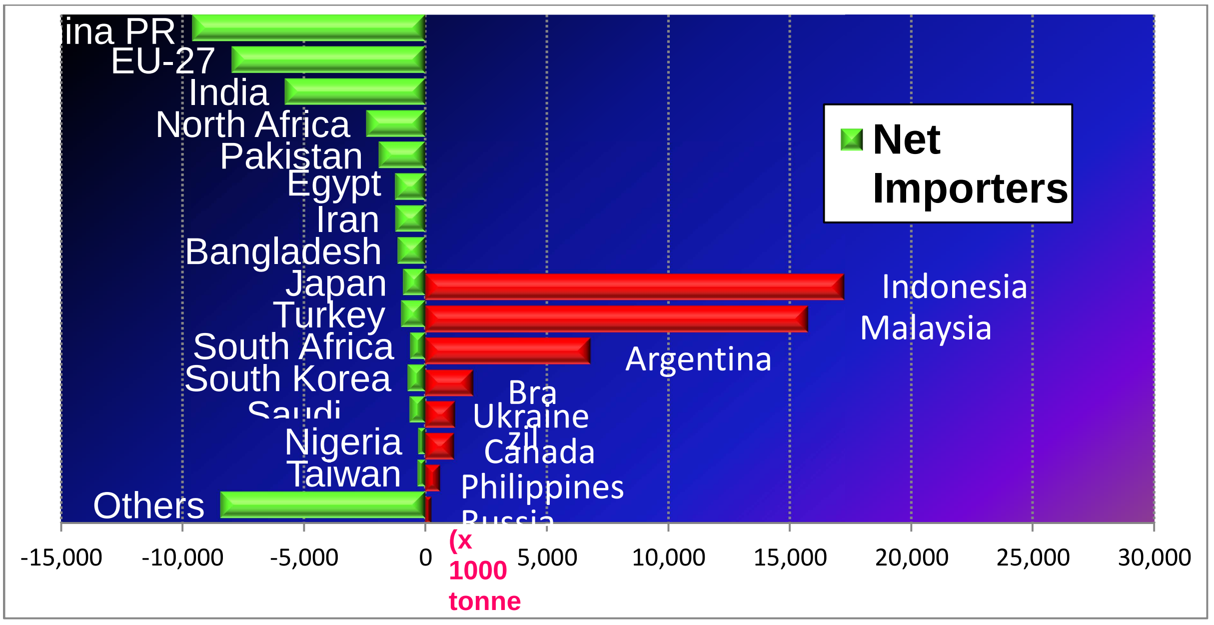
CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

As the discussion in Chapter 1 shows, palm oil is an agricultural crop of great economic importance, and the industry stakeholders have taken numerous measures to make the produce sustainable. However, the consumers and the media have challenged the acceptability of the oil palm plantation industry's sustainability claims and of its products as well.



Source: Oil World, 2012

Figure 2.1 Palm Oil Exporters and Importers World Wide

However, with food price inflation escalating, all necessary action is needed to keep global food production costs low. It is noteworthy that palm oil is one of the cheapest forms of edible oil. Many countries have become net importers of oils and fats (***Figure***

2.1), while Malaysia and Indonesia are net exporters, and can provide a much-needed solution for keeping food prices low by increasing the yield of oil palm.

Sustainability in agricultural practices is no more an option because the growing billions of the Earth's population need to be fed by means of a productive agricultural sector. Furthermore, the increasingly degraded environment needs to be protected and restored in order to ease the pressure on the Earth's natural resources. For sustainability to be achieved, however, a holistic approach must be taken towards all aspects of agriculture. Therefore, sustainability practices need to prevail in the market sector as well. This means that the sustainability approach needs the support of all the market players in the supply chain, instead of the current focus on the growers/producers.

An important vehicle in this regard is the multi-stakeholder RSPO. Now running into its sixth year of operation, it has achieved some success in certifying plantations and mills. However, the next few years of its operation and progress towards the milestones it has set will show whether it is indeed the way forward towards sustainable agriculture. However, even if the RSPO fails it should not mean that sustainability in the sector cannot be achieved. Other efforts by the industry, such as the Malaysian Palm certification scheme and ISPO should be given encouragement and support. Similar efforts should be promoted in the rest of the oil palm world (Yew et al., 2010).

Even though efforts to achieve sustainability in the palm oil industry have been going on since the mid- 2000s, and significant progress was made with the formation of RSPO in 2004 (RSPO, 2012), these efforts to introduce sustainability are not accepted by all parties. From the oil palm growers' viewpoint, the RSPO has failed the oil palm growers. This was evident when the Indonesian growers groups quit the RSPO in late

2011. Also, the palm oil market has not endorsed the RSPO's certification scheme, as seen by the fact that until late 2012, 4.78 million tonnes of RSPO-certified oil remained unsold in the market (MPOC, 2012).

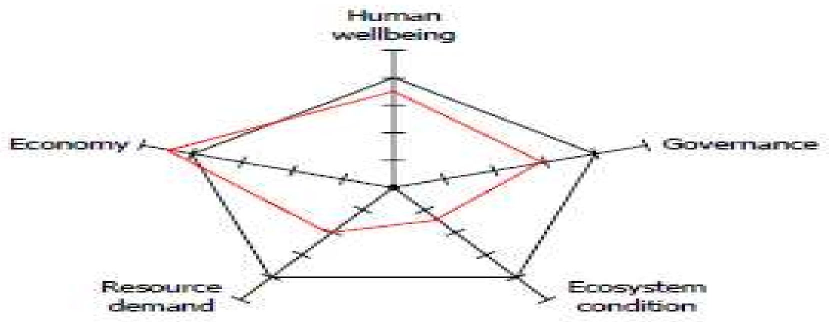
2.2 Study Statement

This study looks at the possibility that the palm oil sector can operate under sustainable conditions. It hopes to state that:

"The oil palm sector can improve its credentials by managing all aspects of the industry more sustainably. This will help the global market accept this edible oil as sustainable."

A balanced society is depicted in Prescott-Allen's model as one where social and economic conditions are optimised through good governance, the promotion of human wellbeing and the sound management of resource demands (Prescott-Allen, 2006). As depicted in ***Figure 2.2***, such a balanced society draws a wider rim around these parameters of sustainability. This wider rim involves the farmers/growers in regional programmes for water management, watershed conservation, rebuilding soil quality, ecosystem restoration, and reforestation. Thus, all activities, including agriculture, need to be considered in the whole human paradigm of sustainable management, and should contribute to human progress.

The Prescott Allen's Model (***Figure 2.2***): The figure shows the performance scores of a hypothetical country: human wellbeing 68, economy 88, governance 59, resource demand 40, and ecosystem condition 28 (Allen, 2006).



Sourc: Prescott Allen, 2006

Figure 2.2: Graphic combination of 5 pillars of a balanced society

2.3 Review of Literature and Its Dissections

A compilation 171 articles have been referred and for the purpose of review some of the latest publications, the current situation in the palm oil market and its efforts to meet sustainability criteria, the relevance of this market to the agricultural sector and growth prospects of sustainable agriculture are examined.

The review was carried out thematically, and the first task was to group the articles into categories, so as to arrive at a clear synthesis of the current state of sustainability. The thematic synthesis is listed below:

i. The Environment and the Oil Palm Industry
ii. Agricultural Management and Requirements
iii. The Sustainability of Palm Oil and Its Products
iv. Palm Oil as a Biofuel and Biodiesel
v. Managing the Greenhouse Gases from the Palm Oil Industry
vi. The Palm Oil Industry and The Carbon Market
vii. Food, Fats and Oils
viii. Social Well Being and The Economy
ix. Perception, a New Management Tool

2.4 Literature Summary, Analysis and Key Ideas

The literature review for this study looks into the relevance of the literature to the area of research: the relevance of the publication's topic to the research subject, the issues raised in the publication and whether the literature being reviewed is among the relevant and significant research works on the subject. Here information from distinguished academic and non-academic sources of information is discussed. A summary the studies reviewed, the key ideas presented in the studies and scope of the review, including relevant theories, concepts, definitions and conceptual ideas, are laid out. Key issues from a variety of sources are highlighted.

