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Sustainability in the Malaysian palm oil industry

Chee Guan Choong [a,*], Alison McKay [b]

[a] Mechanical Engineering Department, Ungku Omar Polytechnic, Jalan Raja Musa Mahadi, 31400 Ipoh, Malaysia
[b] Institute of Engineering Systems and Design, School of Mechanical Engineering, University of Leeds, Leeds LS2 9JT, United Kingdom

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A B S T R A C T

With a rapidly growing world population, the demand for palm oil is increasing. In 2010, palm oil accounted for 36.5% of the world's vegetable oil production and it is projected to be the leading vegetable oil in the world by 2016. As the Malaysian palm oil industry is committed to delivering sustainable palm oil products to meet customer demand, this research was to enable identification and prioritisation of areas for improvement. As an example, the Roadmap of Malaysian Palm Oil Industry 2009–2020 was finalised as one of its strategies to attain sustainable production of palm oil and improvement in the quality of planet, people and profit. These include the implementations of Environment Management Systems (since 2004) and National Life Cycle Assessment Project (since 2006). The implementation of carbon footprint labelling is currently being carried out under the National Carbon Footprint Labelling Scheme (2011–2015) by the Standards and Industrial Research Institute of Malaysia (SIRIM) as part of continuous improvements for the delivery of sustainable palm oil products. Current approaches used for governing sustainable palm oil products are unsatisfactory due to limitations such as lack of potential impact models, data availability and uncertainty of impact results. Hence, this research addressed the need to improve understanding of having clear information requirements based on the different impacts in the Malaysian palm oil industry supply network tiers. Simulation experiments were then used to explore the aggregation of these information requirements across the Malaysian palm oil industry supply network. Agent-based and system dynamics modelling techniques were applied to simulate the behaviours of different entities and their interactions in the plantation, mill and mill-refinery models. These simulation techniques were able to build understanding on how information could be linked throughout the different tiers in the supply network. In order to have significant results, the output of the models of each tier must be linked (e.g. the mill and refinery models were linked together).

1. Introduction

Sustainability issues are increasingly important among government, consumers and corporations around the world (Kumar et al., 2005, p. 215; Geibler, 2013). A widely adopted and quoted definition of sustainability is that of the Brundtland Commission (World Commission on Environment and Development, 1987, p. 8): "development that meets the needs of the present without compromising the ability of future generations to meet their needs." This broad rubric of sustainability includes issues such as understanding the environmental impact of economic activity in both developing and industrialised economies (Erlich and Erlich, 1991); ensuring worldwide food security (Lal et al., 2002); ensuring that basic human needs are met (Savitz and Weber, 2006); and assuring the conservation of non-renewable resources (Whiteman and Cooper, 2000).

The definition of sustainability is still very broad. The fact that there is no common agreement from stakeholders' perspectives of what information is needed for the definition of sustainability represents a research opportunity. In the Malaysian palm oil industry, the primary tools applied are environmental management systems and life cycle assessment which reflect the importance of environmental sustainability. Friends of the Earth (2011) demand prioritisation of protecting land use for future food production. This is to control future land expansion in order to reduce environmental impacts (e.g. greenhouse effect). Hence, the scope of this research was on environmental sustainability focussing on strategies to address climate change such as environmental management systems, life cycle assessment and eco-labelling. This provided a basis for assessments with respect to the environmental sustainability performance.

* Corresponding author. Tel.: +60 165 116 872; fax: +60 554 711 62.
E-mail addresses: cgchoong@gmail.com, dr.choong@jkm.puo.edu.my (C. G. Choong).

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There is a growing awareness among manufacturers of the benefits of considering triple bottom line performance and to recognise that environmental challenges represent both business opportunities and a societal responsibility (Marks and Spencer, 2012). A summary report from Department for Environment, Food and Rural Affairs (DEFRA, 2006) asserts that the UK government commitment to stimulate the market for more sustainable goods and services and to shift consumption patterns of business and consumers is a move to a more sustainable economy. In 2008, recommendations were also made available from the International Reference Life Cycle Data System (ILCD, 2008), set up by the European Commission in consultation with several non-EU countries, industry associations, as well as scientific experts to facilitate development of formal international recommendations for life cycle assessment (LCA). Life cycle assessment is a tool used to assess environmental impacts and resources used throughout a product's life cycle (Finnveden et al., 2009). One of the instruments in supporting life cycle assessment activities is the life cycle impact assessment. This instrument is important since increasing environmental impacts occur in fast growing economies. Life cycle thinking is important for all countries to avoid shifting of burdens between countries rather than reducing overall impacts (Finnveden et al., 2009). Urgent action in many countries is critical for sustainable development.

