

Complementing Social Life Cycle Assessment to Reach Sustainable Development Goals - A Case Study from the Malaysian Oil Palm Industry

Zainal Haryati^a, Vijaya Subramaniam^a, Zainura Zainon Noor^{b,*}, Soh Kheang Loh^a, Astimar Abd Aziz^a

^aEnergy and Environment Unit, Engineering and Processing Research Division, Malaysian Palm Oil Board, 6, Persiaran Institusi, Bandar Baru Bangi, 43000 Kajang, Selangor, Malaysia

^bDepartment of Chemical Engineering, Faculty of Chemical Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
zainurazn@utm.my

The Malaysian oil palm industry is one of the important contributors to the national economy, which improves the socio-economic of people, source of employment and eradicating poverty, but the industry is always scrutinised on its sustainability performance related to the human well-being and social issues. One of the approaches to address the associated social impacts in the oil palm industry is through social life cycle assessment (S-LCA). S-LCA was developed by the United Nations Environmental Programme and Society of Environmental Toxicology and Chemistry (UNEP/SETAC) to assess positive and negative social impact along the supply chain. The Sustainable Development Goals (SDGs) also has set the social criteria to move society towards the improvement of the well-being of people and surroundings. This study aims to assess the social impacts of the workers in the Malaysian oil palm industry using S-LCA and to indicate their connection with relevant SDGs. The system boundary of this study was from nursery, plantation up to palm oil mill where the worker's stakeholder categories were chosen. The S-LCA methodology was adopted from the UNEP/SETAC guidelines for the subcategory lists and the methodological sheet for indicators development. Out of eight worker subcategories, only six subcategories were assessed. The method assessment of this study using performance reference point using five classifications of level which are 1 - Excellent, 2 - Above average, 3 - Average, 4 - Below average and 5- Extremely poor) to gauge the organisation performance. The subcategory results ranged between 1 – 3 and indicated that some improvements are required for certain subcategories. Linking with S-LCA and SDG showed that 6 out of 17 SDGs are relevant. LCA can be a tool to support oil palm businesses to achieve SDGs, but further explanation is needed to link LCA with SDGs since SDGs are conceptualised at the country or regional level whereas LCA is mainly used to gauge the impacts of products or services at the micro or business level.

1. Introduction

Palm oil is now the world's leading vegetable oil, accounting for one-third of global consumption due to its lower price and higher productivity as compared to other vegetable oils (Nambiappan et al., 2018). Not only that, the population growth, increasing standard of living, non-food uses, as well as renewable energy demands also make palm oil one of the most traded oils (Choo et al., 2011). As the second-largest palm oil producer globally, Malaysia has contributed to the country Gross Domestic Product (Lin et al., 2018), which makes this industry have opportunities for the new export markets. Even though the oil palm industry has substantial impacts on economic development, the industry has always been scrutinised on the sustainability of its products and supply chain. Many claims that the increase of oil palm plantations to produce oil to meet the global market demands have significantly caused adverse impacts on the environment and social aspects (Sharaai et al., 2020), but the social impacts' issues become more prominent. As such, common highlighted social issues associated with the

oil palm industry includes forced labour, child labour, working condition, foreign workers, etc. (Corciolani et al., 2019).

For the last 10 y, the life cycle assessment (LCA) has been used as a tool to assess the environmental impacts of products and services (Klöpffer, 2008). With global emerging sustainability challenges, the concept of LCA has evolved to focus on sustainability evaluation such as strategic planning, improve in policies, environmental product declaration and much more. Life cycle sustainability assessment (LCSA) was established to understand the complexity and to address the sustainability aspects in a life cycle perspective. LCSA has emerged as a technique that consists of environmental LCA (E-LCA) - (ISO 2006), life cycle costing (LCC) - (Swarr et al., 2011) and social LCA (S-LCA) - (UNEP/SETAC 2009). Among these life cycle approaches, S-LCA is new in its field and still evolving. S-LCA as defined by UNEP/SETAC is a tool to assess the social impacts both positive and negative along the life cycle of products or services (UNEP/SETAC, 2009). S-LCA adopts the international standard of E-LCA (ISO 14040 and 14044) that consists of four phases - goal and scope, life cycle inventory, life cycle impact assessment and interpretation (Hoque et al., 2019). The application on S-LCA is challenging, but the number of case studies is increasing every year (Petti et al., 2016).