2.5 Environment and the Oil Palm Industry

The environmental issues pertaining to the oil palm industry are:

- Biodiversity and the High Conservation Value Concept
- Peat and Soil Management
- Greenhouse Gases (GHG) and Climate Change

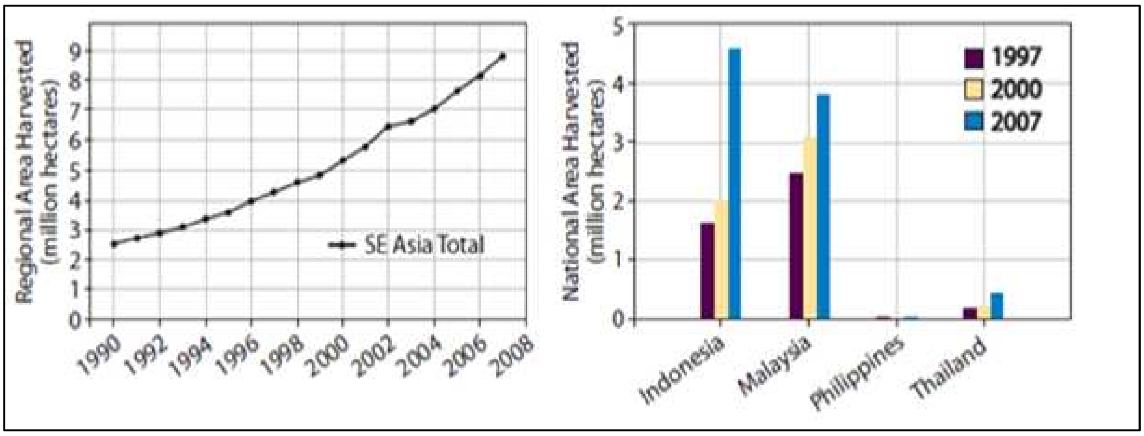
2.5.1 Biodiversity and the High Conservation Value (HCV) Concept

Palm oil production has been documented as a cause of substantial and often irreversible damage to the natural environment. Its impacts include deforestation and habitat loss of critically endangered species such as the Orang Utan and Sumatran Tiger. Furthermore, not only is Southeast Asia's annual deforestation rate the highest in the tropics, but it was reported to have also increased between the periods 1990–2000 and

2000–2005. This could result in projected losses of 13–85% of biodiversity in the region by 2100. Secondary habitat restoration, at least in certain countries, would allow for some amelioration of biodiversity loss and thus potentially lower the currently predicted extinction rates. Nonetheless, urgent conservation actions are needed. Conservation initiatives should include public education, sustaining livelihoods, and introducing measures to enhance the sustainability of agriculture and increase the capacity of oil palm plantations (Sodhi et al., 2008).

An ecosystem-based spatial planning programme was carried out for Sumatra and Borneo covering the distribution of Sumatran tigers, Sumatran elephants, Sumatran rhinos, Sumatran orang-utans, Sumatran peat lands, important bird areas, key biodiversity areas and Sumatran forest coverage for the year 2007. The data for all the above natural assets have been overlapped since all of them have equally important values. This information will help to identify sensitive areas to conduct HCV assessment in forest concession units (Hermein & Sulistywan, 2010).

In the study by Sodhi, the median effect size for pristine areas was found to be 22.2 per cent higher in ecological health than equivalent disturbed areas. The most responsive measure of ecological health is species richness (median = 28.6% higher in pristine areas), whereas agricultural areas were the most ecologically degraded (median = 35.6% higher in pristine areas). However, the study revealed no marked differences overall between taxonomic groups, habitat impact types, or ecological health measures, which implies that the sensitivity of biodiversity to forest disturbance is moderately high. However, the findings suggest the need for urgent forest conservation actions (Sodhi et al. 2009).



Source: FAO, 2011 ***(Note: oil palm trees take several years to grow to harvestable size, so these data lag three or four years behind for area planted and even further behind for area cleared for plantations.)***

Figure 2.3 Rapid Growth in Area Harvested for Palm Oil, 1990-2007

2.5.2 Peat and Soil Management

Peat swamp forests are significant for their capacity as carbon stores and sinks. They are among the few ecosystems which, in their natural state, accumulate carbon. If peat lands are maintained in their natural state, CO_2 is incorporated as organic carbon in dead organic matter and stored in the peat, moderating greenhouse gas emissions. When disturbed either by drainage and burning or both, carbon is released into the atmosphere, contributing to the greenhouse effect and climate change. Peat swamp forests also play important functional roles in the regulation of water resources. Such functions as flood control, flow regulation, water supply and prevention of saline water intrusion are crucial to maintain the integrity of downstream ecosystems and to prevent economic losses to agriculture and industry.

Of the 2 million ha of peatland in Malaysia, 1.2 million ha occur in Sarawak, 600,000 ha in Peninsular Malaysia and 170,000 ha in Sabah. It is estimated that 50% of peatland is still under some form of forest cover. Around 25 % of the total area of peatland in

Malaysia has already been drained for large scale oil palm plantations and timber concessions and there is great concern that the projected increased demand for oil palm as a component of biofuel will lead to the acceleration of drainage and degradation of intact peatland areas (***Figure 2.3 and Table 2.1***).

Table 2.1: Basic data for PEAT-CO2 calculations, including the rate of deforestation in lowland peatlands.

Basic data for PEAT-CO2 SE Asia calculations	Total Area	Lowland peat area	Peatland % of total area	Total forest cover 1985	2000	Forest loss 1985-2000	Lowland peatland forest cover 1985	2000	Forest loss 1985-2000
	ESRI km2	WI+FAO km²	%	GFW %	GLC2000 %	%/y	GFW %	GLC2000 %	%/y
Indonesia	1919317	225234	12	67	59	-0.7	81	61	-1.3
Kalimantan	531506	58379	11	72	57	-1.2	87	58	-1.9
Central Kalimantan	154829	30951	20	69	63	-0.6	90	57	-2.2
East Kalimantan	193351	6655	3	88	65	-1.9	85	44	-2.8
West Kalimantan	147527	17569	12	61	50	-0.9	92	74	-1.2
South Kalimantan	35799	3204	9	45	26	-1.5	41	17	-1.6
Sumatra	464301	69317	15	52	40	-1.0	78	52	-1.8
D.I. Aceh	56515	2613	5	71	62	-0.8	87	59	-1.8
North Sumatra	71316	3467	5	40	36	-0.4	76	36	-2.6
Riau	92141	38365	42	69	48	-1.7	87	66	-1.4
Jambi	48518	7076	15	56	44	-1.0	67	42	-1.7
South Sumatra	84198	14015	17	38	20	-1.5	66	26	-2.6
West Sumatra	41585	2096	5	68	62	-0.5	69	38	-2.1
Papua	411649	75543	18	84	80	-0.3	80	72	-0.5
Other Indonesia	511,860	21995	4					61	
Malaysia	327291	20431	6				78*	53	-1.8*
Peninsular M.	131205	5990	5				78*	37	-2.8*
Sabah	72767	1718	2				86*	43	-2.9*
Sarawak	123320	12723	10				76*	59	-1.1*
Brunei	5772	646	11				85*	84	-0.2*
Papua New Guinea	399989	25680	6				80*	61	-1.3*
SE Asia	2652370	271991	10					61	

* Estimated

Source: Aljosja, et.al, 2006.

The production of 1 tonne of palm oil on fully-drained peatland can result in CO_2 emissions of 10-30 tonnes due to peat oxidation. Thus, the demand for biofuel, the aim of which is to reduce CO_2 emissions, may actually cause substantially increased CO_2 emissions if plantations are established on peatland areas (Aljosja et al., 2006).

Most of the concern about the drainage of peatland is centred on the resultant increase in their susceptibility to fire, leading to increased CO_2 emissions. However, there are other serious consequences of peatland drainage. Peat fires are the major source of "haze" that blankets parts of Indonesia, Malaysia, Singapore and Brunei during dry spells, with serious implications for the health of their citizens and for their economies, whilst subsidence following oxidation and loss of peat can lead to serious and regular flooding in such areas (***Figure 2.4)***.

