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Sustainability Risk Management Using Failure Mode Effect Analysis: Evidence from Malaysia

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Abstract

Palm oil industry in Malaysia has been in the limelight due to criticisms from various pressure groups on the severe sustainability issues as the results of palm oil productions and processes. Emerging sustainability issues expose palm oil industry to face the unprecedented set of sustainability risks. As such the identification of sustainability risks, the assessment of their impact, the development of sustainability risk management (SRM) to respond and monitor those risks are critical for organization in order to ensure company's viability and survival in current business environment. Thus, this study intends to provide useful insights on the management of sustainability issues using risk management framework that includes risk identification, risk assessment and analysis, risk response, and risk monitoring. Questionnaires were distributed to operational managers in selected palm oil mills. Failure Mode Effect Analysis (FMEA) was employed to analyse the data. The findings reveal that sustainability risks are perceived as having major impact to business operations; they occur occasionally and are moderately easy to be detected. By assessing the impact of sustainability risks, an acceptable range of risk mitigation strategies can be assigned properly. This finding highlights the need for integrated sustainability risk management approaches to facilitate the development of effective sustainable strategies.

Keywords: *Sustainability; Sustainability Risk Management; Sustainability Practices; Palm Oil Mill; Failure Mode Effect Analysis (FMEA)*

1. Introduction

The management of sustainability risk in business operations has attracted considerable attention among practitioners and academics and emerged as one of the principal topics in the recent risk management and sustainability management literature. The interest of sustainability risk is cultivated by the need to manage the arising of sustainability issues as a results of company's business operations (Wijethilake & Lama, 2018). Environmental issues such as climate change (Bui & de Villiers, 2017), product waste and excessive emission (Giannakis & Papadopoulos, 2016), and social issues such as low wages (Hofmann et al., 2014) and health and safety issues (Zimmer et al., 2017) are some of the sustainability issues that may cause firms to face with an unprecedented set of risk including regulatory, commercial and reputational risks (Aziz et al., 2016; Kumarasiri & Gunasekarage, 2017; Sakhel, 2017; Subramaniam et al., 2015).

Traditionally, the treatment of costs and risks associated with sustainability issues were externalized to the environment and society (Giannakis & Papadopoulos, 2016). However, growing pressure from stakeholders including customers and suppliers of the importance of adopting sustainability practices and the introduction of certain stricter sustainability regulations have increasingly demanded companies to be accountable for the sustainability risks (Fan et al., 2017). Consequently, there is now heighten pressures for many firms to adopt a more sustainable

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and responsible stance and to take measures to control the sustainability issues of their operational activities to avoid them facing severe risks (Subramaniam et al., 2015; Wang, Wang, & Wang, 2018). Business scandals such as the BP deepwater horizon oil spill in Mexico, the Rana Plaza disaster in the textile industry and the poor working conditions in Apple's suppliers underscore how these sustainability risks affect the businesses.

Palm oil mills in Malaysia has been in the limelight due to the criticism from various stakeholders on the sustainability issues that have been the consequences of palm oil production processes (Abdullah et al., 2015; Oosterveer, 2015). Numerous certifications and sustainability practices have been adopted by the palm oil mills to address the sustainability issues (Choong & Mckay, 2014). However, studies indicated that palm oil mills in Malaysia have weak performance to comply against the sustainability practices (Jamaludin et al., 2018). In addition, the achievement of palm oil mills towards complying with sustainability practices is found to be slightly lower than the priority given to them (Abdullah et al., 2017). This lead to some importing countries impose stricter regulation to stop severe sustainability issues, exposing our nation to risk of losing market share and export revenues which indirectly threaten the livelihood of small growers who are depending on the palm oil's export revenue (Saideed, 2017).

At present, Malaysia is world's second largest producer and exporter of palm oil, with 29% and 44% respectively. Total exports revenue reached to a new height of RM77.8 billion in 2017. In addition, the increasing demand of palm oil for food products, cosmetics, bio-energy etc. has placed palm oil as the leading oil and fat sources in the world (Khatun et al., 2017). These show that the sustainability of palm oil industry is not only important for Malaysia economy but also to the fulfilment of worldwide demand (Lim, Biswas, & Samyudia, 2015). Palm oil mill has been regards as the important sector in palm oil industry (Abdullah et al., 2017). Thus, the management of sustainability issues in palm oil mills in crucial to avoid sustainability risk which may lead to reputational and boycott risk as a consequences of adverse stakeholder reaction and bad press coverage (Hofmann et al., 2014; Zimmer et al., 2017), requiring companies to implement an appropriate risk management system (Sakhel, 2017).