In responding to these recommendations, Malaysia was among the participating representatives involved with the National Life Cycle Assessment Project since 2006 to support a national eco-labelling programme and fulfil the requirements of foreign legislation that demand evidence on the control measures taken to reduce environmental impact of products and services throughout their life cycles. For example, in the implementation of eco-labelling, information of a product needs to be traced back to the plantation tier (e.g. raw materials) of the supply network. In this respect, the Standards and Industrial Research Institute of Malaysia (SIRIM) Berhad is mandated as the implementing agency by the Government of Malaysia and the Ministry of Natural Resources and Environment, specifically the Environmental Conservation and Management Division as the executive agency; both to work together to ensure delivery of the national life cycle project outputs by the end of the Ninth Malaysia Plan (2006–2010). The objectives of the National Life Cycle Assessment Project are:

i. To develop a national life cycle inventory database;
ii. To develop a critical mass of local Life Cycle Assessment practitioners;
iii. To develop eco-labelling criteria documents for the National Eco-labelling Programme; and
iv. To create awareness among industry and consumer groups on the importance of Life Cycle Assessment in today's manufacturing and procurement practice.

The key milestones of current practice implementation and future action plans of the Malaysian palm oil industry are illustrated in Fig. 1. These include the implementation of Environment Management Systems (since 2004) and National Life Cycle Assessment Project (since 2006). The implementation of carbon footprint labelling is currently being carried out under the National Carbon Footprint Labelling Scheme (2011–2015) by SIRIM as part of continuous improvements for the delivery of sustainable palm oil products.

2. Sustainability in the context of Malaysian palm oil industry

Palm oil is the most traded vegetable oil in the world. The demand for it is expected to continue to increase with rising consumer income and population growth (Wahid et al., 2007). Such economic impact in the growth of population for the next two decades is likely to affect the demand for food items including palm oil (Basiron and Simeh, 2005). As a result, the total consumption of world palm oil is expected to be 43 million tonnes in 2020.

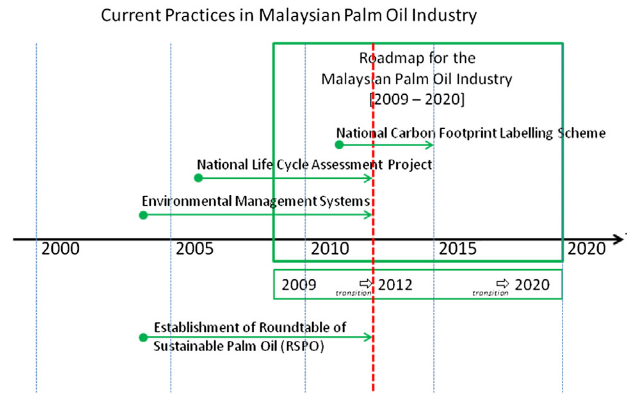

Fig. 1. Key milestones of current practices in Malaysian palm oil industry.

As far as food security for palm oil as a source of edible oil is concerned, there are two main factors that are crucially important (Lam et al., 2008). The first factor is that there should be ample supply to meet the current market demand and also for future expanding demand. Secondly, the price should be stable and affordable to the majority of the world's population. In order to cope with increased global demand for palm oil, Malaysia's government is committed to and has identified environmental, social, and economic or planet, people and profit challenges. This is evidenced through various environmental, social and economic implementation strategies put forward in the national Malaysia Plans (e.g. National Life Cycle Assessment Project since 2006). In addition, during the entire period of the 9th Malaysia Plan (2006–2010), the Roadmap of Malaysian Palm Oil Industry 2009–2020 (MPOB, 2009) was being finalised as one of its strategies to attain sustainable production of palm oil and improvement in the quality of planet, people and profit. Studies of materials flow and energy balance of fresh fruit bunches (FFB) analyses using integrated technology also showed improved economic viability (i.e., integrated technology of biogas and compost production can provide a good solution for palm oil mills to utilize their by-products more profitability). This integrated technology such as using simulation software can be a new solution for a more sustainable palm oil industry management, while simultaneously addressing all the three pillars of sustainability of profit, people and planet (Yoshizak et al., 2013).

The Malaysian Palm Oil industry supply network is illustrated in Fig. 2. The palm oil industry supply network can be divided into four tiers: (1) plantations; (2) mills; (3) refineries; and (4) manufacturers of different palm-based products. These tiers are linked together from upstream to downstream. Upstream tiers comprise of plantations and mill sectors. Plantations sectors are involved in the seedlings and nursery establishments, plantation of palm oil plants and the production of fresh fruit bunches. Whereas, downstream tiers comprise of palm oil refineries, palm kernel crushers and different manufacturers of palm-based products such as biodiesel, chemical, cosmetic, food, feeds and other value-added products. The network structure was used to inform the definition of the simulation models. These models were developed based on the identified system boundaries of the Malaysian palm oil industry supply network. As the key characteristics of sustainability vary across the different tiers of the supply network (e.g. such as the impacts of fertilisers and pesticides used at the seedling stage),