The Indonesian peat forest fires during 1997/98 were estimated to cover an area of 1.8 – 2.2 million ha and have been estimated to have released between 3,000 and 9,400 mega-tonnes (Mt) of CO_2 (Harrison et al., 2009), which is equivalent to 13-40 % of mean annual global CO_2 emissions. This enormous release of CO_2 resulted in the largest annual increase in atmospheric CO_2 concentrations since records began in 1957.

Source: Wetlands International, 2006

Figure 2.4: Forest Land Cover in South-east Asia

2.5.3 Greenhouse Gases (GHG) and Climate Change

Whilst fire has a dramatic and rapid effect on the amount of CO_2 released into the atmosphere, it must not be forgotten that drainage of peatland without the occurrence of fire also results in a substantial release of CO_2 into the atmosphere, albeit at a slower and less dramatic rate. The current total CO_2 emissions from peatland is 2,000 Mt per year (over 90% originating from Indonesia), which amounts to 8% of the global emissions from fossil fuel burning (Aljosja et al. ,2006). This significant source of Greenhouse Gas (GHG) emissions is not being addressed effectively at present since the Kyoto Protocol deals exclusively with GHG emissions from fossil fuel burning and not from land degradation sources.

It is estimated that the production of 1 tonne of palm oil on fully-drained peatland can result in CO_2 emissions of 10-30 tonnes due to peat oxidation. However, various values for the savings on greenhouse gas (GHG) emissions for palm oil have been reported by different researchers due to the different methodologies and approaches used in life cycle assessment. This can be seen in the values derived by Aljosja, et. al., 2006, where the differences range from 19% to as high as 80%. This has made it very difficult for international authorities/agencies drafting biofuel legislation and standards to find a consensus for a universally accepted value for greenhouse gas emission savings for palm oil and other oilseed crops. Scientists and practitioners have been at loggerheads to arrive at the best number for current practices. Overcoming the assumption barrier and oversight is vital for the future determination of values for the palm oil Industry (Yew et al., 2010).

2.6 Agricultural Management

The dramatic expansion of oil palm acreage in the tropical rainforest region poses the question: “Is oil palm the next emerging threat to the Amazon?" The Amazon Basin appears poised to experience rapid expansion of oil palm agriculture. Nearly half of Amazonia is suitable for oil palm cultivation, and Malaysian corporations are now moving into the region to establish new plantations while the Brazilian government is considering a law that would count the area cultivated with oil palm as “forest” and so contribute towards a landowner’s forest reserve requirement. Strong economic incentives for a major Amazonian oil palm industry are likely, given growing global demand for edible oils, oil-based products, and biofuel feedstocks.”, (Butler and Laurance ,2009).

The two main concerns of Butler and Laurance are, first, that oil palm plantations are ecologically depauperate, supporting little forest-dependent wildlife. Second, they disbelieve political and corporate statements suggesting that oil palm plantations will be concentrated on previously deforested lands in Amazonia. In reality, oil palm producers strongly favour clearing primary forest for plantations because they can reap immediate profits from timber production. These profits subsidise the costs of plantation establishment and maintenance for the initial 3-5 years until the oil palm plantations become profitable. Hence, oil palm agriculture could soon emerge as a major new threat to the Amazonian environment.

Variability in biodiversity retention across systems has been linked most strongly to economic function, management intensity and extent of remnant forest within the landscape, as well as more subtle cultural influences. Species richness and abundance generally decrease with increasing prevalence of crop species, more intensive management, decreasing stratum richness and shortening of cultivation cycles. Increasing holding size did not necessarily reduce α diversity. Knowledge of the general effects of small-scale agroforestry on biodiversity is substantial, but the great diversity of systems and species responses means that it is difficult to accurately predict biodiversity losses and gains at a local level. Further work is required on the influence of spatial and temporal structure of agricultural holdings on biodiversity retention across agriculture/succession/forest mosaics, how β diversity across individual holdings influences biodiversity across landscapes, and ultimately on how agricultural intensification can be best managed to minimise future losses of biodiversity from tropical landscapes (Scales and Marsden, 2008).

2.7 Sustainability of Palm Oil and Its Products

In response to the consistent calls for sustainability, the RSPO or the Roundtable on Sustainable Palm Oil was set up, adopting the Brundtland definition that "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987) as its frame of reference. The RSPO has provided a context for promoting efforts towards sustainability¸ beginning with good environmental, social and agricultural practices: where the oil palm is first planted, to the harvesting of its fruits and then through to the many life-cycle pathways till the produce reaches its final destinations - the plates of consumers or as other products.

The evaluation of sustainable palm oil practices under the RSPO framework is based on a set of standards called the Principles & Criteria (P&C) which address the legal, economic, environmental and social requirements of producing palm oil sustainably. RSPO's Principles and Criteria (P&C) for sustainable palm oil production are:

1. Commitment to transparency
2. Compliance with applicable laws and regulations
3. Commitment to long-term economic and financial viability
4. Use of appropriate best practices by growers and millers
5. Environmental responsibility and conservation of natural resources and biodiversity
6. Responsible consideration for employees and for individuals and communities affected by growers and mills
7. Responsible development of new plantings
8. Commitment to continuous improvement in key areas of activity

Similar initiatives have been in established for other sectors, and they include: Roundtable on Sustainable Biofuels; Roundtable on Sustainable Forests; Roundtable on Sustainable Development; Roundtable on Responsible Soy; Roundtable on Sustainable Cocoa Economy. The Roundtable on Sustainable Biofuels is coordinated by the Energy Center at EPFL in Lausanne. It is an international initiative that brings together farmers, companies, non-governmental organisations, experts, governments, and inter-governmental agencies concerned with ensuring the sustainability of biofuel production and processing.

The Roundtable on Sustainable Forests, an American initiative, is an open and inclusive process committed to the goal of sustainable forest management on public and private lands in the United States. This Roundtable includes public and private organisations and individuals committed to better decision-making through shared learning, increased understanding and fostering dialogue on sustainable forests. The Round Table on Sustainable Development was established in 1998 to provide an informal setting through which ministers can engage with one another and key international business and civil society leaders without prejudice to negotiating positions on cross-cutting issues.

The Round Table on Responsible Soy (RTRS) is an international platform composed of the main soy value chain stakeholders with the common objective of promoting the responsible soy production through collaboration and dialogue among the involved sectors in order to foster an economic, social and environmental sustainability. The Roundtable for a Sustainable Cocoa Economy is an initiative for dialogue and sustainability amongst all stakeholders in the cocoa economy: cocoa farmers and cooperatives, traders, exporters, processors, chocolate manufacturers, wholesalers, governmental and non-governmental organisations, financial institutions as well as donor agencies.

2.8 Palm oil as a *Biofuel and Biodiesel*

Demand for palm oil has increased in recent years due to its use as a biofuel, but recognition that this increases the environmental impact of cultivation as well as causes food versus fuel issues has forced some developed nations to reconsider their policies on biofuel to improve standards and ensure sustainability. Biodiesel made from palm oil grown on sustainable non-forest land and from established plantations effectively reduces greenhouse gas emissions. However, Greenpeace has concluded that "first generation" biodiesel extracted from new palm oil plantations may not on balance reduce emissions (Liefting, 2009). If wood from forests cleared for palm plantations is burned instead of used for biodiesel, leaving forests untouched, this may keep more carbon out of the atmosphere. (Greenpeace, 2012).

First-generation biofuels were created largely from feedstocks that had been traditionally used as food. Today's first-generation biofuels (ethanol from corn and biodiesel from vegetable oil and animal fats) have been widely criticised in the media as the culprit behind rising food prices. Although they may contribute to higher food prices, it is a very small effect, and the debate does not consider the environmental and energy security benefits of biofuels. As there are limited quantities of low-cost options for feedstocks, the first-generation biofuels have nearly reached their maximum market share in the fuels market (Biomassmagazine.com, 2012).

