



UNIVERSITI PUTRA MALAYSIA

***GREEN LOGISTICS PRACTICES IN MALAYSIAN FOOD-BASED
MANUFACTURING INDUSTRY***

HILDA HUSSIN

FP 2015 4



**GREEN LOGISTICS PRACTICES IN MALAYSIAN FOOD-BASED
MANUFACTURING INDUSTRY**

By
HILDA HUSSIN

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

July 2015

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

**GREEN LOGISTICS PRACTICES IN MALAYSIAN FOOD-BASED
MANUFACTURING INDUSTRY**

By

HILDA BINTI HUSSIN

July 2015

Chairman : Associate Professor Nitty Hirawaty Kamarulzaman, PhD
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Logistics has been regarded as a key determinant to business performance over the past 50 years. However, the increase in environmental concerns over pollution, climate change, congestion, waste disposal, and resource depletion among others have triggered an increased attention from the government and society. Business operations such as sourcing, manufacturing and logistics are believed to be responsible for most of the environmental problems. Besides, growing demand of customers and environmental societies for more environmental friendly products have led 'green' become a common practice to portray the environmental friendly image of products, processes, systems and technologies, and the way business is conducted. Therefore, green logistics practices were conceptualized concerning the production and distribution of goods in a sustainable way, taking into account the environmental and social factors. The main objective study is to investigate green logistics practices in food-based manufacturing industry in Malaysia. The addresses of food-based manufacturers were obtained from the list of Federation of Malaysian Manufacturers (FFM) Directory 2010. Census sampling technique was used in this study and data collected from 155 food-based manufacturers throughout Malaysia. Statistical analyses such as descriptive analysis, green manual analysis, factor analysis, and multiple regression analysis were used in this study.

In this study, green manual with European Guideline (2007) was used to determine the level of green logistics practices among Malaysian food-based manufacturers and to identify which of the green logistics practices need critical review from the manufacturers. From the analysis, the result shows that the Malaysian food-based manufacturers had implemented green practices in three logistics activities namely; transportation and distribution; warehousing, material handling and information processing and last but not least in packaging and reverse logistics activity. From the analysis, it was found that majority of the Malaysian food-based manufacturers green logistics practices fall into light green colour band for each one of three logistics activities. This colour band indicated that the manufacturers have practiced green in their logistics activities and they are well on the way to operating "green logistics practices" but still need to adopt the remaining green practices. The ultimate finding of this study also showed overall Malaysian food-based manufacturers green practices logistics level by taking into account all three selected logistics activities. From the green manual analysis, the result showed that out of 155 manufacturers, about 54% of

manufacturers logistics practices fall into light green colour band, 39% pale light green and the remaining categorized as green (7%). Besides that, green manual analysis has identified three infrequent green logistics practices that rarer implement in manufacturers' logistics activities namely; manufacturer unusual used alternative fuel such as biofuel or biodiesel in their vehicle, manufacturer less install and use dedicated blast freezing chambers for frozen or chilled storage to accelerate the speed of product freeze and lastly only few manufacturer making business transaction with supplier that execute recycle program.

In addition, the results from factor analysis shows Malaysian food-based manufacturers implemented green practices because they were motivated by three factors namely environment motivational factor, economy motivational factors and social motivational factor. In addition, the findings showed that the manufacturers obtained several perceived benefits when applying green in their logistics activities. All the benefits are apparent into three perspectives as well like what have motivated them to practice green. The three benefits are economy, environment, and social benefits perspectives.

Last but not least, the relations of all the motivational (three factors) and perceived benefits (three factors) obtained were examined with the manufacturers' green logistics practices level. The result showed that out of six factors that investigated, only one had a significant relationship with green logistics practices level. From the multiple regression analysis, the result showed that environment benefits factor become the utmost pressure that influence the manufacturers' green logistics practices level, followed by economy (cost) benefits factor and next economy (cost) motivation factor. The subsequently factors that influenced the level of green logistics practices are social motivation factor and social benefits factor.

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

AMALAN LOGISTIK HIJAU DALAM INDUSTRI PEMBUATAN BERASASKAN MAKANAN DI MALAYSIA

Oleh

HILDA BINTI HUSSIN

Julai 2015

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Logistik telah dianggap sebagai salah satu petunjuk utama prestasi bagi sebuah perniagaan semenjak lebih 50 tahun yang lalu. Bagaimanapun, peningkatan berkenaan isu-isu alam sekitar, yang meliputi pencemaran, perubahan iklim, kesesakan, pembuangan bahan sisa, dan kepupusan sumber telah mencetuskan perhatian yang mendadak dari kalangan kerajaan dan masyarakat. Operasi perniagaan seperti mencari sumber, pembuatan dan logistik dipercayai bertanggungjawab dalam kebanyakan daripada masalah alam sekitar. Selain itu, permintaan yang semakin meningkat dari pelanggan dan persatuan-persatuan alam sekitar untuk menghasilkan produk mesra alam sekitar telah menjadikan 'hijau' sebagai satu amalan yang menggambarkan imej produk mesra alam sekitar dan diterapkan dalam proses, sistem dan teknologi serta cara sesuatu perniagaan itu dijalankan. Oleh itu, amalan logistik hijau ditafsirkan sebagai cara yang mampan dalam mengeluarkan dan mengagihkan barangan dengan mengambil kira faktor sosial dan alam sekitar. Objektif utama kajian ini adalah untuk melihat amalan logistik hijau dalam industri pembuatan berasaskan makanan di Malaysia. Alamat pengeluar-pengeluar berasaskan makanan diperolehi dari senarai direktori Persatuan Pekilang-Pekilang Malaysia 2010. Teknik persampelan banci telah digunakan di kajian dan data telah dikutip dari 155 pengeluar berasaskan makanan dari seluruh Malaysia. Analisis statistik seperti analisis deskriptif, analisis manual hijau, analisis faktor, analisis regresi berganda dan analisis korelasi telah digunakan dalam kajian ini.

Dalam kajian ini, buku manual hijau dengan garis panduan dari Eropah digunakan untuk menentukan tahap amalan logistik hijau di kalangan pengeluar-pengeluar berasaskan makanan di Malaysia. Buku manual hijau terdiri daripada jalur warna yang berbeza dan setiap satunya menunjukkan peringkat amalan hijau yang dilaksanakan oleh pengeluar dalam aktiviti logistik mereka. Daripada analisis yang dijalankan, majoriti amalan logistik hijau yang dipraktikkan oleh pengeluar berasaskan makanan tergolong dalam kumpulan jalur warna hijau muda. Ini bermaksud pengeluar-pengeluar ini ada mempraktikkan amalan logistik hijau bagi setiap satu ketiga-tiga logistik aktiviti yang dijalankan dan dalam usaha untuk mencapai 'amalan logistik hijau', bagaimanapun pengeluar masih perlu mempraktikkan amalan logistik hijau yang lain. Kajian ini juga menunjukkan penemuan yang penting berkenaan amalan logistik hijau bagi keseluruhan pengeluar makanan berasaskan makanan di Malaysia. Daripada analisis hijau yang dijalankan, keputusan menunjukkan daripada sejumlah 155

pengeluar, sebanyak 54% amalan logistik hijau pengeluar jatuh dalam jalur hijau muda, 39% dikategorikan sebagai jalur warna hijau muda cair dan selebihnya (7%) dikategorikan dalam jalur warna hijau. Selain dari itu, analisis manual hijau juga digunakan untuk mengenalpasti amalan logistik hijau yang paling kurang dipraktikkan oleh pengeluar. Antara yang dikenalpasti ialah pengeluar kurang menggunakan minyak alternatif seperti biodiesel dan biofuel; pengeluar jarang menggunakan bilik penyejukbekuan berdedikasi untuk menyejukkan produk dan akhir sekali pengeluar tidak memilih untuk menjalankan transaksi perniagaan dengan pembekal yang menjalankan program kitar semula.

Kajian ini juga mendedahkan keputusan yang dibuat daripada analisis faktor yang mana menunjukkan pengeluar berasaskan makanan Malaysia melaksanakan amalan hijau kerana mereka dimotivasikan oleh tiga faktor iaitu faktor motivasi persekitaran, faktor motivasi ekonomi dan faktor motivasi sosial. Sebagai tambahan, penemuan juga menunjukkan bahawa pengeluar memperolehi beberapa faedah-faedah yang ketara apabila mengamalkan logistik hijau dalam aktiviti mereka. Semua faedah dilihat dalam tiga perspektif juga seperti apa telah mendorong mereka untuk mengamalkan logistik hijau. Tiga faedah tersebut ialah faedah dari sudut ekonomi, faedah dari sudut persekitaran dan faedah dari sudut sosial.

Akhir sekali, hubungan semua motivasi (tiga faktor) dan faedah-faedah yang diperolehi (tiga faktor) dikaji dengan tahap amalan logistik hijau pengeluar. Keputusan menunjukkan bahawa daripada enam faktor yang disiasat, hanya satu sahaja yang tidak mempunyai hubungan penting terhadap tahap amalan logistik hijau pengeluar. Dari analisis regresi berganda, keputusan menunjukkan bahawa faktor faedah persekitaran menjadi keutamaan yang mempengaruhi tahap amalan logistik hijau pengeluar, diikuti oleh faktor faedah ekonomi dan faktor motivasi ekonomi. Faktor seterusnya yang mempengaruhi tahap amalan logistik hijau ialah faktor motivasi sosial dan faktor faedah sosial.

