoemde stellingen van de ecologische-moderniseringstheorie over beleid en economie kunnen worden geoperationaliseerd in toestbare factoren die mogelijk van invloed zijn op de milieuprestatie in industriesectoren. De tweede onderzoeksvraag is welke factoren op beleids- en economisch terrein een verklaring kunnen bieden van de variaties in milieuprestaties tussen sectoren. De derde onderzoeksvraag betreft aanbevelingen voor de ontwikkeling van een sectorgericht beleid voor industriële ontwikkeling in Maleisië, met name voor de POPC en de TAPC.

De ontwikkeling van een kwantitatieve methodologie begint met de operationalisering van de theorie van ecologische modernisering in hypotheses waarmee de validiteit van de claims van deze theorie in een ontwikkelingsland kan worden getoetst. Hypotheses zijn geformuleerd die ofwel direct voortvloeien uit, ofwel in overeenstemming zijn met de ecologische-moderniseringstheorie. Op basis van de centrale stelling over politieke modernisering zijn hypotheses geformuleerd met betrekking tot de relatie overheid-industrie (Government-Industry, G-I). Deze hypotheses omvatten de karakteristieken beleidsformulering, technologie, inspanningen op het gebied van regulering en handhaving, stimulering van preventie, en betrokkenheid van locale gemeenschappen. Op basis van de centrale stelling over marktdynamiek en economische actoren zijn hypotheses geformuleerd over de relatie industrie-industrie (I-I). Deze hypotheses concentreren zich op de karakteristieken internationale handel, verticale integratie, internationale relaties en lokale industriële samenwerking. Al deze karakteristieken in de G-I-relatie en de I-I-relatie zijn gerelateerd aan relevante hypotheses en uitgewerkt in onafhankelijke variabelen. Elk van de onafhankelijke variabelen is vervolgens statistisch getoetst op samenhang met milieuprestatie. Milieuprestatie - de afhankelijke variabele - werd geoperationaliseerd als een samenstelling van milieuprestatie-indicatoren (Environmental Performance Indicators, EPIs). Op deze wijze werden de onafhankelijke en afhankelijke variabelen in meetbare vorm geoperationaliseerd, zodat het mogelijk werd de hypotheses op basis van kwantitatieve toetsing te ondersteunen of te verwerpen. Om het probleem van beperkte informatie over milieuprestaties van bedrijven op te lossen - een veel voorkomend struikelblok bij onderzoek in ontwikkelingslanden - zijn vijf categorieën van EPIs geformuleerd, welke zijn geaggregeerd tot een samengestelde variabele voor milieuprestatie. De vijf basale categorieën van EPIs bieden tezamen een zekere robuustheid die kan compenseren voor variabiliteit en beperktheid in de data.

Een aantal van 35 respectievelijk 36 bedrijven werd geselecteerd voor de POPC en de TAPC, via een gestratificeerde random steekproef, die daarmee in beide sectoren een omvang had van meer dan 5% van de populaties. De strategie van (disproportionele) gestratificeerde steekproefname werd gekozen omdat zij efficiënter is dan een eenvoudige random steekproef en in een *worst case* scenario tenminste gelijkwaardig daaraan. Kendall's tau-b werd gebruikt als non-parametrische toets, gegeven de datakenmerken en de minder stringente voorwaarden van deze toets. Data werden verzameld op de bedrijfslocaties zelf via interviews, op bureaus voor statistiek in Maleisië, bij de milieuautoriteiten van de districten waar de bedrijven in de steekproef gesitueerd waren, en bij (academische) experts.

Het onderzoek toont aan dat twee van de vijf hypotheses over de G-I-relatie statistisch significant zijn - dat wil zeggen, worden ondersteund - voor de POPC. Voor de TAPC was geen van de hypotheses over de G-I-relatie significant. Dit kan hoofdzakelijk worden verklaard door het feit dat de POPC door de overheid als een hooggeprioriteerde industrie wordt aangemerkt. Politieke modernisering heeft wortel geschoten in deze keten. Wat betreft de I-I-relatie zijn drie van de vier hypotheses significant, zowel voor de POPC als de TAPC. Dit tekent de invloed en het toenemende belang van marktdynamiek en economische actoren in milieuhervormingen in de Maleisische palmolie- en textielketens.