Currently, more than 80% of the world biodiesel production is from rapeseed oil. However, the cost of palm oil which is at least US$ 200 per tonne cheaper than rapeseed oil indicates that palm oil could be a more suitable and attractive source of biodiesel compared to other vegetable oils. Although palm oil is known to be a multi-purpose vegetable oil with uses ranging from food to biodiesel, there are a lot of issues surrounding palm oil production and its use for palm oil biofuels (Tan et al., 2009). These issues include the accounting of GHG emissions in the cultivation of oil palm, the pathways taken in the production of biofuels and the lifecycle analysis of these products.

Consistency in measuring emissions is the main area of contention. The ISO International Standards for climate change is an option that can be used as a basis for ensuring trust, integrity and effective governance and management in the quantification, measurement and verification of the greenhouse gas (GHG) mitigation efforts. ISO has provided the way forward to solve the multitude of GHG accounting issues impacting the quantification of GHG emissions measurements in various industries, including the oil palm industry (Weng et al.,2010).

The current development of green technology and its related policies have enhanced the growth of renewable energy in Malaysia. The Malaysian palm oil industry, with 4.69 million hectares of planted land, has tremendous potential to supply renewable energy in the form of biomass based bio-energy. From palm-based materials alone, Malaysia can generate up to 1,260 MW of energy. This amounts to nearly 10% of the maximum energy demand of electricity required for the country (Ng et al., 2011). Biomass from oil palm industries appears to be a very promising alternative as a source of raw materials including renewable energy in Malaysia (Shuit, et. al., 2009). For this Malaysia has positioned herself on the right path to utilise palm oil biomass as a source of renewable energy.

If palm oil can be produced without creating emissions from the disposal of milling waste, its carbon balance will become significantly better than those of the other vegetable feed-stocks. By utilising its waste products and avoiding GHG emissions, a reduction in emissions of up to 80% can be achieved, making it the feedstock with the highest capacity for GHG reduction.

Fertilisers used in planting have a significant impact on the overall emissions of rape, soy, sunflower and canola oils. The carbon balance for palm oil is much less sensitive to fertiliser use, due to its much higher oil yield per ha. Among the feed-stocks studied, palm oil has the greatest potential for further GHG emission reduction through fertiliser management and usage improvement.

It is erroneous to consider a palm oil yield of 5 tonnes per hectare in order to calculate the additional area that needs to be cultivated to meet the demand from the biofuel sector. Advancements in oil palm breeding technology have shown that a palm oil yield of 7.7 tonnes per hectare per year is now possible. The agronomic approach taken by the palm oil industry for the development of new clonal varieties and harvesting techniques have increased the economically viable lifetime of palm oil plantations and reduced the ratio of the crop's immature to harvested period by about 8.3% to 12%.

"Palm Oil Carbon Stocks" or the volume of carbon contained in oil palm areas: The EPA's estimation of palm oil's carbon stock is based on current practices. Advancements in oil palm breeding techniques, such as in the production of compact oil palm planting materials, allow for high density planting of the crop. A density of 177 palms/ha is now possible and this is 30% higher than the normal practice. In essence, the oil palm carbon stocks will also increase by 30% or more correspondingly.

2.9 Managing the Greenhouse Gases for the Palm Oil Industry

The agricultural sector, along with other economic sectors, is increasingly being required to account for its contribution to greenhouse gas (GHG) emissions, which are driving global warming and climate change. In Malaysia, the dominant presence of oil palm, which now occupies some 13 per cent of the total land area (18 per cent in the Peninsula) (Henson, 2008), has received particular attention. Henson's paper, The Carbon Cost of Palm Oil Production in Malaysia, summarises the results of a recent study, which evaluates the balance between sequestration and emission of GHG resulting from oil palm cultivation, associated land-use change, and processing of products in the palm oil mill. The study, which covers the 25 years from 1981 to 2005, quantifies the major sinks and sources of C and evaluates the C balance, using a number of alternative options and assumptions. The main results are outlined and probable future developments, likely to impact on the balance, are evaluated.

As of 2006, the cumulative land area of oil palm plantations was approximately 11,000,000 hectares (42,000 square miles) in Malaysia. In 2005, the Malaysian Palm Oil Association, responsible for about half of the world's crop, estimated that they manage about half a billion perennial carbon-sequestering palm trees (Malaysia Palm Oil Association, 2005). The minimum rate of 35% greenhouse gas savings is attributed to the crop, where the greenhouse gas savings of the biofuels are calculated through the use of LCA (Life Cycle Assessment), a technique to determine a product's environmental load, including its greenhouse gas emissions.

Ng et al. (2010) from the Malaysian Palm Oil Council have shown in" The Greenhouse Gas Savings Challenges and Potential of Malaysian Palm Oil – from a Life Cycle Assessment Perspective" – that various greenhouse gas (GHG) emission reduction savings values for palm oil have been reported by different researchers due to the different methodologies and approaches used in life cycle assessment. Such differences could be significant, ranging from 19% to as high as 80%.

In estimating the carbon footprint of biofuel production from oil palm, the methodology and results from two sites in Indonesia have shown that CO2 and other greenhouse gases can be measured, but vary in the estimated carbon emissions, as different definitions of organisational and operational boundaries are used. The different schemes of oil palm production vary from large scale company operations to cooperation between a large-scale company (nucleus) and smallholders (plasma), and independent smallholders. Consequently, these schemes in Indonesia give varying estimates (Noordwijk et al. ,2010).

The global impact of Indonesian forest fires is also apparent in (Page et al. 2009). It is estimated that Bornean peat fires alone produced an average of 74MtC per year between 2000-06, making Indonesia one of the world's largest CO2 emitters (Aljosja et al., 2006). Much evidence now indicates that the frequency and severity of peatland fires in Indonesia are increasing dramatically.

2.10 The Oil Palm Industry and the Carbon Market

The Carbon Market was set in place after the Kyoto Protocol of 1997 to curb greenhouse gases (GHGs) and so reduce their adverse climatic impacts. With carbon trading schemes in place, there now exist major policy and business tools for those who wish to offset their emissions through new ventures. These schemes allow the market mechanisms to favour low emission approaches, and also allow the purchase of carbon credits from those countries or businesses that are carbon positive, i.e. they are sequesters of carbon. There are Carbon Trade Exchanges or trading platforms for buyers and sellers to trade carbon credits. The mode of the exchange is very much dependant on the type of project or industry involved.

Oil palm trees are good sequesters of carbon and it is estimated that this industry alone covers 11 million hectares (2010) of the crop, or about half a billion perennial carbon-sequestering palm trees (Liefting, 2009). The question is whether farming schemes make attractive carbon offset projects for the Carbon Exchange. Malaysia produced 17.7 million tonnes of palm oil on 4,500,000 hectares in 2008, and can position itself as a carbon trading partner for the buying nations, with its carbon sequestering palm plantations.

In the paper "Creating incentives for the Adoption of Sustainable Agricultural Practices in Developing Countries: The Role of Soil Carbon Sequestration", Antle and Diagana (2003), state that it is important to "provide farmers in developing countries with the economic incentives needed to adopt more sustainable land use and management practices. As of the present time, the use of agricultural soil carbon sequestration has been limited under the Marrakesh Accords."

Conservation agriculture based on minimum tillage, crop residue retention, and crop rotations are "additionalities" that can be considered (Govaerts, et. al., 2009). Improving food security, environmental preservation and enhancing livelihoods are the main targets of the innovators of today's farming systems, and the sequestration capacity of farming practices and their influence on emissions from farming activities should be considered together with their influence on soil C stocks.

