



SOCIAL SUSTAINABILITY ASSESSMENT OF RICE PRODUCTION SYSTEMS IN MALAYSIA: A LIFE CYCLE PERSPECTIVE ON STAKEHOLDER WELL-BEING IN SELANGOR'S GRANARY AREAS

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The social sustainability of rice production systems in Malaysia remains underexplored despite stakeholders including rice mill workers, paddy farmers, and local communities facing various social challenges throughout the production lifecycle, necessitating comprehensive assessment to support the government's target of achieving 75% rice self-sufficiency by 2025. This study applied Social Life Cycle Assessment (S-LCA) methodology based on ISO 14040:2006 framework to evaluate social impacts in Sungai Leman and Sekinchan divisions of Barat Laut Selangor, utilizing three validated questionnaire sets with 5-point Likert scales based on UNEP 2020 guidelines and multistage sampling that yielded 355 respondents comprising 41 rice mill workers, 136 farmers, and 178 local community members, achieving content validity (I-CVI: 0.83-1.0) and reliability (Cronbach's Alpha: 0.813-0.894). Social impact analysis revealed highest mean scores for health and safety among rice mill workers (3.86), agricultural technology assistance among paddy farmers (4.16-4.20), and job opportunities among local communities (3.87-3.94), while Social Performance Scores demonstrated good sustainability levels across all stakeholder groups with rice mill workers (64.33), paddy farmers (63.29-64.29), and local communities (64.31-65.98), all achieving classifications within the good range (61-80). The findings indicate socially sustainable rice production operations in both divisions, with key contributors including health and safety protocols, agricultural technology assistance, and job opportunity creation, supporting Malaysia's agricultural development goals and suggesting effective implementation of national policies, leading to recommendations for continued multi-agency involvement, enhanced technology dissemination through FAMA and AgroBank, and regular monitoring to support the national rice self-sufficiency target.

Keywords: social life cycle assessment, rice production, social sustainability, social impact, stakeholder analysis, Malaysia, agricultural sustainability

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INTRODUCTION

Rice production plays a crucial role in Malaysian culture and food security, with approximately 2,353 thousand tonnes of paddy produced in 2019, where 12 granary areas are responsible for more than 75% of total production (Ministry of Agriculture and Food Industries Malaysia, 2019). According to the Twelfth Malaysia Plan (2021-2025), the government aims to achieve 75% self-sufficiency rate by 2025, emphasizing the need for sustainable agricultural practices (Economic Planning Unit, 2021).

Rice production stakeholders including rice mill workers, paddy farmers, and local communities face distinct social challenges throughout the production lifecycle. Paddy farmers encounter health hazards from using unregistered pesticides to combat pests like Golden Apple Snail, as subsidized pesticides prove ineffective (Mahavera, 2018). More than 100,000 paddy farmers remain relatively poor, with many young people showing disinterest in farming, resulting in an ageing agricultural workforce (Fatah & Cramon-Taubadel, 2017; Khazanah Research Institute, 2019).

Rice mill workers face occupational health risks, including exposure to dust causing lung diseases when safety equipment is inadequate (Amiratul Aifa et al., 2020; Roy et al., 2020). Additionally, concerns exist regarding job security, economic security, and insufficient social benefits in rice mill working environments. Local communities experience mixed impacts, with climate change and socio-economic challenges affecting the sector's future sustainability (Tan et al., 2021).

This study applied Social Life Cycle Assessment (S-LCA) methodology to evaluate social impacts and sustainability levels in Sungai Leman and Sekinchan divisions of Barat Laut Selangor. The research objectives were: (1) to analyze social impacts faced by rice mill workers, paddy farmers, and local communities, and (2) to visualize social sustainability levels of these stakeholder groups using a cradle-to-gate system boundary.

METHODOLOGY

The research employed S-LCA methodology based on ISO 14040:2006 framework, comprising four phases: Goal and Scope Definition, Life Cycle Inventory (S-LCI),



Life Cycle Impact Assessment (S-LCIA), and Life Cycle Assessment Interpretation (S-LCAI). This approach builds upon previous S-LCA applications in Malaysian agricultural contexts (Sharaai et al., 2019). Data collection was conducted from October to November 2021 in Sungai Leman (3° 31' 19.21" N, 101° 5' 27.52" E) and Sekinchan (3° 31' 45.84" N, 101° 7' 26.26" E).