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LIST OF ABBREVIATIONS

1st MP	First Malaysia Plan
2nd MP	Second Malaysia Plan
3rd MP	Third Malaysia Plan
4th MP	Fourth Malaysia Plan
5th MP	Fifth Malaysia Plan
6th MP	Sixth Malaysia Plan
7th MP	Seventh Malaysia Plan
8th MP	Eighth Malaysia Plan
9th MP	Ninth Malaysia Plan
10th MP	Tenth Malaysia Plan
3rd IMP T	Third Industrial Malaysia Plan
3PL	Third Party Logistics
ANOVA	Analysis of Variance
API	Air Pollutant Index
β	Beta coefficient
CA65	Companies Act 1965
CFS	Central Forest Spine
CO ₂	Carbon Dioxide
CNG	Compressed Natural Gas
CPI	Consumer Price Index
CSR	Corporate Social Responsibility
DOA	Department of Agriculture Malaysia
DOE	Department of Environment Malaysia
DOS	Department of Statistics
DTD	Door-to-door
DRI	Domestic Reporting Initiative
DV	Dependent Variable
EEE	Electrical and Electronic Equipment
EMR	Extended Manufacturer Responsibility
EPA	Exploratory Principal Analysis
EPU	Economic Planning Unit
ESA	Environmental Sensitive Area
ETP	Economic Transformation Plan
EU	European Union
FiT	Feed-in Tariff
FMM	Federation of Malaysian Manufacturers
GDP	Gross Domestic Profit
GHGs	Greenhouse gases
GIS	Geographical Information System
GLP	Green Logistics Practices
GNI	Gross National Income
GTP	Government Transformation Plan
HGV	Heavy Goods Vehicles
ICT	Information Communication Technology
ID	Independent Variable
IMP3	Third Industrial Malaysian Plan
ITC	International Trade Centre
JIT	Just-in-Time

KETTHA	Ministry of Energy, Green Technology and Water
KMO	Kaiser-Meyer-Olkin
LGV	Light Goods Vehicles
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LPI	Logistics Performance Index
MIDA	Malaysian Industrial Development Authority
MITI	Ministry of International Trade and Industry
MLC	Malaysia Logistics Council
MMD	Malaysia Meteorology Department
MNRE	Ministry of Natural Resources and Environment Malaysia
MOA	Ministry of Agriculture and Agro-Based Industry
MOSTI	Ministry of Science, Environment and Technology
MP	Malaysia Plan
MW	Megawatts
NAP1	The First National Agricultural Policy
NAP2	The Second National Agricultural Policy
NAP3	The Third National Agricultural Policy
NEM	New Economic Model
NEP	New Economic Policy
NGT	The National Green Technology Policy
NGV	Natural Gas Vehicles
NKEAs	National Key Economy Areas
NKRA	National Key Result Areas
NO2	Nitrogen Dioxide
NPBD	The National Policy on Biological Diversity
NPCC	National Policy on augment Climate Change
NPE	The National Policy on Environment
NPP	National Physical Plan
NPPC	National Physical Planning Council
NPP2	Second National Physical Plan
NUP	The Urbanisation Policy
O3	Ground Level Ozone
Pb	Lead
PC	Principal Component
PCA	Principal Component Analysis
PERNAS	Perbadanan Nasional Berhad
PETRONAS	Petroleum Nasional Berhad
PM10	Particulate Matter
POIC	Palm Oil Industrial Clusters
R & D	Research and Development
RE	Renewable Energy
R2	R- Square
RT	Refrigeration Tonnes
SAVE	Sustainability Achieved via Energy Efficiency
SCM	Supply Chain Management
SIRIM	Standard & Industrial Research Institute of Malaysia
SE	Standard Error
SEDA	Sustainable Energy Development Authority
SMEs	Small and medium enterprises

SO2
SPAN
SPSS 20
SWCorp
UNDP
USEPA
WAITRO

WCED 1987

Sulphur Dioxide
Suruhanjaya Perkhidmatan Air Negara
Statistical Package Social Sciences 20
Solid Waste Management and Public Cleansing Corporation
United Nations Development Programme
United States Environment Protection Agency
World Association of Industrial and Technological
Organisations
World Commission on Environment and Development 1987



CHAPTER 1

INTRODUCTION

This chapter of the thesis consists of background discussion on environmental problems and green Malaysia, problem statement, research questions, research objectives, significance of the study, and organization of the thesis. The background discussion covers three main aspects namely, food-based industry, logistics industry, and environmental issues in Malaysia. An integrated discussion of above aspects are important to rationalise the implementation of green logistics practices, with a wholesome view of its causes and effects. The following sections in this chapter describe the rationale behind this study, the research objectives and its significance.

1.1 Malaysia Plan and Government Initiatives Towards Green

The Malaysia Plan (MP) is the Malaysian government's development plan for every five years. In the past, Malaysia plan was known as the Malaysian five-year plan, an inheritance from the British colonial period of Malaya. However, the formation of Malaysia in 1963, led to the rename of Malaysian five-year plan to the Malaysia Plan. Before this transformation, the economic development plan focused only on the development of Peninsular Malaysia. Nevertheless, the new MP emphasized on economic improvement of the country as a whole, and incorporated Sarawak and Sabah into its developmental plans. So far, Malaysia has developed 10 plans as listed in Table 1.1.

Table 1.1: Malaysia Plan from Year 1966 Until 2015

Malaysia Plan	Year
Tenth Malaysia Plan (10 th MP)	2011 – 2015
Ninth Malaysia Plan (9 th MP)	2006 – 2010
Eight Malaysia Plan (8 th MP)	2001 – 2005
Seventh Malaysia Plan (7 th MP)	1996 – 2000
Sixth Malaysia Plan (6 th MP)	1990 – 1995
Fifth Malaysia Plan (5 th MP)	1986 – 1990
Fourth Malaysia Plan (4 th MP)	1981 – 1985
Third Malaysia Plan (3 th MP)	1976 – 1980
Second Malaysia Plan (2 nd MP)	1971 – 1975
First Malaysia Plan (1 st MP)	1966 – 1970

Source: Malaysia Prime Minister' Office, updated on 14 August 2015

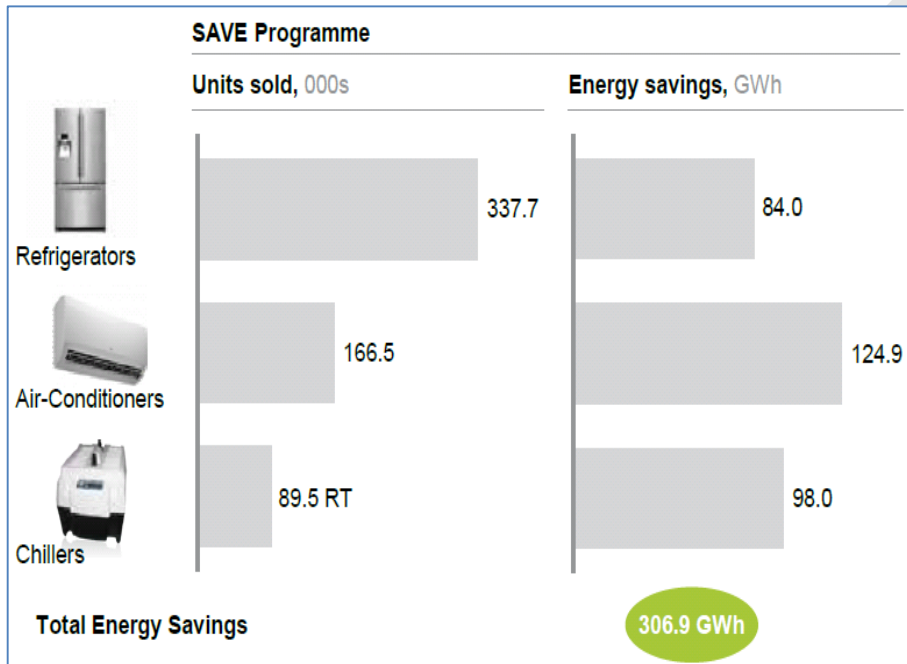
Tenth Malaysia Plan (10th MP) is the latest five year Malaysia plan for the period 2011-2015. It was presented by the Malaysian Prime Minister Datuk Seri Najib Tun Razak in Parliament on June 10, 2010, with the theme “Prosperity Plan Economic and Social Justice”. The 10thMP proposed five main strategic thrusts. The first one is to modulate government philosophy and approach towards transforming Malaysia with National Key Result Areas (NKRA) methodology. Second, create a conducive environment for unleashing economic growth, and third is moving Malaysia towards inclusive socio-economic development. The fourth and the fifth thrusts are to develop and maintain world-class talent and building an environment that enhances the quality of life of Malaysians.a

In this Tenth Malaysia Plan (10th MP), the Malaysian government developed various policies and green initiatives in order to reduce the environmental impact. One main objective of the Malaysia Plan is to reduce the impact of climate change, environmental deterioration, and increase the sustainable consumption of Malaysia’s natural legacy. According to United Nations Development Programme (UNDP) Human Development Report 2007/2008, Malaysia contributed only 0.7% to global CO₂ emissions. Nevertheless, Malaysia’s greenhouse gas (GHG) emission intensity levels with respect to the country’s gross domestic product (GDP) are above the global average in the energy sector. Consequently, the Malaysian government introduced several initiatives, with the intent to lessen emission of GHGs across few areas. One of the focus areas is to reduce emissions to improve air quality. This will be achieved by carrying out the Clean Air Action Plan. The strategy will focus mainly on decreasing the emissions from motor vehicles and industries, as well as avoiding haze pollution from land and forest fires. Moreover, Malaysia designed a dual approach to reduce climate change impacts (mainly GHG emission), firstly by adopting strategies to prevent economic growth and development factors as a result of climate change, and secondly through mitigation strategies to diminish emission of greenhouse gases (GHGs).

Malaysia also aims to build strong investment incentives for renewable energy (RE) generation. Malaysia is rich in many RE resources, such as biomass, biogas, mini-hydro and solar, which could provide a more secure supply of energy. However, the rigor initiatives developed were not successful in accomplishing the objectives set up under the Ninth Plan period. Therefore, under the Tenth Plan, numerous new initiatives related to Renewable Energy Policy and Action Plan were redeveloped. The 10th MP has introduced the Feed-in Tariff (FiT) of 1% and will be combined into the electricity tariffs of consumers to fund improvement in RE generation. This will support the selling of electricity produced from RE to utilities at a fixed best price for a specific period.

Subsequent government initiatives towards green can be seen through Sustainability Achieved via Energy Efficiency (SAVE) Programme. The SAVE programme was an initiative organized by the Ministry of Energy, Green Technology and Water (KeTTHA) from 2011 to 2013. The SAVE programme is under the Malaysian Government cooperation with utility firms and joint venture of appliance manufacturers. In this programme, an amount of RM200 for refrigerators and RM100

for air-conditioners will be rebated to qualified customers for purchase five star rated appliances. Other than that, RM200 per RT (Refrigeration Tonnes) will be given for replacement of old chillers (>10 years). The aim was to stimulate the addition of new energy efficient products which consists of 27 new brands of air-conditioners and refrigerators. Figure 1.1 shows the energy saving due to SAVE Programme over the period 2011 - 2013.



Source: Sustainable Energy Development Authority (SEDA), Economic Planning Unit (EPU)

Figure 1.1: Energy Savings From SAVE Programme Over 2011 - 2013

Malaysia is also committed to managing its entire waste disposal in a sustainable way as an effort to protect the environment. Selected wastes such as solid, agricultural, construction, radioactive, mining, sewage, and scheduled wastes are managed in an all-inclusive way based on a life cycle approach. The National Solid Waste Management Department and the Solid Waste Management and Public Cleansing Corporation (SWCorp) together with other relevant agencies such as the Atomic Energy Licensing Board, Department of Agriculture (DOA), Department of Environment (DOE), Minerals and Geoscience Department, and Suruhanjaya Perkhidmatan Air Negara (SPAN) are responsible for this initiative. The objective of this plan is to intensify reutilizing and retrieval rate of waste and expand management of landfills in order to reduce the amount of waste and effluence.