Australian farming initiatives are the subject of a case study that provide valuable insights into possible carbon trading systems. In Sabto and Porteous, 2011, it is stated that "*Under the new scheme, farmers will receive carbon credits, which can then be traded on the international compliance and voluntary markets, and the domestic market, depending on the nature of the rural activity. Carbon offset projects established under the CFI (in full) will need to apply government-approved methodologies - the detailed rules for implementing and monitoring specific abatement activities and generating carbon credits under the scheme.*"

Agricultural yields, biodiversity and ecosystem services trade-offs are important considerations (Wade et al. 2010): One option is to adopt high yield, intensive farming that allows land to be spared elsewhere for conservation (land sparing); another is to adopt low yield, extensive farming over a greater area that retains more biodiversity and protects ecosystem services (wildlife-friendly farming). Management of the trade-offs between agriculture, biodiversity and ecosystem services in tropical forest landscapes needs to consider current and expected future yields.

If conversion of forest is deterred, and degraded land is used for farming with the best option for yield increase, that would be a scheme that qualifies for carbon credits (Mongabay.com, 2009). "POTICO" (Palm Oil, Timber, and Carbon Offsets) integrates sustainable palm oil, FSC-certified timber, and carbon offsets in order to "divert new oil palm plantations onto degraded lands and bring the forests that were slated for conversion into certified sustainable forestry". POTICO will provide an alternative model for the oil palm industry that will enable it to truly become more sustainable.

CDM opportunities in the palm oil sector via its mill effluent are another significant aspect of the carbon market to consider (Hassan, et. al., 2008). “In view of the anaerobic digestion of palm oil mill effluent (POME) waste treatment produces biogas with 65% methane, as Malaysia is one of the largest palm oil producers in the world. It is estimated that 50 million tonnes of POME are produced annually in Malaysia.”

Managing the carbon footprint of the palm oil industry (Noordwijk et al., 2010) is another hurdle: The main challenges are: (1) the definition of forest and its institutional implications, (2) the projections that are embedded in the definition of CDM, (3) non-linear baselines related to forest transitions that complicate attribution, (4) the inherent lack of synergy with other development activities and (5) high transaction costs and the temporary nature of credits. In possible new international regimes that aim to include all relevant changes in land-use based emissions, a more outcome-based programmatic approach may partially replace the project cycle assessments of CDM.

It is worthwhile to review the various energy efficiency efforts and carbon trading potential in Malaysia, although it does not bear any international treaty obligation to reduce carbon emissions, but has ratified and lauded the cause of the protocol (Oh and Chua, 2010). Business ventures in Malaysia in biomass management can be leveraged through the CDM. The Sabah biomass project is a benchmark for Malaysia's corporate sector. Other sectors with potential to capitalise on the CDM process include palm oil, agriculture, transportation, manufacturing, oil and gas, and the wastewater sectors. (ClimateAvenue, 2011).

2.11 Food, Fats and Oils

The need for enhancing food production and availability in underprivileged regions of the world requires the attention of scientists. The article by Henning explores the possibilities for rethinking agricultural research for development in the light of new challenges characterised by a high degree of scientific uncertainty along with associated intense political differences. Without such rethinking, traditional scientific approaches and logic may limit the contribution that agricultural R&D can make toward the achievement of the Millennium Development Goals of halving extreme hunger by 2015 and improving the livelihoods of all (Henning, et al., 2010).

The world population has grown exponentially over the past two thousand years. In 2012, the world population passed the seven billion mark. Latest world population estimates indicate there will be 9 billion people by the year 2030. As the world's appetite for edible oils grows, fuelled by demand for everything from food to detergents, it is very apparent from Figure 1.3 (as previously depicted in Chapter 1), the need for edible oils will continue to increase.

Although Indonesia has diversified away from food crops, food insecurity there declined by nearly 60 per cent from 1981 to 2007, driven largely by increased food access and higher incomes. Food security is generally defined as sufficient availability of food (2,100 calories per person per day) that is readily accessible (physically available and affordable) and utilised (through nutrient consumption and absorption). Indonesia boosted food availability through agricultural growth and food imports, but increasing food availability was not the sole factor contributing to its improved food security. The expansion of accessibility to food in Indonesia through greater consumer purchasing power and mobility of goods and services is likely to have played a significant role in enhancing Indonesia's food security (Rada, 2010).

Oil palm is entirely GMO-free and produces up to 10 times more oil per unit area than soybean, rape or sunflower. Oil palm produces more than 34% (palm and palm kernel oil) of the world's eight major vegetable oils on less than 5% of the total area under oil crops. This means that to produce the same volume of oil, oil palm requires less land. Although oil palm is a more sustainable producer of vegetable oil than other oil crops, there is concern that the growing demand of palm oil for food and biofuel could lead to rapid and ill-managed expansion of palm oil production and result in serious environmental and social consequences such as deforestation, loss of natural habitats, illegal fires and land conflicts with indigenous people (Oil and Fats, 2009).

2.12 Social Well Being and Economy

The social aspect of the oil palm industry can be divided to:

- *Social Environment*
- *Small Farmers or Small Holders*
- *Indigenous Land Rights and Human Rights Violations*
- *International Organization for Standardization (ISO)*
- *Human Development Index*

2.12.1 Social Environment

The social and environmental impacts of oil palm cultivation are highly controversial topics. There are multiple sources highlighting the positive and negative aspects of this industry. Oil palm is a valuable economic crop and provides a major source of employment. It allows many small landholders to participate in the cash economy and also often results in the upgrading of the infra-structure within that area. An estimated 1.5 million small farmers grow the crop in Indonesia, along with about 500,000 people directly employed in the sector in Malaysia, in addition to those connected with related industries. It is estimated that 40% of the palm oil production in Indonesia comes from small holders or small farmers (Aikanathan, 2010).

However, there are cases where native customary lands have been appropriated by oil palm plantations without any form of consultation or compensation, leading to social conflict between the plantations and local residents. In some cases oil palm plantations are dependent on imported labour or illegal immigrants, and there are some concerns about the employment conditions and social impacts of these practices.

2.12.2 Small Farmers or Small Holders

An estimated 1.5 million small farmers in Indonesia grow the crop with the total area reaching 3,013,973 ha in 2009 (source: Directorate General of Estates, Indonesia), which is approximately 40 % of the total oil palm area in Indonesia. Smallholders are variable in size and also very diverse in their management standards and capabilities. It is important that the smallholders also move towards the production of sustainable palm oil through the RSPO scheme or the local government scheme (Gustomo, 2010).

When small farmers are given the opportunity to increase production, it was found in Race, et. al., (2009): "Partnerships for involving small-scale growers in commercial forestry: lessons from Australia and Indonesia." that farmers enter into trade relationships between small-scale growers and processing companies. These relationships often play an important role in determining the nature and extent of benefits derived from commercial forestry, and the distribution of these benefits. These include increased knowledge of the operations and components of commercial forestry; improved access to competitive markets; increased knowledge of the dynamics of forest product markets; improved capacity of local farmer forest groups to share experiences and information, and build their knowledge of commercial forestry; and reduced administrative and financial burden imposed by government on small-scale forestry operations.

2.12.3 Indigenous Land Rights and Human Rights Violations

Palm oil producers have been accused of various human rights violations, from paying low wages and providing poor working conditions to theft of land and murder. However, some palm oil producers have adopted social initiatives that use palm oil profits to finance poverty alleviation strategies. Reforms directed toward decentralising the management of natural resources are intended to increase stakeholder involvement and improve the effectiveness and sustainability of resource management arrangements though the application of the principle of subsidiarity (Blomquist, et. al. 2010).

Unfair processes of land use allocation and land acquisition and the lack of respect for local communities and indigenous peoples' rights not only result in marginalisation and impoverishment but also give rise to long term disputes over land, which all too often escalate into conflicts with concomitant human rights abuses due to repressive actions by company or state security forces. The conclusion that flows from the above is that the legal frameworks in the world's two foremost palm oil producing countries are inappropriate to protect indigenous peoples' rights and ensure an equitable development process. Heightened global demand for edible oils and biofuels and international investment is driving these countries to expand oil palm estates and intensify palm oil production. However, the weak legal frameworks (and lax enforcement) are compatible neither with international human rights law, nor with indigenous peoples' customary law (Colchester, 2010).