Studies op basis van de theorie van ecologische modernisering in China, Vietnam en Thailand lieten zien dat de theorie in deze landen beperkte toepasbaar is. De bevindingen van dit onderzoek in Maleisië, een ontwikkelende economie in Zuidoost-Azië, zijn in zekere zin positiever. Zoals hierboven is betoogd, zijn de twee centrale stellingen van ecologische modernisering, namelijk politieke modernisering en een toenemend belang van marktdynamiek en economische actoren, tot op zekere hoogte toepasbaar op de POPC. In het geval van de TAPC is de laatste stelling wel in zekere mate toepasbaar, maar kon de eerste stelling, over politieke modernisering, niet bewezen worden. Samenvattend kan gesteld worden dat de theorie van ecologische modernisering in het huidige Maleisië, als nieuw industrialiserend land in Azië, tenminste gedeeltelijk van toepassing is.

Een aspect dat aandacht verdient is de verfijning van de ecologische-moderniseringstheorie in de context van gelokaliseerde condities en institutionele ontwikkelingen in Maleisië. De centrale stelling dat milieuhervormingen worden gestimuleerd en geïnitieerd door transformaties in milieugerichte *governance*, betekent in het kader deze studie dat de rol van de staat ten opzichte van de POPC zich heeft toegespitst op contextuele sturing. Dit wordt mogelijk gemaakt door het bestaan van gemoderniseerde, sectorspecifieke overheidsgerelateerde instituties zoals de Malaysian Palm Oil Board en de Malaysian Palm Oil Council. Iets dergelijks is echter niet het geval voor de TAPC, die meer *laissez faire* karaktertrekken draagt. Het overheidsbeleid voor innovatie in technologieontwikkeling en -overdracht, waarvan ecologische-moderniseringsauteurs veronderstellen dat het een hoofdrol speelt in milieutransformatie, komt bij zowel de POPC als de TAPC weinig uit de verf. De zeer bureaucratische en tijdrovende aanvraagprocedures, samen met een gebrekkige publieke dienstverlening, schrikken bedrijven af bij pogingen tot technologische samenwerking. Ook leidt de gebrekkige handhaving van milieuregels door direct en indirect bij milieu betrokken overheidsorganen tot een situatie waarin milieuregelgeving niet tot de belangrijkste drijfveren van milieuhervorming hoort, zowel voor de POPC als voor de TAPC. De door de ecologische-moderniseringstheorie gepostuleerde invloed van preventieve maatregelen en zelfregulering is aantoonbaar in de POPC, maar niet in de TAPC. Preventieve maatregelen in de vorm van verschillende ISO-certificaten, welke sterk worden gestimuleerd door de staat, zijn onderdeel geworden van de standaard uitvoeringsprocedures van overheidsorganen zoals Federal Land Development Authority (FELDA) en met de overheid verbonden bedrijven in de POPC. Zoals eerder betoogd, heeft de TAPC meer *laissez faire* kenmerken; daarom ontbreekt in deze sector de drang of katalyserende werking om deze overheidslijn van preventie te volgen. De rol van *civil society* in milieuhervorming, die uitvoerig aan de orde komt in de ecologische-moderniseringsliteratuur, is tot op grote hoogte afwezig voor de lokale gemeenschappen in Maleisië. In de maatschappelijke visies en de structurele politieke mogelijkheden van de lokale gemeenschappen zal de milieudimensie nog tot ontplooiing moeten komen.