Over time, Malaysia has established many initiatives on environmental protection to show its commitment to protect and maintain the health and well-being of its society

for now and the future. Figure 1.2 lists a part of the government's commitment and output towards green as given in Thrust 4 of the Tenth Malaysia Plan (10th MP).

Thrust 4: Improving the Standard and Sustainability of Quality of Life

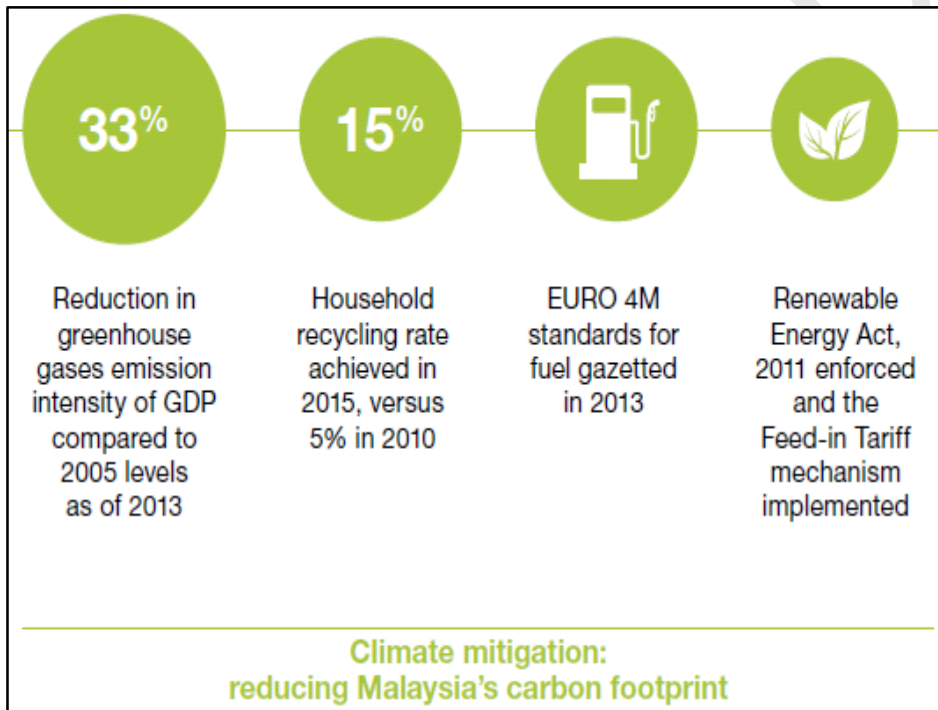
Commitment	Output
<i>Environment</i>	
<ul style="list-style-type: none"> Addressing climate change issue 	<ul style="list-style-type: none"> National Climate Change Policy and National Green Technology Policy adopted in 2009 National Green Technology Council formed in 2009 Total of certified emission reduction units from Clean Development Mechanism projects are 673,857 CO₂ eq Green Technology Financing Scheme amounting to RM1.5 billion established in 2010 to promote green technology
<ul style="list-style-type: none"> Improve air quality 	<ul style="list-style-type: none"> Clean Air Action Plan developed in 2009 EURO 2M standards implemented in 2007
<ul style="list-style-type: none"> Improve river water quality 	<ul style="list-style-type: none"> Integrated Action Plan to Prevent Pollution and Improve Water Quality developed for Sg. Linggi, Sg. Sepetang, Sg. Merbok, Sg. Kuantan and Sg. Kinabatangan Environmental Quality (Industrial Effluent) Regulations 2009, Environmental Quality (Sewage) Regulations 2009 and Environmental Quality (Control of Pollution from Solid Waste Transfer Station and Landfill) Regulations 2009 formulated

Note: Output as at December 31st, 2009, unless stated otherwise

Source: Tenth Malaysia Plan 2011-2015, The Economic Planning Unit Prime Minister's Department Putrajaya (2011)

Figure 1.2: A Part of Malaysia Commitment and Output towards Green in Trust 4 of Tenth Malaysia Plan

Meanwhile, Figure 1.3 shows selected accomplishments made during the 10th MP, mainly on reduction of carbon footprint. In 2009, Malaysia established a voluntary objective to decrease GHGs emission concentration of its GDP by up to 40% as compared to 2005 levels by 2020. Under the Tenth Plan, Malaysia succeeded to achieve a 33% decrease in GHG by the end of 2013. Also, in an effort to reduce GHGs emission, the Malaysian Energy sector promoted the use of clean and environmentally friendly sources. Other than that, Feed-in Tariff (FiT) system was executed in 2011, through the Renewable Energy Act, to increase speed renewable energy (RE) development in Malaysia. As the result, the Malaysian electric capacity grew from 53 megawatts (MW) in 2009 to 243 MW in 2014 after RE installation.



Source: Eleventh Malaysia Plan 2016-2020. Anchoring Growth on People. Economic Planning Unit, Prime Minister Office.

Figure 1.3: Highlights Tenth Malaysia Plan, 2011-2015: Achievements

1.2 Agriculture Sector in Tenth Malaysia Plan

The Ninth Malaysia Plan (9th MP) was formulated for 2006-2010, with the objective to upgrade the manufacturing sector into a higher value added activity and strengthen the related services. The focus was on altering SMEs as industrial businesses into knowledge based and value-generating entities. The application of technology and innovation was emphasized to support the strategies. The 9th MP also aimed to increase

Malaysia's self-sufficiency level to lessen its dependence on imports, especially imported food products. To accomplish that objective, the government planned to intensifying agro-based processing activities and product diversification to promote Malaysian products at international level. In order to achieve this, a strategy was made to involve the private sector to boost up agricultural production. In 2009, small and high value agriculture farming such as herbs and spices, swiftlet agriculture, aquaculture, ornamental fish, mushroom, organic fruits and vegetables and floriculture contributed to 1% of Malaysian GDP. There is mounting demand for this type of agriculture, wherein the farmers are able to raise their profits due to good prospects. Nevertheless, factors such as lack of funding for further research and development (R&D), weak connections to the market, uneconomical scale operations and lack of skilled labour constricts the growth of this subsector. Understanding this, the Malaysian government adopted a multi approach strategy for the Tenth Malaysia Plan (10th MP).

The Tenth Malaysia Plan (10th MP) formulated for 2011-2015, was designed in consideration of Malaysia's New Economic Model approach (NEM). The NEM is an economic plan developed by the Malaysian Prime Minister Najib Tun Razak with the intent to double per capita income of Malaysians. The NEM model uses three main elements namely high incomes, sustainability and inclusiveness to accelerate the Malaysian economy growth by 2020. The 10th MP used different approaches to compensate the slow development witnessed under the 9th MP period. The 10th MP put forward the private sector as an engine to accelerate economic growth. The 10th MP targets the government to increase GDP to RM21.9 billion and the gross national income (GNI) per capita to RM38, 850 or USD12, 140 by 2015. To achieve this, Malaysia needs to attain a real GDP growth of 6% annually. The services and manufacturing sectors are expected to spur the growth. Meanwhile, introduction of ICT (Information Communication Technology), biotechnology and other pertinent technologies into the agriculture sector will assist developments in this sector. Besides that, the government plans to publicize the Malaysian palm oil industry as a global hub on areas such as oleochemical-based products, facilities, and R&D, and to make Malaysia a chosen destination for investments. Palm Oil Industrial Clusters (POIC) were developed to advertise downstream activities such as biofuel, biofertilisers, biomass products, nutraceuticals and pharmaceuticals. The first POIC was recognized in Lahad Datu Sabah in year 2005.

The Tenth Plan period pays extraordinary focus on agriculture activities to increase its contribution to GDP by 2% by 2015. To achieve such objective, government plan to establish agriculture associations and co-ops to obtain the benefits of scale, boost adoption of accredited practices by farmers, fishermen and agropreneurs, and reinforce marketing through contract farming and strategic agreements. Besides that, in this Tenth Malaysia Plan, Malaysia has encouraging farm technology and ICT (Information & Communication Technology) in agriculture sector such as ICT-based Agriculture Flagship Project. Other than that, Malaysia has invested to enhance the facilities and logistics to smoothen the agriculture supply chain particularly in the designated Permanent Food Production Parks and Aquaculture Industrial Zones to secure the food supply. The Tenth Malaysia Plan also emphasized on promoting R&D (Research and Development) by establishing agriculture research institutes to obtain advance

innovation in the production processes, disease governor, safety and quality monitor, including development of innovative high-value added products. Moreover, food security will be strategically reviewed to confirm the accessibility, openness and affordability of food, particularly rice for the society. During the Plan period, Malaysia is also aiming to warrant adequate supply of rice including the preservation of rice stockpile at 292,000 metric tonnes or sustained consumption for 45 days. No new areas will be established for paddy farming and local production of rice will be set to accomplish a 70% level of self-sufficiency.

In the 10th MP, the government also plans to help smallholders to reduce their input expenses by centralizing the purchasing and procurement of agricultural inputs such as fertilizers and pesticides. In addition, the strategy such as promoting good agriculture and agronomic management and mechanization was developed to strengthen contribution of agriculture sector. Agriculture will continue to be acknowledged as one of twelve national key economic areas (NKEAs) under Government Transformation Programme (GTP). Under this GTP plan, potential areas are identified and given attention for improvement. NKEAs are defined as Malaysia engines of economic growth denote economic sectors that will drive Malaysia with uppermost potential income over the next ten years. Education and electric and electronic sectors are the other areas in NKEAs.