In Malaysia, the courts have consistently upheld customary rights in terms of common law contrary to Government pleadings. In Indonesia, the international human rights treaty bodies have likewise recommended reforms in national law to protect the rights of indigenous peoples. Similar deficiencies in the current legal framework in Indonesia have been found with regard to the need to protect high conservation values, and likewise to effect adequate controls of agro-industrial pollution.

2.12.4 International Organization for Standardization (ISO)

The International Organization for Standardization, widely known as ISO, is an international standard-setting body composed of representatives from various national standards organisations. Founded on February 23, 1947, the organisation promulgates worldwide proprietary industrial and commercial standards. It has its headquarters in Geneva, Switzerland. While ISO defines itself as a non-governmental organisation, its ability to set standards that often become law, either through treaties or national standards, makes it more powerful than most non-governmental organisations. In practice, ISO acts as a consortium with strong links to governments.

The ISO International Standards can help fight climate change by providing a basis for ensuring trust, integrity and effective governance and management in the quantification, measurement and verification of the greenhouse gas (GHG) mitigation effort. It also provides practical tools for measuring energy efficiency and alternative energy use. The success in tackling climate change relies heavily on the ability of the industry and other actors to comprehensively contribute to reducing GHG emissions with local and national adaptation prior to adding their benefits towards the global mitigation objective (Weng et al., 2010).

The ISO International Standards in being used as benchmarks to measure the baseline for comparability and effective trading of carbon emissions are to ensure that a tonne is indeed a tonne of CO2. The ISO international Standards in providing such a much-needed and credible platform to the UNFCCC and its members, government, business and industry is achieved through its voluntary, multi-stakeholder and consensus-based process to reach agreement among the international experts as well as obtaining approval through representative national voting.

This approach has provided the way forward to solve the multitude of GHG accounting issues impacting the quantification of GHG emissions reduction measurements in the oil palm industry. Accordingly, accounting of GHG mitigation and adaptation efforts in the reduction of emissions requires two key areas to be addressed. Firstly, what ISO GHG International Standards should be used? Secondly, when incentivising the beneficial climate change mitigation practices, care should be taken to avoid any potential conflict with the World Trade Organisation (WTO) rules. Finally, the issue of cost in measuring, reporting and verifying (MRV) of climate change mitigation and adaptation activities must be matched hopefully with premium prices.

2.12.5 Human Development Index

Expansion in agricultural activities and other government expenditure in a country are planned in the context of its Gross Domestic Product (GDP). The GDP or Gross Domestic Income (GDI) is the amount of goods and services produced in a year in a country. The appropriateness of using GDP to evaluate the development status of a country was challenged by the Human Development Index developed by Mahbubul Haq for the United Nations Development Programme (Haq, 1990). The Human Development Index (HDI) is a composite statistic used to rank countries by level of "human development" and separate developed (high development), developing (middle development), and underdeveloped (low development) countries. The statistic is composed from data on life expectancy, education and per capita GDP (as an indicator of the standard of living). The HDI has been used since 1990 by the United Nations Development Programme for its annual Human Development Reports.

All these economic tools are examined to evaluate their robustness in setting an appropriate management model for the palm oil industry.

2.13 Perception: A New Management Tool

2.13.1 Perception Management

Perception is a way of seeing, understanding or interpreting a situation or set of variables. In business, perceptions describe the way stakeholders perceive an enterprise or a brand, based on its actions and the behaviour of its people. To stakeholders, perception is their reality. Perceptions may be good or bad, depending on the experiences the stakeholder groups might have had when engaging with the entity. A gap may exist between stakeholders' perceptions and the entity's ideal perceptions of itself. Hence, perceptions have to be managed to ensure that a sound reputation of the palm oil industry is nurtured, (Heijmans, 2001).

2.13.2 How are perceptions managed? Can perceptions be managed?

The process would begin with a Stakeholder Perception Audit to gauge perceptions held by key stakeholder groups towards the industry. Following from that, the industry needs commit to addressing each key issue of perception, identifying perception gaps where they exist and implementing appropriate change programmes. Meanwhile, the task of communicating messages begins, messages founded on truth and fact. Essentially, there must be interest in feedback and a commitment to addressing the issues raised in the interest of changing negative perceptions to positive ones.

2.13.3 How does Perception relate to Palm Oil Sustainability?

The success of the oil palm has brought with it its own problems. It remains a target of campaigns launched by international NGOs as well as European and American countries with regards to its sustainability. Anti-palm oil campaigns have been carried out systematically and consistently through the media and international publications, claiming that the palm oil industry is damaging the environment, causing deforestation, destroying biodiversity and contributing to global warming.

This is actually about a very basic misperception or perceptions towards the industry and the main ones are (The Jakarta Post, 14 Oct 2010):

Perception 1: Palm oil plantations cause deforestation;

Perception 2: The palm oil industry is the biggest contributor of greenhouse gas emissions (GHG);

Perception 3: Palm oil is cultivated on peatland that emits huge amounts of carbon;

Perception 4: The palm oil industry eliminates biodiversity;

Perception 5: The palm oil industry is not sustainable

2.13.4 Perception or Misperception 5: The palm oil industry is not sustainable

The palm oil sector is, on the contrary, the most sustainable industry, compared to other vegetable oils or even other sectors. Palm oil plantations manage the land very efficiently, in fact, 6-10 times more efficiently than other vegetable oil cultivation. The life cycle of a palm oil plantation of 25-30 years makes it an efficient form of carbon sequestration, while soybean cultivation follows a four-month cycle, and rapeseed requires replanting once a year. This means that palm oil plantations do relatively better in reducing GHG emissions.

2.13.5 Can Perception be measured in the Palm Oil Industry?

Perception is the subjective process of acquiring, interpreting, and organising sensory information. Survey questions that assess perception, as opposed to those assessing factual knowledge, are aimed at identifying the processes. Perception questions differ from other types of survey questions — behavioural, factual, attitudinal, or demographic—in that questions that measure perception asks respondents to provide information on how they perceive. Broadly, research on perception is driven by many different kinds of questions that assess how individual senses and perceptions operate; how and why individuals are susceptible to perceptions or misperceptions; which structures in the brain support perception; and how individual perceptions acquire meaning.

Research on the psychology of perception suggests that the actions of individuals are influenced by their perceptions of the opinions, values, and expectations of others, including those individuals identified as important by the respondent. This is of particular import to survey methodologists, because an individual's perceptions may influence her or his survey responses and, moreover, may be inaccurate. When this inaccuracy is systematic (biasing) rather than random, such inaccuracy has consequences for interpreting the survey data collected.

Including perception measures in a survey instrument enables researchers to investigate both qualitative and quantitative empirical hypotheses by incorporating open-ended and closed-ended measures that assess the way the respondent acquires, interprets, and organises information, questions about the relationships among the respondent's perceptions, and the meaning of reported perceptions. The subjective nature of perception, however, presents a reliability problem. Because the survey interviewer or researcher cannot often easily or reliably identify whether a respondent is being truthful or accurate in her or his reports of a subjective experience, it is not possible to tell whether a particular word used to report an experience is being used to refer to the same kind of experience reported by another respondent.

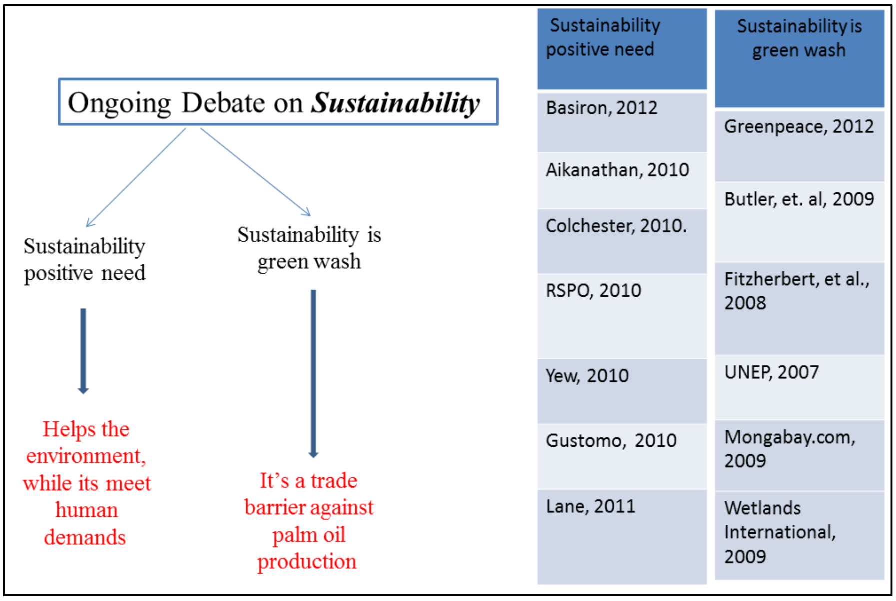
For the very first time, this study looks at the possibility of gauging sustainability perceptions amongst the main oil palm stakeholders in Malaysia. This was done through a survey, engaging the stakeholders through a trained survey team.