Three questionnaire sets were developed containing 73 items for workers and 48 items each for farmers and local communities, using 5-point Likert scales based on UNEP (2020) guidelines. Content validity achieved I-CVI values of 0.83-1.0 with eight expert panels including officials from IADA Barat Laut Selangor and academic experts. Reliability testing showed Cronbach's Alpha values of 0.813 (workers), 0.894 (farmers), and 0.839 (local communities).

Multistage sampling was employed, yielding 355 respondents: 41 rice mill workers (Sekinchan only), 136 farmers, and 178 local community members. The performance reference points method was applied for impact assessment, with Social Performance Scores (SPS) classified as: Poor (0-20), Fair (21-40), Medium (41-60), Good (61-80), and Very Good (81-100).

RESULTS AND DISCUSSION

Social impact analysis by mean scores

Table 1: Mean scores of social issues among rice mill workers (Sekinchan)

Social issue	Mean score
Health and safety	3.86
Employee benefits	3.83
Fair salary	3.73
Discrimination	3.57
Working hours	3.56
Child labour	2.77

Health and safety showed the highest impact as workers are aware of machinery risks, reflecting compliance with Malaysia's Occupational Safety and Health Act 1994. Employers provide safety equipment and procedures to reduce accident risks, addressing concerns raised in previous studies about dust exposure and respiratory issues in rice mills (Roy et al., 2020).

Table 2: Mean scores of social issues among paddy farmers



Social issue	Sungai Leman Sekinchan	
Assistance with agricultural technology development	4.20	4.16
Safety and health	3.80	3.76
Living standards	3.78	3.73
Income	3.44	3.57

Agricultural technology assistance showed the highest impact, aligning with the National Agrofood Policy 2021-2030 (DAN 2.0) emphasis on modernization and smart farming (Economic Planning Unit, 2021). Most farmers are satisfied with income as many have alternative income sources, addressing poverty concerns highlighted by Khazanah Research Institute (2019).

Table 3: Mean scores of social issues among local community

Social issue	Sungai Leman	Sekinchan
Job opportunity	3.94	3.87
Community engagement	3.65	3.62
Delocalization and migration	3.55	3.53
Health and safety	2.31	2.33

Job opportunity had the highest impact as agricultural modernization creates employment for locals with suitable skills. This finding contrasts with trends in other regions where youth migration occurs due to disinterest in agricultural work, as observed in Thailand by Salvador et al. (2019).

Social Sustainability Assessment

Table 4: Social performance scores by stakeholder

Stakeholder	Sungai Leman	Sekinchan	Classification
Rice mill worker	-	64.33	Good
Paddy farmers	64.29	63.29	Good
Local community	65.98	64.31	Good

All stakeholder groups achieved good-level social sustainability scores (61-80 range), indicating socially sustainable rice production operations in both divisions. These results demonstrate higher social performance compared to some developing countries where agricultural workers face significant social challenges (Lin & Nguyen, 2021).



CONCLUSIONS AND RECOMMENDATIONS

This study successfully demonstrated S-LCA methodology application in assessing social sustainability of rice production systems in Malaysia. All stakeholder groups achieved good-level social sustainability, with most social issues showing moderate to high positive impacts, supporting Malaysia's agricultural development goals outlined in the Twelfth Malaysia Plan.

Key findings reveal that health and safety, agricultural technology assistance, and job opportunities are primary contributors to social sustainability. The consistent scores between divisions suggest uniform social performance across Barat Laut Selangor granary area, reflecting effective implementation of national agricultural policies.

Limitations include: (1) time constraints due to COVID-19 standard operating procedures limiting data collection, and (2) need for additional social issues for more comprehensive impact measurement, particularly regarding climate change adaptation (Tan et al., 2021).

Recommendations align with national priorities: (1) multi-agency involvement to increase awareness and improve rice industry performance, supporting DAN 2.0 implementation, (2) enhanced dissemination of agricultural technology information through agencies like FAMA and AgroBank, (3) continued emphasis on health and safety protocols in accordance with Malaysian occupational standards, and (4) regular monitoring of social performance indicators to support the national goal of 75% rice self-sufficiency by 2025.

Future research should expand system boundaries to include retail and consumer phases, incorporate climate change adaptation measures, and conduct longitudinal assessments to track sustainability trends in line with Malaysia's sustainable development objectives.

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