Recent S-LCA and LCSA studies related to the oil palm industry are increased such as the study by Muhammad et al. (2019) conducted a gate-to-gate study from oil palm plantation to the palm oil mill. Lim and Biswas (2019) developed the Palm Oil Sustainability Assessment (POSA) framework to assess the sustainability impact in palm oil production in Sarawak and Jamaludin et al. (2018) developed the Palm Oil Mill Sustainability Index for the palm oil mill. But many studies highlighted the limitation and methodological difficulties in the process the data and interpretation of the result.

Malaysia has continuously supported sustainable development in the national agenda whereby the Agenda for Sustainable Development (2030 Agenda) has been drawn into the Eleventh Malaysia Plan to align strategies and initiatives to support SDGs. According to Malaysia's initial report on SDGs (DOSM, 2018), out of 244 SDGs indicators, 137 indicators (56 %) are related to social aspects, 58 indicators (24 %) on the environment and 49 indicators (20 %) linked to economics. This social criteria in the SDGs show the importance of addressing comprehensive social aspects and impacts along the life cycle of products and services. This study aims to assess the social impacts of the workers in the Malaysian oil palm industry in the context of S-LCA and to indicate their connection with relevant SDGs.

2. Material and methods

The social impacts of the workers from 3 sub-sectors were explored in a cradle-to-gate study starting from nursery, plantation, and palm oil mill, as shown in Figure 1. This study used the S-LCA guidelines developed by UNEP/SETAC whereby the methodology of this study used performance reference point (PRP) approach.

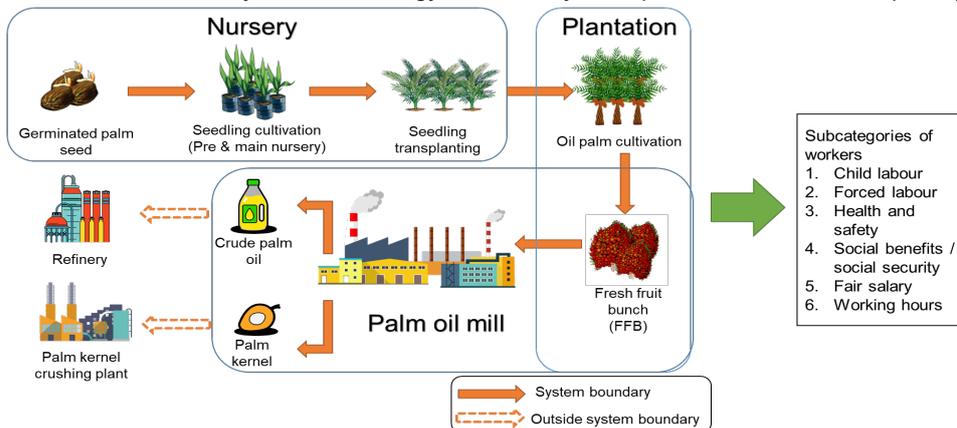


Figure 1: Overall system boundary in this study

2.1 Life cycle inventory

The inventory data were collected from three companies located in Peninsular Malaysia between 2018 to 2019. Five workers from each sub-sector were selected with multiple age, both male and female local and foreign workers were selected for the face-to-face interview using semi-structured questions with 41 constructed questionnaires. The selection of the workers was based on purposive sampling method. From this, the number of interviewed workers choose was 15 for each company. All in, 6 subcategories and 19 indicators of workers were created as shown in Table 1.

2.2 Life cycle impact assessment

The impact assessment method used for this study is a PRP method whereby the collected inventory data were compared to a benchmark (Parent et al., 2010). The PRP was based on Malaysian labour law as well as international conventions such as the International Labour Organisation (ILO). The indicators of each subcategory were created based on PRP. A scale-based approach was adapted from Ciroth and Franze (2011) by assigning a score of 1 to 5; 1 - Excellent, 2 - Above average, 3 - Average, 4 - Below average and 5 - Extremely poor. The results were then calculated, and the sum was later converted into a percentage to represent each subcategory.