Table 1.2: Gross Domestic Product for Agriculture Sector follow by States, 2006-2015

State / Region	RM Million(Price constant at 2000)							Average Annual Growth Rate (%)	
	Actual			Predict		Projected		Predict	Projected
								9 th MP	10 th MP
	2006	2007	2008	2009	2010	2012	2015	2006 - 2010	2011 – 2015
Johor	4,939	4,705	5,344	5,385	5,496	5,846	6,308	3.7	2.8
Kedah	1,556	1,729	1,824	1,675	1,728	1,870	2,260	4.1	5.5
Kelantan	1,625	1,880	1,913	1,839	1,804	1,996	2,340	4.5	5.3
Melaka	514	561	658	600	591	635	699	6.4	3.4
N.Sembilan	1,226	1,187	1,222	1,292	1,361	1,452	1,590	4.2	3.2
Pahang	4,214	3,849	4,011	4,309	4,609	4,916	5,514	3.2	3.7
Perak	3,733	3,873	3,876	3,944	4,146	4,490	5,035	2.9	4
Perlis	710	823	830	757	778	871	1,042	4.3	6
P.Pinang	786	799	824	840	870	933	1,046	4.1	3.8
Sabah	7,618	7,957	7,810	8,126	8,498	9,054	9,878	2.7	3.1
Sarawak	7,472	7,599	7,715	7,993	8,331	8,729	9,331	1.8	2.3
Selangor	1,605	1,513	1,783	1,737	1,762	1,828	1,981	5.9	2.4

Terengganu	1,254	1,238	1,446	1,362	1,387	1,446	1,627	3.7	3.2
K. Lumpur	32	42	38	34	36	38	44	-2.5	4.5
WP Labuan	92	92	100	100	102	108	119	9	3

Source: Malaysia Economic Planning Unit and Department of Statistics (2013)

Table 1.2 shows GDP for agriculture sector from year 2006 until 2015 and percentage growth rate for the 9th MP and the 10th MP. Based on the implementation of both previous and current Malaysia plans, the increment of GDP of agriculture sector can be seen in eight states out of fifteen states that constitute Malaysia. Kedah, Kelantan, Perak, Perlis, Pahang Sabah, Sarawak, and Kuala Lumpur states recorded a better percentage of annual growth rates in agriculture sector from the 9th MP to the 10th MP. Kuala Lumpur indicates a greater increase of average annual growth rate since the GDP of agriculture sector in this state jump from -2.5% in the 9th MP to 4.5% in the 10th MP. The remaining states such as Johor, Pulau Pinang, Selangor, Terengganu, Melaka, Sembilan, and Federal of Labuan show a declining contribution of agriculture GDP annual growth rate when shift to the 10th MP from the 9th MP. Federal of Labuan shows the largest diminishing rate that is 6% with 9% in the 9th MP and change about 3% in the 10th MP. The deterioration might be influenced by the effect alteration of Labuan states into oil and gas and petroleum producers.

1.2.1 Malaysia National Agriculture Policy

Malaysia executed the First National Agriculture Policy (NAP1) in 1984 and the Second National Agriculture Policy (NAP2) in 1992 and as the result the agricultural sector had achieved an average annual growth of 3.2%. Meanwhile, the added value of agriculture had increased from RM11.9 billion in 1985 to RM16.2 billion in 1995. In addition, exports had also raise from RM12.92 billion in 1985 to RM32.87 billion in 1995. The growth of agriculture sector is contributed by oil palm, sawlogs, and fisheries commodities. Nevertheless, share of agricultural industrial commodities to the total agricultural value-added reduced from 72.1% in 1985 to 71.6% in 1995. At the same time, food commodities increased from 24.1% to 26.7%. NAP1 emphasized on the development of crop export strategy such as oil palm and cocoa. For that reason, the government put greater investment on infrastructure development and modern land expansion for oil palm and cocoa commodities. Besides that, the government also made an effort to resolve uneconomic farm size and small productivity among smallholder farmers in order to achieve the objectives of NAP1. With not much gap from the NAP1 strategy, the NAP2 focused on increasing production, competence, and competitiveness of agriculture sector. In the NAP2, the strategy to increase land for palm oil still continue since this commodities give enormous contribution to the growth of agriculture sector. The new plan introduced in the NAP2 is in consideration of the development of agro-based industry.

In 1997, Asia was facing financial crisis, with the manufacturing sector no longer having tremendous growth and Malaysia needed to find an alternative growth sector. The Third National Agriculture Policy (NAP3) that was established in year 1998 until 2010 put forward the agro-food sub-sector to be an engine of growth of Malaysia's economy. NAP3 proposed on new approaches to boost up productivity and competitiveness of agriculture sector. This new policy granted a thrust and strategy that

concentrates on national interest on agriculture development and the economy as a whole. The objective of NAP 3 is to maximizing nation income through optimal resources utilization, increasing agriculture contribution to national GDP and increasing income of producers. All these three objectives National Agriculture Policy have been formulated to ensure that agriculture products continue to be competitive in the international market.

1.3 Malaysian Food-Based Manufacturing Industry

The agricultural sector in Malaysia has become the third engine of growth for national economy under the Ninth Malaysia Plan (9th MP). The agriculture contribution towards the achieving the goals appeared from various efforts such as the establishment of large-scale and profitable farming activities, application of extensive modern technology, produce product that has high valued added and quality control, improvement of biotechnology, utilize more systematic information and communications technology, and encourage the involvement of entrepreneurial farmers and skilled labour force and expand the food-based production to increase self-sufficiency level as well. Meanwhile, the Ministry of Agriculture and Agro-Based Industry (MOA) has reported that food commodities sub-sector are predicted to grow at 7.6% per annum in average rate by increasing the efficiency of production on per hectare land. As the results, this will encourage and boost up the Malaysian food processing industry and become an imperative component of the agro-based industry. At the same time, the Ministry of International Trade and Industry (MITI) clarified that about RM24.6 billion investments have been allocated for food processing industry under Third Industrial Malaysian Plan 2006-2020 (IMP3) since this industry has a potential to capture earnings and profits enormously. In Malaysia, food industry is conquered by small and medium scale of business firms. The Malaysia food industry is nowadays advanced and has moved together with the current market demand by processing various kind of food such as functional food, health food, convenience food, food ingredients, and halal food among others.

Furthermore, Malaysia food industry has evolved a lot, influenced by several factors such as mounting of production costs, technological expansion, altering in business competitiveness, changing in consumers demand, and others. Today's Malaysian food industry is enlarged and a bit complex. The supplies come from both the local and imported markets around the world. Presently, most of the consumers show some brand conscious and prefer to shop in store which can provide convenience and good product assortment. In metropolitan neighbourhood, hypermarkets stores are the outlet that gets attention the most and about 45% to 60% of urban household find their packaged foodstuff here. Traditional markets or conventional markets are of slightly lower interest to the consumer, however they are still essential outlets when it comes to fresh fruits and vegetables. Other than that, consumers' awareness towards food enrichment (nutritional value) and how it's being processed has created the demand for healthy and minimally processed food as well as green or lean manufacturing. Consumers at these days also are well educated about environment-friendly products or green products. Consequently, this has forced food manufacturers to build up different food processing operation in manufacturing industry. The modification not only affects

and concern about the element to be used in the products, but their practices have transformed as well to fulfil the requirement of particular food manufacturing activities. The most demanded product in the market today is related to halal and green product. This is supported by the Ministry of International Trade and Industries (MITI) which predicted that global market demand for halal foods (for Muslim) are approximately around US\$560 billion per year. Thus, Malaysian government has recognized the food processing industry as an important sector for industrial enlargement and raise exports. According to the Bureau of Labour Statistics, the food manufacturing industry (including in Malaysia) is not significantly affected by economic conditions and is a steady source of employment for those with little or no formal education and qualifications. Food manufacturing can be described as the series of processes that linkage raw products from farmers to food products for consumers. Fresh fruits, seafood, vegetables, poultry, grains, meats, and dairy products from the supplier undergo a series of manufacturing processes to prepare products for sale to the public. The food manufacturing goes through several preservation processes such as such as canning and freezing.

In term of Malaysia food import, the amount rise from RM3.5 billion in 1985 to RM7.7 billion in 1995 and RM10.0 billion in 1997 after the implementation of the 9th MP and 10th MP. Imported inflation has stimulated by the inconsistency and unpredictability on Malaysia's foreign exchange. At the same time, food demand continues to increase and trigger food prices escalation. In 1997, Consumer Price Index (CPI) recorded 51.9% increment as the result of food prices rises. After the three years recover from financial crisis, Malaysian Investment Development Authority (MIDA) reported in 2011, Malaysia has produced and exported more than RM13 billion foods. While in 2012, Malaysia food product exports value increase to RM13.4 billion. Next, in year 2013, Malaysia food product and exports continuously increased about RM14.2 billion. Malaysia has exported several food-based products such as cocoa and cocoa preparations (RM3.2 billion), cereal and cereal preparations (RM1.8 billion), dairy products (RM957.4 million), sugar and sugar confectionery (RM893.8 million) and prepared/preserved vegetables and fruits (RM578.1 million). In addition, Malaysia exported food products to more than 200 countries. Singapore, Indonesia, the USA, Thailand and Republic of China are the major export destinations for Malaysia food products currently. The recent study has shown that changes in food-based demand are influenced by increasing of household income and responsiveness towards balanced diet and health consciousness of the consumers nowadays. In addition, changing of tastes and preferences among customer also affected the demand trend. Therefore, food manufacturing industry must respond to these changes by providing nutritious, healthy and high quality food at reasonable prices.

1.4 Malaysia Environmental Issues and Current Status

Awareness towards environmental issues has entered the agenda in many countries worldwide. The consciousness emerge as the result of that the earth had been facing to the disaster, calamity, bad phenomena and many issues since 90's century period. Environmental catastrophe is continuously take place as no interested parties take expeditious prevention action. Climate change is one of the major concerns of most

countries because of its effect. Natural disasters such as rising of sea-level, forest fires, erosion of coastal and land, drought, haze, floods, acid rain are the results of climate change. The entire phenomenon has impacted human quality life, safety and health, and upset the nation's economy growth and triggers the modification of natural landscapes. Other than that, climate change has interfered global water and food security systems. Amongst the factor that contributes to climate change occurrences is continued dependence on conventional energy supply such as fossil fuels. The dependencies produce greenhouse gas emissions (GHG) and made the planet more susceptible to climate change. Enormous GHG emission will initiate ozone depletion of this planet and eventually emit global warming phenomenon. Record-keeping on climate start about 130 years ago and August 2010 witnessed as the hottest years of world. Recent study showed that global warming induces snow at the North Pole melting gradually. Malaysia also felt the effects of global warming as this region facing with longer drought in certain areas than usual. This heat temperatures also give some difficulties to paddy commodity cultivation aside of pest and diseases factors. As the result, Malaysia is ongoing importing the staple foods. Figure 1.4 shows the statistics of total rainfall at 24 selected principal meteorological stations in Malaysia along the year 2006 - 2011. The data roughly indicated that total annual rainfall in Malaysia move in average motion from year 2006 until 2008. However, total annual rainfall slightly decreased from 68,017.1 mm in 2009 to 59,517.8 mm in 2010. Conversely, for the period of the first six months of year 2011, total rainfall increased to 34,796.5 mm from 24,737.7 mm for the same phase of 2010. This might influenced by the current conservation activity through environmental awareness campaign among nations.