2. 14 Synthesis and Evaluation of the Literature Reviewed

There is as yet no sustainability index or other empirical measurements for setting sustainability requirements and the insufficient measurements clearly show gaps in the development of sustainability science, especially for the agricultural sector. The industry has set up its principles and criteria, yet these differ among stakeholder groups, according to geographical location and according to the stakeholders' priorities.

For Malaysia, important sustainability criteria would include: greenhouse gas management, good forestry programmes and effective communication of sustainability efforts. However, some of these variables are recent in their importance and do not have sufficient historical records for a meaningful analysis.

The on-going debate on sustainability is depicted in Figure 2.6. There are almost equal number of journals and reports that support or discredit sustainability development in the oil palm industry.



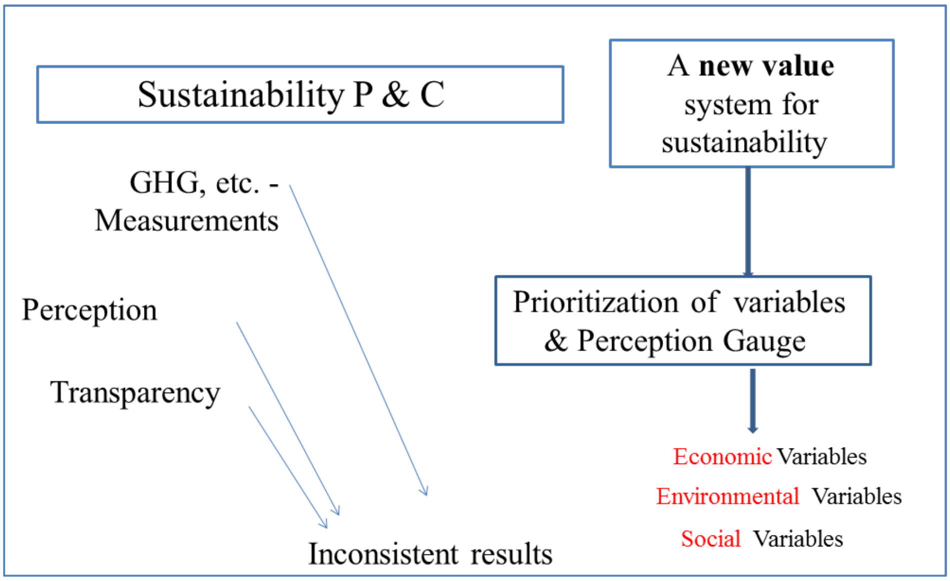
Source: Author, 2013

Figure 2.6 Literature Review: Research Synthesis on Sustainability

2.15 Research, Controversies and Gaps in Existence

The challenges in setting up a system of viable sustainability for the oil palm industry will not be simple, as the industry is not geared towards such transparency and scrutiny in its style of functioning. Review of journals, reports and also personal communications with industry members have brought forth various controversies and gaps. The main controversies and gaps found are (Figure 2: 7):

- The Roundtable Concept and Future Sustainability Requirements
- Scientific Tools and International Standards
- Lack of Data for Sustainability Challenges and Empirical Values For Sustainability Measurement
- Understanding Tropical Biodiversity
- Biofuel Production & Trade Matters
- Economic Crisis and the Oil Palm Industry
- Carbon Trade and the Palm Oil Sector:
- Role of Perception



Source: Author, 2013

Figure 2.7: ***Literature Review: Research Gaps in Sustainability***

From Figure 2.7 we can see that the inconsistant inputs from stakeholder perception reviews, GHG values, and lack of data from the industry (transparency of information) are the major gaps for the oil palm industry’s sustainable development. Thereby a new value system is encouraged by systematically prioritizing important industry variables and also with industry related perception gauged and managed for development purposes.

2.15.1 ***The Roundtable Concept and Future Sustainability Requirements***

The establishment of the roundtable has not been without criticism from various sectors, especially the environmental NGOs. The main issues flagged include:

a. The impact of palm oil plantation expansion on the Orang Utan population;

b. Destruction of tropical forest for the new oil palm plantation schemes in South-East Asia;

c. The burning and draining of large tracts of peat swamp forest in Kalimantan, Indonesia.

The RSPO has included inadequate representation from oil palm growers. Indonesian grower groups quit the RSPO in 2011. There are 4.78 million tonnes of RSPO-certified oil in the market, unsold (MPOC, 2012). However, the question that needs to be answered is whether the oil palm industry can afford to fail with or without RSPO. If sustainability is to be achieved, it has to happen in the market sector. This means that sustainability needs the support of market players, such as companies and producers. It must also be reinforced by market processes, such as pricing which reflects the social and ecological costs of production and environmental values (Fairtrade Foundation, 2010).

A sustainable market depends on the interaction between three parties: companies committed to sustainable practises, good governance by governments and involvement of civil society organisations firmly grounded in society. When all the stakeholders in the chain play their part, sustainable trade flows occur. Other efforts by the industry, such as Malaysian Palm and ISPO, should be given encouragement as sustainable agriculture is no more an option. Similar efforts should be promoted in the rest of the oil palm world (Yew et al., 2010). If sustainability is to be achieved, it has to happen in the market sector. This means that sustainability needs the support of all the market players in the supply chain.

2.15.2 *Scientific Tools and International Standards:*

Scientific tools and standards such as ISO are important in international trade because incongruent standards can be barriers to trade, giving some organisations advantages in certain areas of the world. Scientific tools and standards provide clear identifiable references that are recognised internationally and encourage fair competition in free market economies. Standards facilitate trade through enhanced product quality and reliability, greater interoperability and compatibility, greater ease of maintenance and reduced costs.

2.15.3 *Lack of Data for Sustainability Challenges and Empirical Values for Sustainability Measurement*

The lack of data to support the implementation of palm oil sustainability criteria is apparent. There has been a perpetual need to meet the challenges that are faced by growers and producers to implement practices that will make the production of palm oil economically viable and simultaneously acceptable according to sustainability criteria. Yet there is a sustainability index and other empirical measurements that set sustainability requirements for the industry.

There has been a proposal for the adaptation of a ‘System for Weighted Environmental Impact Assessment in Oil Palm Production’ (APOIA-Oil Palm) (Rodrigues et al., 2010), an Assessment Tool and Integrated Index for Sustainable Oil Palm Production to define and implement social responsibility and sustainability benchmarks. The document report is still at a conceptual stage, but the methodological adaptation and the validation field trials have been carried out for consolidation of the proposed APOIA-Oil Palm sustainability index. The experience attained in the development and international negotiation of this proposed sustainability index, dedicated to such an important productive sector as palm oil, can be instrumental for the environmental management of other sectors and agriculture produce.

2.15.4 Understanding Tropical Biodiversity

In the article: "Have we overstated the tropical biodiversity crisis?” Laurance (2007) reviews whether the tropical biodiversity crisis has been blown out of proportion His work is supported by the vigorous debate following a study by Wright and Muller-Landau (2006) that challenges the notion of large-scale tropical extinctions, at least over the next century. Laurance (2007) describes this controversy and how the debate is stimulating a serious examination of the causes and biological consequences of future tropical deforestation.