Table 1: Classification of worker's subcategories and indicators

Subcategory	Indicator	PRP ^a	Source
Child labour	Existence of child labour policy	Company practice	-
	Child in the organisation	Malaysia law	Employment Act 1955 and Conventions ratified by Malaysia
Forced labour	Document retention	ILO ^b	Conventions ratified by Malaysia
	Restriction of movement	ILO ^b	
Health and safety	Formal policy of safety and health	Company practice	-
	Training program	Malaysia law	Occupational Safety and Health Act 1994, Factories and Machinery Act 1967 and Conventions ratified by Malaysia
	Safety working equipment	Malaysia law	
	Safety and health records	Malaysia law	
Social benefits/ social security	Leaves and holiday	Malaysia law	Employment Act 1955, Workers' Minimum Standards of Housing and Amenities Act 1990 [Act 446],
	Worker accommodation	Malaysia law	
	Retirement	Malaysia law	
	Medical benefits	Malaysia scheme	Employment Injury (EI) Scheme under Act 4
	Worker accommodation	Malaysia law	
Fair salary	Other benefits	Company practice	-
	Paid below minimum wage rate	Malaysia law	Employment Act 1955 and Minimum wage order
	Late wage payment	Malaysia law	
	Schedule of wage paid	Malaysia law	
Working hours	Working hours per week	Malaysia law	Employment Act 1955 and Minimum wage order
	Overtime work hours	Malaysia law	

^aPerformance Reference Point (PRP); ^bInternational Labour Organization (ILO)

2.3 Interpretation

The SLCA findings were then compared with the SDG indicators to see the similarity and compatibility.

3. Results and discussion

The overall findings of all subcategories from 45 respondents shown in Figure 2. The subcategories scores ranged from 1 to 3 where child labour and social benefits/ social security scored 1 with 91 % and 80 % respondents giving positive responses. Health and safety, fair salary, and forced labour scored 2, based on limited positive responses of 84 %, 80 % and 93 % respondents, and working hours scored 3 based on moderate responses of 71 % respondents. Findings for social benefits/social security subcategory showed that all three companies had provided a lot of benefits to their workers such as house and amenities, medical benefits, workers accommodation, canteen, shelter during rain and much more. For child labour subcategory, during the interviews and site visit, no children were visible in the plantation. The policy of child labour prohibition is available and rests in the Children and Young Persons (Employment) Act 1966 compliance. All companies have also affirmed that they forbid any form of child labour. Workers in the interview were also able to define and understood the meaning of child labour.

Subcategory of health and safety subcategory showed that all these companies have strict compliance with safety and health regulations as they are required to follow the Occupational Safety & Health Act 1994 and the Factory & Machinery Act 1967. The safety and health policy can be seen in workers' workplace including measures such as proper personnel protective equipment (PPE), training and regular medical check-ups are provided to all workers as well as the safety reports that are well documented. The fair salary subcategory showed that workers received wages as stipulated by the law under the Minimum Wages Order (Amendment) 2018, which came into effect on 1st January 2019 with a minimum wage set at MYR 1,100. During the interview, the workers informed that their monthly salary higher than the minimum wage order. A study by Muhammad et

al. (2019) reported a similar range of salary from MYR 1,200 to MYR 5,000. Field operators working as harvesters in the plantation sub-sector are often paid via piece-rate based on production target. The interviewed harvesters commented that the production target is reasonable because they can earn up to MYR 2,500 monthly. Workers in the milling sub-sector received more wages since they have rotating shifts and overtime work which differ depending on the low or high crop season. Subcategory of forced labour found that all foreign workers in these three sub-sectors had informed that their employers are no longer holding their documents such as a passport. Each foreign worker has their personal safety box located in the plantation office. All workers keep their keys and no restriction to take their documents. These have been in practice for 2 – 3 y starting with pilot until it officially opened in the organisations. They also can go to the nearby town as there is no restriction of movement since they kept and have free access to their documents.

The overall findings from the interview for working hour subcategory showed that this subcategory required improvement for the well-being of workers. Certain workers from the plantation sub-sector had raised concern on their challenging and time-consuming tasks, especially during pruning and harvesting activities which require them to move from one area to another. It can be understood that such activities require skills, training and proper tools for an overall improvement of plantation activities. Bakar et al. (2018) conducted a study to compare the effect of manual and mechanised harvesting tool on working hours and showed that having a mechanised tool can improve the efficiency and productivity of the harvesting work in the plantation. The job scope in the palm oil milling process often requires shift work and overtime. The average production hours of these three companies were around 16 to 18/d. There are two working shifts and overtime work is on a voluntary basis. During the interview, it was found that workers do not have any issues working overtime, but their overtime hours have exceeded the allowable limit.