Source: Malaysian Meteorological Department (2011)

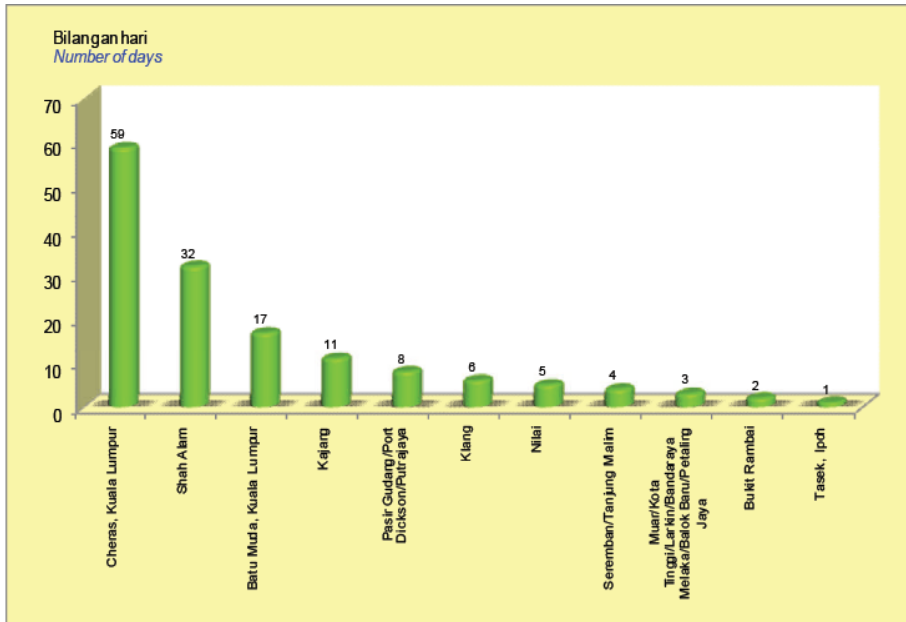
Figure 1.4: Total Rainfall at 24 Selected Principal Meteorological Stations, Malaysia, 2006-2011

Other than that, overheated climate will cause bleaching of coral reefs. Coral reefs are important to the sea nurseries as foundation of marine ecosystems and as the most beautiful part of the ocean that attracts snorkelers and scuba divers lover around the world. Malaysia is a country acknowledged for its stunning coral reef and unique underwater creatures. Tourism is the sector that assists Malaysia GDP boost up and eradication of this marine life will cause fluctuation of Malaysia economy level.

Some regions in this world are ravenous of humidity as the transformation of climate patterns. At the same time, additional moisture will be hold by warmer air until it will unleash in severe storm and hurricane. Hail phenomenon is one climate change effect. Hail is a type of concrete precipitation. It consists of balls or asymmetrical pieces of ice called a hailstone. The first hail occurred in Malaysia on 24 February 2007 at Sungai Buloh, Selangor. The Malaysian Meteorology Department (MMD) reported that the incident happen about 15 minutes and produce 20cent size of hailstone. On 28 September 2009, the second hail phenomenon hit Malaysia at Jerantut, Pahang. The MDD stated that the second hail incident is riskier that previous one since it produces hailstone in a form of 50cent size and it was linked of Katrena Typhoon that occurs in Filipina and Vietnam. The incident destroyed lot of house roofs, trees collapse and electric posts crumble. Hail incident happen because the dramatic changes of climate change and it should not happen in Malaysia since its commonly happen in a snow region.

Pollution is another environmental issue faced by most nations nowadays. It is one kind of contamination that content of chemicals toxic amount in the air, water, and land, which is dangerous or give malicious effects to human life as well as the environment. Air is generally form mixture of 21% oxygen, 78% of nitrogen, and other 1% of other gases. Air is vital for human life and has been used for common activities such as to burn fuels for heat, roasting, mechanization process, transportation, power generation and etc. Air is said to be polluted if it's contented with subject matter such as Sulphur Dioxide (SO₂), Lead (Pb), Ground Level Ozone (O₃), Nitrogen Dioxide (NO₂) Carbon Monoxide (CO), and Particulate Matter (PM₁₀). All this substances can be in the form of gases, solid particles or liquid droplets. Appendix 1 demonstrates the sources and effects of air pollutants. In Malaysia, air quality is observed by The Department of Environment (DOE) through 52 monitoring stations positioned in the housing areas. The remaining stations are located in high traffic volume area, industrial-concentrated area and manufacturing areas. The air quality was measured using Air Pollutant Index (API). The API will calculate the quantity of O₃, CO, NO₂, SO₂ and PM₁₀ in the air and certain benchmarking was identified. There are six indicators to determine the air quality based on API Likert scale. Air quality with Good indicator was scale from 0 to 50, moderate air quality means the API fall in range from 51 to 100. Meanwhile unhealthy air was indicated with API from 101 to 200 and very unhealthy was benchmark with API from 201 to 300. Last but not least, hazardous air indicated with API from 301 to 500 and Emergency level of air was denotes with API above 500. Details of API are presented in Appendix 2.

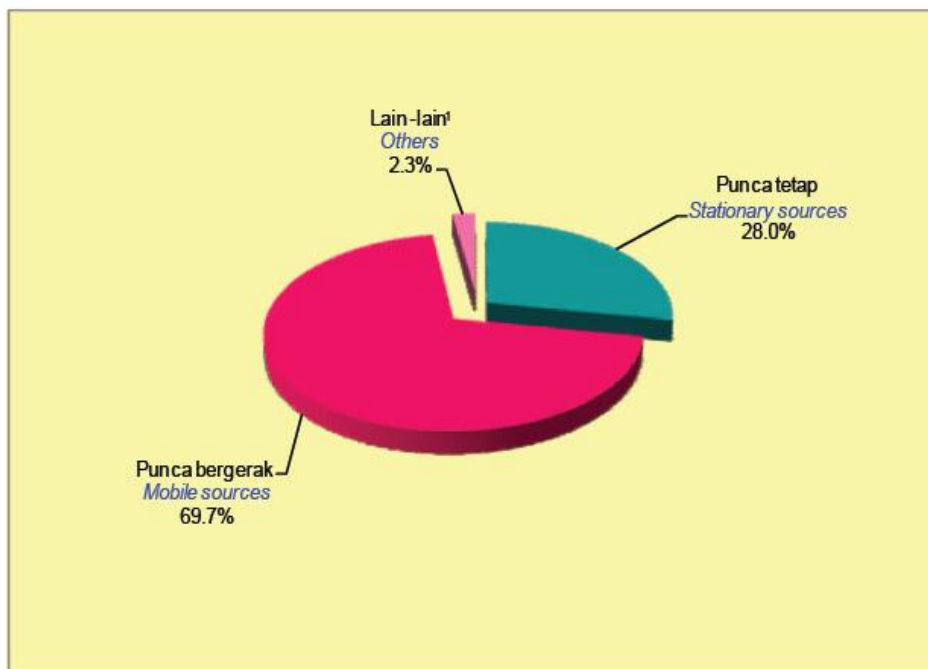
Figures 1.5 illustrates the number of days for unhealthy air quality status by station in Malaysia of year 2010. Monitoring station at Cheras station Kuala Lumpur shows the highest number of unhealthy days that is 59 along the year. While Tasek station in Ipoh verify only one unhealthy day for one year period.



Note: Air quality status readings are based on daily maximum readings
 Source: Department of Environment (2011)

Figure 1.5: Number of Days for Unhealthy Air Quality Status by Station, Malaysia, 2010

The Department of Environment Malaysia (DOE) reported that Malaysia encountered obvious air pollution in 2006. Haze pollution widespread from minor to moderate haze since July until October 2006. This phenomenon was influenced by the cross-border pollution from next-door countries such as forest burning in Sumatra, Indonesia. The status of air quality is different depending on the size of traffic volume, to the geographical concentration, the industrial and commercial activities and populated areas. Klang Valley is an area in Malaysia most exposed to air pollution as compared to any other regions. Estimation over 100% Malaysia air status, 23% was in good level at one time, 70% was in moderate level at one time and the rest 7% identified as an unhealthy air level. Haze caused by factor such as open burning activities, land clearing, combustion of fossil fuels in industrial boilers, vehicle emission and others. The DOE reported three major sources of emission pollution namely stationary sources, mobile sources and others. Stationary sources means the pollutant was produced by industries including power plants, while, mobile sources comes from motor vehicles and open burning activities (Malaysia Compendium of Environment Statistics, 2011). Figure 1.6 shows the emission of pollutants to the atmosphere by source in Malaysia in year 2010. About 69.7% pollution was emitting by mobile sources. Meanwhile 28% comes from stationary sources and the remaining 2.3% appear from other sources. For stationary sources, 84.5% donated by power plants and 15.5% comes from industrial sources.



Note: Includes hotels, commercial centres, institutions and night markets
 Source: Department of Environment (2011)

Figure 1.6: Emission of Pollutants to the Atmosphere by Source, Malaysia, 2010

Malaysia was fortunately gifted with both natural resources and renewable sources of energy and able to meet this country's demand for energy. However some world's natural resources such as fossil cannot be replenished and will not sustain if continuously used to meet the need of increasing population. More than 80% of the planet resources were consumed by 20% population in developed countries. If each person utilize at this figure, human need as a minimum three planets similar to earth to fulfil the demand. Not all the natural resources are consumed 100% as valid products, but are throw away somewhere during manufacturing process. Consequently, it is crucial to increase the utilization efficiency of natural resources by develop alternatives or substitute resources to reduce the continued dependencies on the natural resources for sustain future generation consumption.

1.4.1 Policy and Environment Act in Malaysia

Malaysia trepidation towards environment can be seen from their efforts in which focusing on the establishment of many laws and regulations to conserve the environment from being exterminate. There are several policies and acts identified related to environment protection and Malaysia's early endeavour could be seen from the formation of NPBD policy. National Policy on Biological Diversity (NPBD) is officially declared on April 16 1998 at Kuala Lumpur by the Ministry of Science, Environment and Technology (MOSTI). The purpose of policy establishment is to

provide guidance and act as a direction to all administrative agencies including state governments on the preservation and management of biological diversity in Malaysia. NPBD emphasize on the conservation of Malaysia's biological diversity by assure the utilization of the components are in sustainable approach for the prolonged consumption of next generation and socio-economic expansion in this nation. Sustaining biological diversity gives significant impact on economic, technological and social for the nation. Failure to protect biological diversity would induce to extinction of species and turmoil environment equilibrium. This policy highlighted biological diversity as the main component to grasp the sustainability benefits and believe that it can give significant effects from perspective of Malaysia 'economic, food security, environmental steadiness, national biological inheritance, scientific, learning and recreational values and biosafety. There are fifteen strategies formulated to implement this policy. The 10th strategy was interesting to environmentalism because its focuses on lessening the impacts of human actions on biological diversity. Exploitation activity such as forest damage by open burning will cause increasing of carbon dioxide (CO₂) concentration in the air, which is not good to human health indirectly. The other impact of human activity is pollution of marine resources cause by hazardous and toxic waste from irresponsible manufacturing activities. This kind of activity not only destruct the environment but also diminish human' food and clean water sources.