Wat betreft het toenemend belang van marktdynamiek en economische actoren in milieuhervorming - de tweede centrale stelling - laat het onderzoek duidelijke verbanden zien voor zowel de POPC als de TAPC. Beide sectoren zijn sterk exportgericht en zijn daarom onderhevig aan de dynamiek van globalisering. Wat betreft de POPC hebben de marktpartijen in de *farm to fork* productieketen milieunormen zoals ISO 14000 omarmd. Wat betreft de TAPC betekent alleen al het feit van export naar markten in ontwikkelde landen een prikkel om aan te sluiten bij bestaande milieunormen. De adoptie van milieunormen heeft bijgedragen aan de harmonisering van milieuactiviteiten. In de TAPC fungeren de transnationale ondernemingen, met hun machtige sleutelpositie in economische netwerken, als een stimulans voor het invoeren van milieuhervormingen bij toeleverende bedrijven. De rol van transnationale ondernemingen bestaat niet alleen uit het opleggen van eisen, maar ook uit het samenwerken met en ondersteunen van toeleverende bedrijven in het halen van de milieunormen die zij hebben gesteld. De afnemers van de POPC hebben daarentegen nog geen samenwerkingsinitiatieven gestart gericht op het voldoen aan milieueisen. Globale marktinvloeden hebben lokale gevolgen. Lokale, verticaal geïntegreerde groepen die zich bezighouden met *palm oil milling* - met name de bedrijven in handen van de staat binnen de POPC - hebben inspanningen gedaan om zich aan te passen aan milieueisen. De sterke bedrijfscultuur, die zich bewust is van de milieudimensie, vormt een hoeksteen in het voldoen aan de eisen van de markt en aan het volgen van de lijnen uitgezet door de overheid. Door lokale samenwerking zijn bedrijven in staat om goede milieumanagementsystemen en -praktijken, via hun structurele inbedding in de groep als geheel, aan de andere bedrijven door te geven. Anderzijds geldt voor de verticaal geïntegreerde groepen die betrokken zijn bij laagverontreinigende activiteiten in de TAPC dat hun inspanningen verband houden met de relatieve lage investeringskosten in vergelijking met 'natte' processen. Met andere woorden, milieuhervorming in de TAPC wordt gestuurd door condities van locale kosten.

De studie sluit af met aanbevelingen. De eerste aanbeveling voor de ontwikkeling van een sectorgebaseerd industriebeleid is de formatie van sectorspecifieke, overheidsgerelateerde instituties met participatie van economische actoren. Deze instituties kunnen voorzien in de middelen voor het formuleren, propageren, implementeren en monitoren van milieubeleid. De ervaringen in de POPC laten zien dat door industrie de gelegenheid te geven om te samen te werken en te participeren in het proces van beleidsformulering, ondersteund door de sector-specifieke overheidsgerelateerde instituties, een sterke synergistische relatie tussen overheid en industrie kon ontstaan, die duidelijke milieuhervormingen met zich mee heeft gebracht. De tweede aanbeveling is dat geavanceerde preventieve en curatieve milieutechnologieën aan alle industrieën ter beschikking zouden moeten worden gesteld bij wijze van publieke voorziening, omdat deze technologieën ten goede komen aan het algemeen welzijn. Thans worden de eigen technologieën die ontwikkeld zijn door de Malaysian Palm Oil Board verkocht aan elke geïnteresseerde partij op basis van bepaalde specifieke voorwaarden. De derde aanbeveling houdt in dat de adoptie en instandhouding van milieunormen en certificaten sterk zou moeten worden aangemoedigd, aangezien dit een werkzame vorm van zelfregulering blijkt te zijn. Het als pionier verkrijgen van een eerste milieucertificaat is relatief gemakkelijk, maar het behouden van dit certificaat op de langere termijn blijkt moeilijker te zijn. Belastingvoordelen via een opklimmende schaal zouden kunnen worden verleend bij het verkrijgen en behouden van milieucertificaten, aangezien deze economische en milieuvoordelen met zich meebrengen. Een dergelijke preventieve maatregel kan een nuttige aanvulling vormen op het werk van de milieuhandhavingsautoriteiten, ter complementering en compensering van hun zwakke positie in handhaving. De vierde aanbeveling luidt dat een programma met snelle procedures zou moeten worden geïnstitutionaliseerd voor het goedkeuren van technologische samenwerking, financiering van technologie, en het toekennen van belastingvoordelen voor milieugerelateerde projecten en technologieën door de relevante overheidsdiensten. Een dergelijk programma zou in plaats moeten komen van de huidige zeer bureaucratische en tijdrovende procedures.

ABOUT THE AUTHOR

Er Ah Choy was born on 22 October 1962 in Batu Pahat, Johore, Malaysia. She obtained her Bachelor of Arts (Economics) from Universiti Kebangsaan Malaysia (UKM) in 1986, and her Master in Economics from the same university in 1990. She was a Senior Economist with a consultancy firm prior to joining UKM as a lecturer in 1995 and has remained there till today. Her research interests and publications are related to sustainable development and environmental management in the agricultural and industrial sectors. In October 2002, she pursued her Doctoral Degree in Wageningen University, The Netherlands.