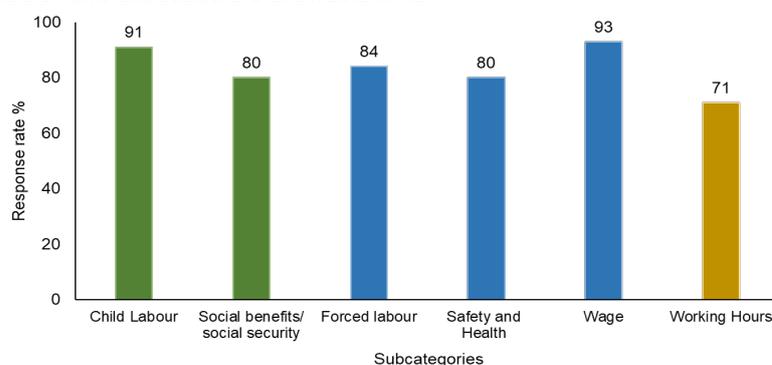


Figure 2: Overall findings of worker's subcategories for three companies

The other part of this study is to see the possibility of linking the findings of S-LCA with SDGs. Notably, the strategic plan of SDGs focuses on the holistic key area of triple bottom line pillars of environment, economic and social. Mapping the SDGs into the business can be seen to be relevant especially in the oil palm industry. We found that about 24 SDGs indicators representing 6 SDGs (1,3,5,8,10 and 11) seem to be pertinent to be linked with the S-LCA indicators. Table 2 shows the connection between S-LCA and 6 SDGs indicators.

Table 2: Classification of worker's subcategories and indicators

Subcategory	S-LCA Indicator (this study)	SDGs Indicator
Child labour	Existence of child labor policy Child in the organisation	1.3.1 Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, new-borns, work-injury victims and the vulnerable 8.6.1 Proportion of youth (aged 15–24 y) not in education, employment or training 8.7.1 Proportion and number of children aged 5–17 y engaged in child labour, by sex and age
Forced labour	Document retention Restriction of movement	10.7.1 Recruitment cost borne by employee as a proportion of monthly income earned in country of destination 10.7.2 Number of countries with migration policies that facilitate orderly, safe, regular and responsible migration and mobility of people

Table 2 (continue): Classification of worker's subcategories and indicators

Health and Safety	Formal policy of safety and health Training program Safety working equipment Safety and health records	8.8.1 Frequency rates of fatal and non-fatal occupational injuries, by sex and migrant status 3.8.1 Coverage of essential health services 3.9.1 Mortality rate attributed to household and ambient air pollution 3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services) 3.b.3 Proportion of health facilities that have a core set of relevant essential medicines available and affordable on a sustainable basis 3.c.1 Health worker density and distribution 3.d.1 International Health Regulations (IHR) capacity and health emergency preparedness 6.1.1 Proportion of population using safely managed drinking water services 6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water 6.3.1 Proportion of domestic and industrial wastewater flows safely treated 6.3.2 Proportion of bodies of water with good ambient water quality
Social benefits/ social security	Leaves and holiday Worker accommodation Retirement Medical benefits Worker accommodation Other benefits	11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing 11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities 11.3.1 Ratio of land consumption rate to population growth rate 11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically
Fair salary	Paid below minimum wage rate Late wage payment Schedule of wage paid	10.4.1 Labour share of GDP, comprising wages and social protection transfers 10.2.1 Proportion of people living below 50 % of median income, by sex, age and persons with disabilities
Working hour	Working hours per week Overtime work hours	8.5.1 Average hourly earnings of female and male employees, by occupation, age and persons with disabilities 10.3.1 Proportion of population reporting having personally felt discriminated against or harassed in the previous 12 months on the basis of a ground of discrimination prohibited under international human rights law

4. Conclusions

Overall, the findings show that S-LCA is able to gauge the social impacts of the Malaysian oil palm industry by presenting positive and negative impacts along its supply chain. Of the six subcategories assessed, working hours subcategory scored 3 - Average, which means improvement is required for the well-being of the workers. This can be accommodated by tapping into a potential opportunity for upstream mechanisation to improve harvesting efficiency and oil palm productivity. Complementing the S-LCA with SDGs seems necessary and comprehensive S-LCA study of the Malaysian oil palm industry is required. As of now, the data from each state are collected and on progress. It is challenging to apply LCA for SDGs because it requires detailed lines of argumentation based on the fact that the SDGs are conceptualised at a country or regional level whereas LCA aims at specific products at the business level. However, the details sustainability evaluation can be made via LCSA to show the holistic assessment to address the sustainability of the oil palm industry.