Malaysia's effort to protect the environment continued with the establishment of the National Policy on Environment (NPE) in year 2002. This policy was set up to facilitate Malaysia' society with a quality life and ensure the development of economic, social and cultural as a result of benefiting environment in sustainable manner. Quality of life not only can be obtained by providing Malaysian society with hygienic and safe environment but take into account the need of protecting unique cultural and nature inheritance of the nation. Active involvement from all sectors of the community is crucial to make it succeed. This policy stress that environment must be operating in sustainable manner and human lifestyle and pattern nowadays should reflects future generation needs. The NPE proposed eight principles to in promoting environmental concerns. The first principle stated that the NPE constantly become the sentinel of environment from being annihilated. The NPE also deal with the maintenance of nature's vitality and diversity for future generation and always searching for development in upgrading quality of the environment. Other than that, the NPE suggested that natural resources need to be utilized in a sustainable mode by integrating all decision making related to environment issues and subject. Besides that, this policy puts emphasis on participation of private and international community in giving commitment and accountability towards environment. This policy has also introduced Malaysia with green strategy by integrating environmental deliberation into development activities and decision making process to promote long term economic and human development while conserve the environment. The policy seeks opportunity to build up a wide foundation regarding environmental concern by allowing participation of all sectors of society to support its objectives and further planning. The green strategy uses a broad-based strategic approach to support environmental consistency through various subjects such as research and development (R&D), economy efficiency, social equity, responsibility and accountability. Assimilation of environment issues and development into educational activities from school to tertiary institutions are example of the strategy. Green strategy also involve with the management of natural resources effectively through frequent updated national record

and environment auditing. Encourage the application of cleaner and alternative fossil fuels are also the strategy. Green strategy in the NEP also put forward prevention and management of pollution and environmental degradation from the industrial activities, which aim results are in operations, and manufactured goods that have lesser environmental impacts.

National Physical Plan (NPP) 2005 is one of the other Malaysia strategies that is focused on environment reinforcement. The NPP uses a unique plan because it engages the application of Geographical Information System (GIS) in preparing and assessing alternative strategies. The plan has been approved by the National Physical Planning Council (NPPC) for evaluation to ensure the need to execute the policies and accomplish the goal of the plan. These policies integrated with sustainable land use planning by supervise sensitive areas, maintain water resources, and conserve prime agricultural areas. The NPP protect environment by focusing on prevention of natural exploitation, which refer to mangroves, forests and peat lands mistreatment and conversion. The planning covered three levels of the national development planning structure, which comprise the national, regional/states and local planning. Each level are incorporated and coordinated as a collectively system with the same objective in order to achieve the Vision of 2020. The Second National Physical Plan (NPP2) is the extension of NPP1. NPP 2 formulates four environment related policies to reduce impact of climate change through facilitated sustainable utilization and supervision of nation's resources. NPP no.22 is the policy which was established to make sure sustainable development in this nation by integrating the environmental sensitive area (ESA) in the planning and organization of land utilization and natural resources. While, NPP no.23 suggested that environmentally sensitive area network can strengthen with the establishment of central forest spine (CFS) as backbone. In addition, NPP no.24 proposes the utilization in a sustainable way of sensitive coastal and marine area. Last but not least, NPP no.25 put forward the planning strategy should take account of alleviation contrary to the impact of climate change.

Climate change is one of the major environment issues facing the earth. This topic is of concern to Malaysia as well. It is believed that climate change is a product of human exploitation of nature and other destructive natural processes. The National Policy on augment Climate Change (NPCC) was created in year 2009 with an aim to bring down climate changes through prudent resources supervision and improved environmental protection resulting in strengthen trade and industry rivalry and improved quality of life. NPCC formulated under the Ministry of Natural Resources and Environment Malaysia (MNRE) and comes with five main principles and ten strategic thrusts to help reducing climate change impacts. NPCC tackled climate change and reduce greenhouse gas emissions (GHG) is through two methodologies namely adaptation and mitigation. Adaptation approaches exemplifies the actions taken to help society and environment manage with real or expected effect of climate change. While mitigation approach refers to activities taken to trim down greenhouse gas emissions that causes global warming and enhance carbon sinks to lower the impacts of climate change. In addressing climate change, particularly its impacts on humans, both adaptation and mitigation should be implemented in an integrated and balanced manner.

Besides that, Malaysia acknowledges that environment sustainability is influenced by technology infusion. It cannot be denied that technology is invented as tools to enhance human life. However, the application of technology in exploring the nature will produce by product such as waste disposal and pollution. For that reasons, National Green Technology Policy (NGT) has been invented in 2009 to solve related problems and simultaneously try to find resolution to manage with declining on natural resources, climate change, power sources and food security. Green technology demonstrated as development and application, tools and systems that help to conserve environment and nature resources while curtail adverse impact of human activities. NGT Thrust no.2 is established to providing encouraging environment for green technology development is crucial whereas no.5 proposes the need of campaign and public consciousness towards the environment. These two strategic trusts in NGT are instance of Malaysia clear visualization on green environment. There are four pillars emphasized in NGT, specifically with regards to efficient energy utilization, reduction of environmental impact, application of technology that boost the national economic and upgrading the quality of life of human being.

Furthermore, implementing sustainable development of environment has been highlighted in The Third National Agricultural Policy. The NAP 3 encourages environmental exercise in agricultural and forestry sectors in order to lessen the bad impact on environment. Great technologies and innovations will be emphasized in this strategy. However, in The Tenth Malaysia Plan environment protection was underline Chapter 6. The 10th MP provide environment protect provision by creating an environment that can enhances quality of life. To achieve this plan, strategic plan on environment protection was planned. In this policy, indirectly quality life of community will be improved through prevention of from climate change risk and reduction of carbon footprint. Besides that, establishing incentive to attract investor to invest in energy resources development and sustain the utilization of natural resources becomes the strategy shielding the environment exploitation. Moreover, to put great effort on environment sustainability, plan to improve waste disposal management and air quality is emphasized under 10th MP. Table1.3 below shows a list of Malaysia policy that relevant to environment safety as discussed previously.

Table 1.3 : Summary of Malaysia Key Policies - Related to Environment

Year	Type of policy
1998	The National Policy on Biological Diversity (NPBD)
2002	The National Policy on Environment (NPE)
2005	The National Physical Plan (NPP)
2009	The National Policy on Climate Change (NPCC)
2009	The National Green Technology Policy (NGT)
1998-2010	The Third National Agricultural Policy (NAP 3)
2011-2015	The Tenth Malaysia Plan (RMK10)

Source: Compiled by the author (2013)

Table 1.4 below shows several law and regulation covered on environment protection around Malaysia. These act, enactment and ordinance have been adopted with selective environment related policy to empower the policy strategy.

Table 1.4 : Summary of Partial Law and Regulation around Malaysia- Related to Environment Protection

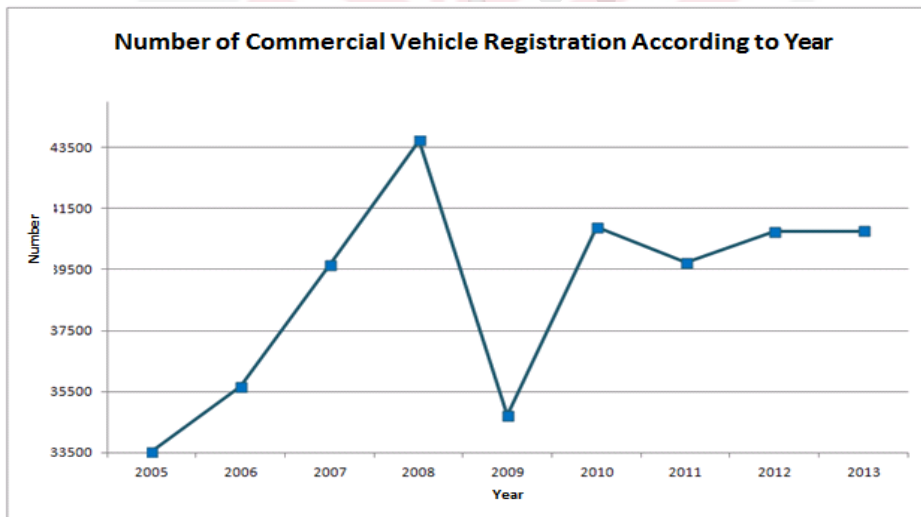
Level	Type of Act
Federal	Land Conservation Act 1960 Radioactive Substance Act 1968 Protection of Wildlife Act 1972 Environmental Quality Act 1974 Pesticides Act 1974 Town and Country Planning Act 1976 Plant Quarantine Act 1976 Local Government Act 1979 National Park Act 1980 National Forestry Act 1984 Fisheries Act 1985 Sewerage Services Act 1993 Merchant Shipping (Oil Pollution) Act 1994
Peninsular Malaysia	Taman Negara (Kelantan) Enactment 1938 Taman Negara (Pahang) Enactment 1939 Taman Negara (Terengganu) Enactment 1939 Aboriginal Peoples Act 1954 Land Conservation Act 1960 National Land Code 1965 Protection of Wildlife Act 1972 Waters Act 1920 (Revised) Act 1979 National Parks Act 1980 National Forestry Act 1984
Sabah	Fauna Conservation Ordinance 1963 Forest Enactment 1968 Parks Enactment 1984 Sabah Biodiversity Enactment 2000
Sarawak	Forests Ordinance 1954 National Parks Ordinance 1956 Wildlife Protection Ordinance 1958 Natural Resources Ordinance 1949 as amended by Natural Resources and Environment (Amendment) Ordinance 1993

Public Parks and Greens Ordinance 1993
Water Ordinance 1994
Sarawak Biodiversity Centre Ordinance 1997

Source: Compiled by the author (2013)

1.5 Overview of Malaysia Logistics Industry

Logistics is assumed a very well-known role as it provides the backbone to assist international business. Logistics value chain engages incorporation of diverse service providers for instance transportation, delivery, distribution, freight, and subsidiary services. In Malaysia, the development of logistics focuses on the outsourcing of logistics activities and expansion of 3rd Party Logistics (3PL). Sohail *et al.* (2006) indicated that about 67.7% of firms in Malaysia used 3PL services since its profits the former by improving the effectiveness of human resources operation and provide greater delivery and handling of consignment. Figure 1.7 shows a line chart of number of commercial vehicle registration from year 2005 until 2013. This figure shows that there is increasing number of commercial vehicle registration from year 2005 until 2008. However, there is a drastic recession on year 2009 and the number of registration start to increase back from year 2010 until 2013.



Source: Official Portal of Road Transport Department, Update on 13 September 2015

Figure 1.7: Line Chart of Number of Commercial Vehicle Registration According to Year

Meanwhile, Table 1.5 shows the exact number of commercial vehicle registration from year 2005 until 2011 statistically.