Of the 20 studies reviewed, seven reported higher species richness/diversity in undisturbed (or the least disturbed) forest than in disturbed habitats, nine reported the opposite trend, three reported no difference and one reported a strong influence of seasonality on the impacts of logging. Some of these studies may contain inherent methodological biases resulting from the failure to control for sampling effects, the lack of consideration for the spatial scale of analysis and incomplete sampling of the vertical strata in tropical rainforests (Koh, 2007).

Paradoxically, few historical or contemporary coextinction events have actually been recorded (Dunn et al. 2009). The current knowledge of coextinction is derived by: (i) considering plausible explanations for the discrepancy between predicted and observed coextinction rates; (ii) exploring the potential consequences of coextinctions; (iii) discussing the interactions and synergies between coextinction and other drivers of species loss, particularly climate change; and (iv) suggesting the way forward for understanding the phenomenon of coextinction, which may well be the most insidious threat to global biodiversity.

2.15.5 *Biofuel Production and Trade Matter*

It is well acknowledged that palm oil biofuels reduce lifecycle GHG emissions, and over time these biofuels will further improve the emission rate. Technical progress on the part of Malaysia and Indonesia is well underway, given the leaps in technology that have been made in the field and government initiatives to promote the sector. The pathways (methodologies) that were set forth in USA and Europe to determine values for palm oil as renewable fuels in both the land use change and mill operations are in question, as the assumptions made create gaps, and the year 2020 projections by the importers are also unreal. Also, there is double accounting in emissions values as the methodology used accounts for GHG emission of the oil palm fruit bunch at plantation level and accounts for it again at the processing level.

The most used indicators to measure the sustainability of biofuels are: Life Cycle Energy Balance, quantity of fossil energy substituted per hectare, co-product energy allocation, life cycle carbon balance and changes in soil utilisation. All these indicators for palm oil need to be correctly worked out and not based on other produce. Existing assessment tools, such as Life Cycle Assessment (LCA) and Integrated Environmental Assessment, have their advantages and disadvantages and the main constraints related to these assessment tools are the lack of reliable data and their effectiveness because of the gaps in the assumptions used (Silva, et. al., 2011).

The need to be consistent with other reputable work done in the palm oil sector cannot be overemphasised as it will only help in establishing emission values and build the science. Work from RSPO, ISCC, MPOB and ISPO are of credible reputation supporting more than 80% market share of the palm oil industry in research and development. In conclusion, palm oil biofuels producers and importing nations need to concur on the methodology used for establishing emission rates for palm oil biofuels, with fair trade terms that are needed to protect the environment and betterment of all mankind. The main areas of concerns are:

Methodologies: The pathways (methodologies) that were set forth to determine values for palm oil as renewable fuels in both the land use change and mill operations are in question, as the assumptions made create gaps;

Import barriers: Emission values used need consistency, and referencing to reputable work undertaken by the industry experts, and not reinventing of the wheel by non-industry players.

Emission Values: The year 2020 projections are unreal, with double accounting occurring in emissions values.

2.15.6 The Economic Crisis and the Oil Palm Industry

The Global Financial Crisis, which had been brewing for a while, really started to show its effects in the middle of 2007 and into 2008 and is considered by many economists to be the worst financial crisis since the Great Depression of the 1930s. The Global Financial Crisis accelerated the shift in the economic balance of power from West to East. ASEAN and its commodity sectors owed its recovery to the stimulus-fuelled sustained growth of China, and to the growing importance of India in the regional economy.

Oil palm being a perennial crop does not respond quickly to market variations or volatility. Producing nations, like Malaysia and Indonesia, to prevent a further plunge of the CPO price, strategically moved into more downstream activities within their countries, reducing export volumes. Major buying nations like China, India and Pakistan on the other hand, increased their purchase volume, as CPO prices were cheaper than other vegetable oils in the commodity market. Reactions from both the palm oil producers and buyers have since further enhanced and diversified the palm oil industry, with the market progression showing very creative overtures. This creativity in the industry is necessary to keep it robust, and for it to be the leading players in the edible food market.

2.15.7 Carbon Trade and the Palm Oil Sector

International organisations have begun to pin their hopes of reform on the creation of a global market in carbon to curb deforestation, although whether this will help or harm indigenous peoples is a matter of debate. Indeed, initial calculations based on current prices in the voluntary carbon trading market suggest that market-based payments for Reduction in Emissions from Deforestation and Forest Degradation will not be enough by themselves to make economies based on maintaining natural forests competitive with oil palm (Colchester, 2010). The carbon pay-off in the palm oil industry has yet to be defined, and the industry needs to work hard to establish this equation, for it to be as lucrative as it has been painted to be.

Challenges in setting up a system of viable carbon credits for the oil palm industry will not be simple, as the industry is not geared towards such transparency and scrutiny in its style of functioning. Some specific challenges are as follows:

a. No perceived need: The fact that carbon credits in this sector have not yet been developed, despite being possible for more than 10 years, implies that the industry has not seen the need to do so yet. Our research does show that this may change in the coming years.
b. Complexities: Essentially the oil palm industry has not developed its cultivation methods significantly (estimates are that yield per hectare can still double). In comparison to a simple mode of farming, the setting up of rigorous methodology and metrics will be a significant challenge to the industry, and will require change agents/education/mind-set change.
c. Involvement of Non-governmental Organisations (NGOs): with the palm oil sector under severe criticism from NGOs/organisations in the West, it is relevant to ask whether carbon credit efforts will receive serious scrutiny and have to face higher-than-normal tests to prove its legitimacy.
d. Unknown factors yet to arise from further research: The risk factors identified so far, and possible obstacles that might be encountered are only indicative of future challenges that may arise from further research.

e. Carbon pay-off in the Palm Oil Industry: Meanwhile, much of the recent investment in new palm plantations for biofuel has been part-funded through carbon credit projects through the Clean Development Mechanism; however the reputational risk associated with unsustainable palm plantations in Indonesia has now made many funds wary of investing there.

2.15.8 Role of Perception

Perception has been used as an instrumental tool in the setting of sustainability principles& criteria in the last decade. However, the perceptions of each stakeholder varies, and more so from non-producing nations and consumers.

Palm oil industry stakeholders regard different issues as important for their groups. Hence there are perception gaps among the stakeholders, thus creating different priority requirements. The perception also has implications for sustainability requirements and priorities adopted by stakeholder groups. For, until now sustainability is just based on principles and criteria designed by some stakeholder members. The perception for the growers and traders/manufacturers' stated behaviour and perception does not tally with the views of NGOs, media, literature and third parties. There are also differences in the perception of Malaysian, Asian and EU/American stakeholders.

There is a need for the stakeholders to understand the need for sustainability and each other's views. However, sustainable criteria are to be managed with scientific and economic tools, guided by good empirical measurements, and perception needs to managed and not used for inconsistent criteria or requirement setting.

2.9 Questions for Further Research

Based on all the review work, it is evident that the following questions stand out as the need to be addressed and this dissertation shall focus on them:

1. Can oil palm plantations in Malaysia be made sustainable?
    - ❑ Is oil palm sustainability driven by perception?
    - ❑ Does perception play a major role is sustainable criteria setting?

2. How does productivity map with sustainability?
    - ❑ Can we measure sustainable growth?
    - ❑ What are the major variables in these three sectors?

3. How do we incorporate social, economic and environmental values into sustainable practices of the industry?
    - ❑ Can all the values from social, economic and environmental variables be standardised and used by all decision makers to get the best output form their land management practices within their industry?

2.10 Conclusions

This study aims to address gaps and issues pertaining to the oil palm plantation industry. However, the boundaries of this study are limited and do not include political or moral issues. Here, to go forward, the focus will include:

a. Priority issues with regards to land management in the palm oil industry, so as to lay a scientific foundation to meet sustainability challenges and address gaps and controversies in this industry, and recommend possible solutions;
b. Explore stakeholder perceptions and the reality of managing oil palm as an agricultural crop for sustainability; and
c. Overlay environmental, social and economic determinants/variables to develop sustainable management.