Acknowledgements

The authors thank the Malaysian Palm Oil Board for permission to publish this article. Also, we thank the palm oil industry for their commitment and support for this study.

References

- Bakar M.A., Firdaus N., Rashid A., Syahlan S., 2018, Comparison of an effective working hour and harvesting cost between manual harvesting (chisel and sickle) and mechanised harvesting (CKAT and motorised cutter) in oil palm plantation, *International Journal of Engineering and Technology*, 7, 282–286.
- Choo Y.M., Muhamad H., Hashim Z., Subramaniam V., Puah C.W., Tan Y., 2011, Determination of GHG contributions by subsystems in the oil palm supply chain using the LCA approach, *The International Journal of Life Cycle Assessment*, 16(7), 669–681.
- Ciroth A., Franze J., 2011, LCA of an Ecolabeled notebook, Consideration of social and environmental impacts along the entire life cycle, GreenDeltaTC GmbH, Berlin, Germany.
- Corciolani M., Gistri G., Pace S., 2019, Legitimacy struggles in palm oil controversies: An institutional perspective, *Journal of Cleaner Production*, 212, 1117–1131.
- Department of Statistic Malaysia, 2018, The Initial Assessment of The Sustainable Development Goals Indicators for Malaysia 2018, Putrajaya, Malaysia.
- Hoque N., Biswas W., Mazhar I., Howard I., 2019, LCSA framework for assessing sustainability of alternative fuels for transport sector, *Chemical Engineering Transactions*, 72, 103–108.
- International Standard of Organisation, 2006, Environmental Management - Life Cycle Assessment - Principles and Framework, British Standards Institution BSI, <iso.org/standard/37456.html> accessed 19.02.2019
- Jamaludin N.F., Hashim H., Muis Z.A., Zakaria Z.Y., Jusoh M., Yunus A., Abdul Murad S.M., 2018, A sustainability performance assessment framework for palm oil mills, *Journal of Cleaner Production*, 174, 1679–1693.
- Klöpffer W., 2008, Life-Cycle Based Sustainability Assessment as Part of LCM in 3rd International Conference on Life Cycle Management, Zurich Switzerland, 27–29.
- Kushairi A., Singh R., Ong-Abdullah M., 2017, The oil palm industry in Malaysia, Thriving with transformative technologies, *Journal of Oil Palm Research*, 29(4), 431–439.
- Lim C.I., Biswas W., 2018, Sustainability assessment for crude palm oil production in Malaysia using the palm oil sustainability assessment framework, *Sustainable Development*, 27(3), 253–269.
- Lin S., Angelo M., Promentille B., Yatim P., Loong H., 2018, Developing sustainability index for Malaysian palm oil industry with fuzzy analytic network process, *Chemical Engineering Transactions*, 70, 229–234.
- Muhammad K.I., Sharaai A.H., Ismail M.M., Harun R., Yien W.S., 2019, Social implications of palm oil production through social life cycle perspectives in Johor Malaysia, *The International Journal of Life Cycle Assessment*, 24(5), 935–944.
- Nambiappan B., Ismail A., Hashim N., Ismail N., Shahari D.N., Idris N.A.N., Omar N., Salleh K.M., Hassan N.A.M., Kushairi A., 2018, Malaysia: 100 years of resilient palm oil economic performance, *Journal of Oil Palm Research*, 30(1), 13–25.
- Parent J., Cucuzzella C., Revéret J.P., 2010, Impact assessment in SLCA, Sorting the sLCIA methods according to their outcomes, *The International Journal of Life Cycle Assessment*, 15(2), 164–171.
- Petti L., Serreli M., Di Cesare S., 2016, Systematic literature review in social life cycle assessment, *The International Journal of Life Cycle Assessment*, 23, 422–431.
- Sharaai A.H., Omran N., Hashim A., 2020, The role of life cycle sustainable assessment (LCSA) in achieving sustainable palm oil production: A meta analysis, *International Journal of Advanced Science and Technology*, 29(9), 1730–1747.
- Swarr T.E., Hunkeler D., Klöpffer W., Pesonen H.L., Giroth A., Brent A.C., Pagan R., 2011, Environmental life-cycle costing: a code of practice, *The International Journal of Life Cycle Assessment*, 16(5), 389–391.
- UNEP/SETAC., 2009, Guidelines for Social Life Cycle Assessment of Products 1st Ed. C. Benoît., B. Mazijn (Ed). United Nations Environment Programme, Milan, Italy.