Table: 1.5: Statistics of Number of Commercial Vehicle Registration According to Year

Year	Total
Year 2005	33,532
Year 2006	35,677
Year 2007	39,655
Year 2008	43,733
Year 2009	34,731
Year 2010	40,887
Year 2011	39,718

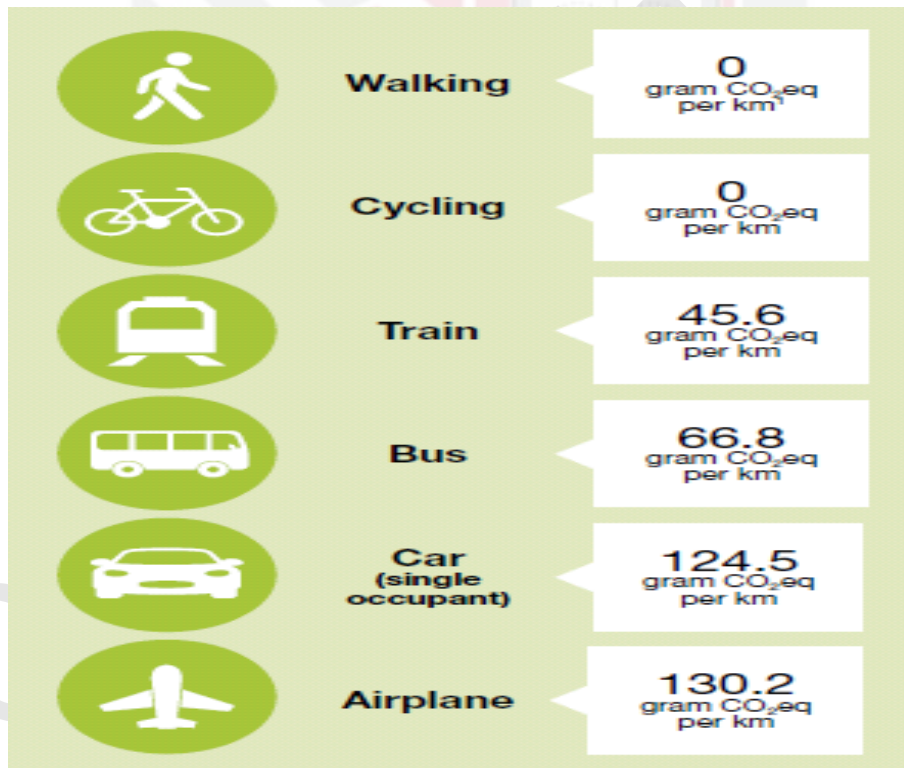
Source: Official Portal of Road Transport Department, Update on 13 September 2015

In February 2007, Malaysian government has established Malaysia Logistics Council (MLC) to give more concentration and improve on this sub-sector. MLC function is to coordinate policies, strategies, guidelines, law, and regulations for the logistics sector. Therefore, it assists the logistics industry to improve competitiveness at both the domestic and international levels. The logistics industry in Malaysia consists of four main transportation modes that are air, sea, land, and rail. According to MIDA (2008), about 12.8% of country's GDP in 2007 was generated by logistics industry which encompassed of transport, storage, and communication services. It is expected that presently, there are about 22,000 firms in the logistics industry in Malaysia established and carried out different kinds of activities. In 2008, MIDA also reported that logistics industry in Malaysia achieved an overall growth of 8.6% during the plan period of Third Industrial Malaysia Plan (3rd MP) and will contribute at least 12.1% of GDP by 2020.

In 2011, logistics industry of Malaysia estimated growth was RM117.8 billion and it was anticipated to increase about RM129.93 billion in 2012. At the same time, Malaysia external trade has also estimated to enlarge from 5.9% to RM1.42 trillion in 2012, as contrast with RM1.24 trillion in 2011. The development of the country's external trade simultaneously stimulate transportation and logistics industry growth rate. The expansion of logistics industry is also motivated by the establishment of few government initiatives and strategies such as Government Transformation Programme (GTP) and the Economic Transformation Programme (ETP) that give positive business environment. GTP and ETP are programs that introduced under Malaysia new economy model in the 10th Malaysia Plan. In year 2016, Malaysian logistics industry is predicted to grow about RM203.71 billion at a compound annual growth rate of 11.6%. As the result of this conjecture, emphasis will be put on sustainability and strength of logistics industry.

Nonetheless, in order to achieve that target, logistics industry needs to manage several sensitive issues that closely related to it. Amongst, most of logistics industry is said to be a major producer of hazardous emission to the environment. Logistics activities such as transportation and shipping are deemed to have a significant contribution to pollute air by discharge CO₂ emissions other dangerous gaseous which eventually accelerate global warming condition. According to the European Commission, in 2010, demand for goods services was 38% and for passengers was 24% which need

utilization of diverse transportation modes from logistics industry. It is also reported that about 44% of the goods and 78% of the passengers are transported using roadways modes mainly. Thus, numerous issues on environment related to logistics have escalated. Among the greatest anxiety was correlated with congestion, accidents, noise, ecological impacts, and others. In logistics industry, transportation sector is always presumed as focal sources that harmful the environment, predominantly concerning air contamination. A study by Aronsson and Brodin (2006) related to Malaysian logistics industry revealed that about 73.1% number of lorry and van have risen and significantly contributed about 98% of CO₂ and 67% of NO_x emission to the air. The amount of these two gases being emitted by the transport industry is considerably higher compared to power station and industrial. As a result, goods delivery and transportation policies need to be revised in order for every logistics player to comply with new and revised policies. Figure 1.8 displays the information on comparison of carbon footprint by few selected modes. The indicator shows that airplane is the transport that emits CO₂eq (130.2 gram) the most compared the others. The interesting part here is a car with single occupant emit about 124.5 gram CO₂eq per kilometre which the amount is not much different with the airplane although the size of the two modest is comparably different.



Note: 1 Grams of carbon dioxide equivalent per kilometer
 Source: European Energy Agency (2010)

Figure 1.8: Comparison of Carbon Footprint by Modes

Furthermore, Malaysia logistics industry performance is measured using the Logistics Performance Index (LPI) administered by World Bank. The purpose of this evaluation

is to measure the logistics gap among countries globally. Countries are arranged with an aggregate LPI score which invented of seven sub-categories assessment criteria such as the quality of customs, infrastructure and international shipments; logistics competence; tracking and tracing; domestic logistics costs and timeliness. The scorecards display comparative performance that range from 1 to 5 (lowest score to highest score). Based on the 2014 survey, Malaysia was ranked 25th worldwide with an LPI score of 3.59 which indicated that Malaysia logistics fall in medium performance. Table 1.6 shows global ranking of logistics performance index for year 2014.

Table 1.6: Global Ranking of Logistics Performance Index for Year 2014

Country	Year	LPI Rank	LPI Score	Country	Year	LPI Rank	LPI Score
Germany	2014	1	4.12	Bosnia and Herzegovina	2014	81	2.75
Netherlands	2014	2	4.05	Maldives	2014	82	2.75
Belgium	2014	3	4.04	Cambodia	2014	83	2.74
United Kingdom	2014	4	4.01	São Tomé and Príncipe	2014	84	2.73
Singapore	2014	5	4	Lebanon	2014	85	2.73
Sweden	2014	6	3.96	Ecuador	2014	86	2.71
Norway	2014	7	3.96	Costa Rica	2014	87	2.7
Luxembourg	2014	8	3.95	Kazakhstan	2014	88	2.7
United States	2014	9	3.92	Sri Lanka	2014	89	2.7
Japan	2014	10	3.91	Russian Federation	2014	90	2.69
Ireland	2014	11	3.87	Uruguay	2014	91	2.68
Canada	2014	12	3.86	Armenia	2014	92	2.67
France	2014	13	3.85	Namibia	2014	93	2.66
Switzerland	2014	14	3.84	Moldova	2014	94	2.65
Hong Kong, China	2014	15	3.83	Nicaragua	2014	95	2.65
Australia	2014	16	3.81	Algeria	2014	96	2.65
Denmark	2014	17	3.78	Colombia	2014	97	2.64
Spain	2014	18	3.72	Burkina Faso	2014	98	2.64
Taiwan	2014	19	3.72	Belarus	2014	99	2.64
Italy	2014	20	3.69	Ghana	2014	100	2.63
Korea, Rep.	2014	21	3.67	Senegal	2014	101	2.62
Austria	2014	22	3.65	Liberia	2014	102	2.62
New Zealand	2014	23	3.64	Honduras	2014	103	2.61
Finland	2014	24	3.62	Ethiopia	2014	104	2.59
Malaysia	2014	25	3.59	Nepal	2014	105	2.59
Portugal	2014	26	3.56	Solomon Islands	2014	106	2.59
United Arab Emirates	2014	27	3.54	Burundi	2014	107	2.57
China	2014	28	3.53	Bangladesh	2014	108	2.56

Qatar	2014	29	3.52	Benin	2014	109	2.56
Turkey	2014	30	3.5	Tunisia	2014	110	2.55
Poland	2014	31	3.49	Fiji	2014	111	2.55
Czech Republic	2014	32	3.49	Angola	2014	112	2.54
Hungary	2014	33	3.46	Chad	2014	113	2.53
South Africa	2014	34	3.43	Tajikistan	2014	114	2.53
Thailand	2014	35	3.43	Mauritius	2014	115	2.51
Latvia	2014	36	3.4	Georgia	2014	116	2.51
Iceland	2014	37	3.39	Macedonia, FYR	2014	117	2.5
Slovenia	2014	38	3.38	Libya	2014	118	2.5
Estonia	2014	39	3.35	Mali	2014	119	2.5
Romania	2014	40	3.26	Botswana	2014	120	2.49
Israel	2014	41	3.26	Bolivia	2014	121	2.48
Chile	2014	42	3.26	Guinea	2014	122	2.46
Slovak Republic	2014	43	3.25	Zambia	2014	123	2.46
Greece	2014	44	3.2	Guyana	2014	124	2.46
Panama	2014	45	3.19	Azerbaijan	2014	125	2.45
Lithuania	2014	46	3.18	Papua New Guinea	2014	126	2.43
Bulgaria	2014	47	3.16	Guinea-Bissau	2014	127	2.43
Vietnam	2014	48	3.15	Comoros	2014	128	2.4
Saudi Arabia	2014	49	3.15	Uzbekistan	2014	129	2.39
Mexico	2014	50	3.13	Niger	2014	130	2.39
Malta	2014	51	3.11	Lao PDR	2014	131	2.39
Bahrain	2014	52	3.08	Madagascar	2014	132	2.38
Indonesia	2014	53	3.08	Lesotho	2014	133	2.37
India	2014	54	3.08	C.A.R.	2014	134	2.36
Croatia	2014	55	3.05	Mongolia	2014	135	2.36
Kuwait	2014	56	3.01	Equatorial Guinea	2014	136	2.35
Philippines	2014	57	3	Zimbabwe	2014	137	2.34
Cyprus	2014	58	3	Tanzania	2014	138	2.33
Oman	2014	59	3	Togo	2014	139	2.32
Argentina	2014	60	2.99	Turkmenistan	2014	140	2.3
Ukraine	2014	61	2.98	Iraq	2014	141	2.3
Egypt, Arab Rep.	2014	62	2.97	Cameroon	2014	142	2.3
Serbia	2014	63	2.96	Bhutan	2014	143	2.29
El Salvador	2014	64	2.96	Haiti	2014	144	2.27
Brazil	2014	65	2.94	Myanmar	2014	145	2.25
Bahamas, The	2014	66	2.91	Gambia, The	2014	146	2.25
Montenegro	2014	67	2.88	Mozambique	2014	147	2.23
Jordan	2014	68	2.87	Mauritania	2014	148	2.23
Dominican	2014	69	2.86	Kyrgyz	2014	149	2.21

Republic Jamaica	2014	70	2.84	Republic Gabon	2014	150	2.2
Peru	2014	71	2.84	Yemen, Rep.	2014	151	2.18
Pakistan	2014	72	2.83	Cuba	2014	152	2.18
Malawi	2014	73	2.81	Sudan	2014	153	2.16
Kenya	2014	74	2.81	Djibouti	2014	154	2.15
Nigeria	2014	75	2.81	Syrian Arab Republic	2014	155	2.09
Venezuela, RB	2014	76	2.81	Eritrea	2014	156	2.08
Guatemala	2014	77	2.8	Congo, Rep.	2014	157	2.08
Paraguay	2014	78	2.78	Afghanistan	2014	158	2.07
Cote d'Ivoire	2014	79	2.76	Congo, Dem. Rep.	2014	159	1.88
Rwanda	2014	80	2.76	Somalia	2014	160	1.77

Note : LPI = Logistics Performance Index

Source : World Bank (2015)

Table 1.7 shows Malaysia logistics performance form year 2010 until 2014. The statistics indicated that there is an increase in performance especially in the last two years (from 2012 - 2014) as the Malaysian ranking in year 2012 was at 29th which has shifted to the 25th place worldwide. Meanwhile Table 1.8 shows the component of Malaysia Logistics Performance Index from Year 2007-2014 from rank perspective and its score.

Table 1.7: Malaysia Logistics Performance Index from Year 2007-2014

Year	LPI Rank	LPI Score
2014	25	3.59
2012	29	3.49
2010	29	3.49
2007	27	3.48

Note: LPI = Logistics Performance Index

Source: World Bank (2015)

Table 1.8: Component of Malaysia Logistics Performance Index from Year 2007-2014

Year	Customs (Rank)	Customs (Score)	Infrastructure (Rank)	Infrastructure (Score)	International shipments (Score)	International shipments (Rank)	Logistics competence (Rank)	Logistics competence (Score)	Tracking & tracing (Rank)	Tracking & tracing (Score)	Timeliness (Rank)	Timeliness (Score)
2014	27	3.37	26	3.56	10	3.64	32	3.470	23	3.58	31	3.92
2012	29	3.28	27	3.43	26	3.40	30	3.450	28	3.54	28	3.86
2010	36	3.11	28	3.50	13	3.50	31	3.340	41	3.32	37	3.86
2007	23	3.36	28	3.33	26	3.36	26	3.400	28	3.51	26	3.95

Note : LPI = Logistics Performance Index

Source : World Bank (2015)

1.6 Problem Statement

Research shows that increasing human population has led to an increase in productivity of food products. Food is important because it is one of the basic needs for human. The growing demand of food products has forced manufacturers to increase their production scale. From Malaysian food industry perspective; the industry has grown significantly in the past two decades and is essential to the Malaysia's economy. It contributes greatly to Malaysian trade and is vital for Malaysia's development because of its dynamic internal and external environments. For instance, in year 2013, Malaysia produced about RM14.2 billion food products and exported it to more than 200 countries worldwide (Malaysian Investment Development Authority, (MIDA), 2014). In the time of Malaysian food industry development, debate about food miles arises when new agriculturists from different points of view start questioning the sustainability of food supply chain. A sample of studies taken up in the United States estimated that processed food in the country travels over 1,300 miles, and fresh produce travels over 1,500 miles before being consumed. It is deemed that food that travels over long distances especially imported food use up tremendous amount of fossil fuels and results in an enormous amount of greenhouse gas (GHG) emissions along the way. General studies showed the transportation of food accounts for approximately 11% of global food system GHG emissions. The debate about food miles and CO₂ emissions is increasing mainly in the developed world markets, being linked to both climate change and sustainability of the food production and distribution systems. It is believed that as the food system becomes increasingly globalized, the food logistics activities are also rapidly expanding.

The role of logistics is crucial in order to deliver food products at the right manner so the food can be delivered at good condition, right time to prevent the food from perishable stage and profitable for both consumers and manufacturers. Rising in food production automatically stimulates the development of logistics activities. Business activities in food industry such as exporting and importing can come with a high price; whereas some of environmental activist assumed it as environmentally destructive, harm regional economies, and hinder many aspects of communities such as induced noise and rise accidental rate. As the results, food processing and manufacturing operations have been accused as one of major contributors that disrupting environment sustainability. Moreover, increasing waste generation represents another challenge for expansion of the Malaysian food industry and its logistics. Food packaging is closely related with this industry and needs extensive systematic waste management. Although waste generation and composition in Malaysia are currently typical of a country at its level of income and urbanization, the quantity of waste generated keeps growing along with the constraints cities face to handle it. The problem becomes critical when the nationwide cycle of landfills reaches capacity with limited room for expansion. Malaysia needs to enforce a landfill strategy using regulatory framework for operating landfills and seek economies of scale by reducing the total number of landfills through consolidation. Malaysia also needs to focus on waste prevention and minimization. Composting packaging, where possible, is another way of reducing the environmental effects of food. This reduces the amount of waste that needs to be taken to the landfill sites and again helps to cut pollution.

Beyond all of allegation towards food industry, concern for environmental issues has entered the agenda in many companies within the manufacturing industry. The food services, food retail industries and food manufacturing industries have tendencies to expose this pressure since these industries represent the active component of industrial systems. Besides that, the pressure also comes from customers, regulators, and suppliers. This has made “green” as a strategic tool for increased competitiveness. Within all aspects of a business food products trading, the supply chain of food manufacturing industries represent the major area for improvement on the environment. Hence, in order to reduce the environmental impact of logistics activities, green logistics practices merge as one of the most excellent solutions that best suited with the current situation.

The application of green practices in logistics activities scientifically can improve the environment sustainability of logistics mainly in food-based manufacturing industry. Green logistics practices are aimed to reduce industry GHG emissions, which focused on clean energy and enhanced energy efficiency as well as transforming food manufacturing industry transportation, warehousing, material handling, reverse logistics and other component of logistics activities. Green logistics practices are very beneficial to its practitioner. However, some companies are still reluctant to practice green logistics. All these become the challenges in implementing green logistics practices. Different priority and perception among the companies is one of the contribution factors for company not concern about environmental friendly logistics practices. In terms of management, lack of customer support becomes one of the barriers why company did not struggle on practicing green logistics practices. Another constraint that prevents company from practicing green in their logistical operation is companies are facing with financial resources problem and lack of funds for training. Besides that, lack of awareness in environmental regulations has become a major challenge to the implementation of green logistics practices. In terms of infrastructure, it was found that most of company is still under development of recycling technologies which significantly prevent then to apply green practices in reverse logistics activities.

In other developed countries, green logistics practices has become a part of important agendas and policies in most logistics related company. There are many new invention, research and development being conduct in those countries. However, in contrast, study on green logistics practices are little, smidgen and seldom to be discussed in Malaysia. There is still lack of report regarding green logistics practices mainly in the Malaysian logistics industry. Therefore, this study has been conducted to take a closer look at this issue. This study will see further from the company’s strategy and effort in greening their logistics activities, and aspects that can affect the company’s contribution for better environment.

1.7 Research Questions

Three main research questions need to be answered in this study. The research questions are as follows: -

1. How green are the logistics activities being practiced by Malaysian food-based manufacturers?
2. What kind of factors motivate the green logistics practices in the Malaysian food-based industry? What are the benefits they perceive from green logistics practices?
3. How strong are the motivation and benefit factors associated with Malaysian food-based manufacturers green logistics practices level?

1.8 Objectives of the Study

The general objective of this study is to investigate green logistics practices in food-based manufacturing industry in Malaysia. The specific objectives are:-

1. To determine the level of green logistics practiced by the Malaysian food-based manufacturers.
2. To identify factors that motivate manufacturers for practicing green in their logistics and reveal the benefits they have perceived.
3. To examine the relationship between motivation and benefit factors and the green logistics practices level.

1.9 Significance of the Study

This study is important because it can provide new knowledge mainly in logistics industry. The information on current green logistics practices may lead to increase further study of green practices in food-based industry. Besides that, this study also can contribute understanding of Malaysian food-based manufacturers towards the application of green logistics and identify the benefits and barriers that affect the application level of green logistics activities. The findings from this study can be used by various ministries such as Ministry of Transportation, and Ministry of Human Resource and Environment, and Ministry of Agriculture and Agro-based Industry to improve and set up new policies related to the logistics in the future.

1.10 Organization of the Thesis

The thesis consists of five chapters. The first chapter reveals about background of Malaysia itself in terms of national policy, current situation in agriculture sector and move forward to Malaysia food-based manufacturing trend and development. Besides that, the first chapter also discusses about environmental issues facing by Malaysia today including factors as well as the impact. Next, the first chapter overviews the

trend of Malaysian logistics industry movement and achievements. This first chapter also describes hypotheses, objectives and problem statement as well as significance of this study at the final part of the chapter.

Meanwhile, the second chapter emphasizes on previous literature on green logistics practices, supply chain management, logistics, and environment. Besides that, this chapter also discloses past studies related to green logistics practices including the concept, scheme, motivation, benefits and challenges.

The third chapter of this thesis discusses on the selection of green logistics practices for this study. In addition, methodology section also explain well in this chapter which comprise data collection method, source of data, sampling frame, research instrument, pilot study and types of analysis that are implemented in the study. There are four types of analysis used in this study that are descriptive analysis, green manual analysis, factor analysis, and multi regression analysis.

Next, the fourth chapter explains on the findings in study. The first findings reveal about descriptive analysis results which show the profile of manufacturers. While, the second findings expose the result of green manual analysis which shows the level of green being practiced by the manufacturers and the third finding is related to the factors that influence green logistics practices. The last finding in this chapter shows the relationships between identified influential factors (motivation and benefits factors) and green logistics practices level.

Finally, the fifth chapter of the thesis discusses about recommendation on policy and future research to improve the green logistics practices mainly among Malaysian food-based manufacturers. This chapter also reveals the limitation while conducting this study and the overall conclusions.

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