Sustainability risk management (SRM) has emerged as an important tool in addressing the multifaceted risk arising from sustainability issues (Abdul Aziz, Abdul Manab, & Othman, 2015). SRM is not a new system, but it provides added improvement to risk management. Risk management refers to the identification, measurement, assessment and analysis, response and monitoring of not only risks with negative consequence on organisational performance, but also opportunities that can increase organisational value (Bui & de Villiers, 2017). It has the capacity to control organisational behaviour and activities (Bhimani, 2009; Mikes, 2009) as well as has been regarded as important internal control to ensure the safety, soundness and survival of the organisations (Rasid, Isa, & Ismail, 2014). By incorporating sustainability issues into risk management, organisations can control their behaviour and activities in addressing the risks and opportunities associated with sustainability (Bui & de Villiers, 2017). Hence, SRM is aimed at managing and minimising the impact of sustainability issues using risk management to sustain themselves over the long term.

Despite the benefits of SRM being highlighted in previous literature, a study by Aziz et al. (2016) revealed that companies in Malaysia are not ready for SRM practices yet. Many organizations already have risk management to deal successfully with traditional financial risks (Wong, 2014). The emergence of sustainability risks, however, provides the greatest challenge for the company to manage them, since the sustainability risks are combination of financial and non-financial in nature (Abdul Aziz et al., 2015; Subramaniam et al., 2015). As such the identification of sustainability risks, the assessment of their impact, the development of sustainability risk management to mitigate and monitor those risks are critical for organization in order to ensure company's viability and survival in current business environment (Abdul Aziz, Abdul Manab, & Othman, 2016; Giannakis & Papadopoulos, 2016; Wijethilake & Lama, 2018; Wong, 2014).

In previous studies, scholars particularly focused on the conceptual and theoretical explanation of SRM (see Abdul Aziz et al., 2015, 2016; Anderson & Anderson, 2009; Soomro & Lai, 2017; Thöni, Madlberger, & Schatten, 2013; Yilmaz & Flouris, 2010). Empirical evidence on the integration of sustainability into risk management of organisations however remains scant and unclear (Subramaniam et al., 2015). Bui and de Villiers (2017) advanced the study in the field by understanding the organizations' risk response strategies towards the environmental risks. Kumarasiri and Gunasekarage (2017) explore the use of management accounting system as a risk management tool in mitigating environmental risks. Zimmer et al. (2017) develops quantitative analytical model to assess and analyse social risks. Giannakis & Papadopoulos (2016) and Rostamzadeh et al., (2018) develops an analytical process for managing sustainable supply chain risk by using risk management.

Although these studies provide valuable insights on specific sustainability risks, the management of sustainability risks is limited to the risk assessment and analysis and risk mitigating in isolated approach. Little attention has been paid to studying the integrated SRM. In addition, previous studies only focus on managing environment risk or social risk. It should be noted that apart from well-established economic or financial risks, companies must also acknowledge the importance of crucially manage sustainability risk with regard to environmental and social issues (Zimmer et al., 2017). As the SRM includes the management of financial, environmental and social risks using risk identification, risk assessment and analysis, risk response and risk monitoring, the lack of a holistic approach to SRM might provide managers with myopic views and an incomplete picture of SRM. Therefore, setting out to shed light on the management of sustainability risks and to apply risk management, this study attempts to investigate the management of sustainability issues using the four components of risk management namely risk identification, risk assessment and analysis, risk response and risk monitoring to form a complete picture of SRM.

The remainder of this paper is organised as follows. Section 2 presents the literature review regarding the sustainability risk management. Section 3 discusses the research methodology. Sections 4 the study's research results of data analysis. The final section provides discussion of results, and conclusions and limitations of the study.

2. Literature Review

2.1. Sustainability risk management

Anderson and Anderson (2009) define sustainability risk management as "sustainability risk management deals with risks emanating from the environmental and corporate social responsibility areas". Yilmaz and Flouris (2010) refer sustainability risk management as an approach used to manage all corporate risks related to social, environmental, and economic aspects. Sustainability risk management is a process which addresses and manages a broad spectrum of unknown and new risks derived from sustainability issues to achieve sustainable value for a long-term survival (Abdul Aziz et al., 2015). Though there are a few definitions of what constitute the SRM, it can be summarised that SRM is a system that includes high-probable and low-probable risks, financial and non-financial risks to be managed in a coherent system to maintain business survival.

A study performed by Harwood and Humby (2008) in supply chain companies highlighted that 20% of the firms viewed sustainability issues as their largest supply chain risk and 25% of the firms required suppliers to adhere to social and ecological standards in order to avoid unnecessary risk to the sustainability of the supply chain. This is because ignorance towards environmental and social issues arise from their business operations may create significant risk to the corporate sustainability (Aziz et al., 2016), as they are likely to encounter problems with regulators, investors or non-governmental organizations which will inflict lasting reputational damage to their business (Lam, 2011). For this reason, Wong (2014) accentuates the need of company to implement a risk management system that include financial and non-financial risks

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for enhancing company's sustainability, whereby the non-financial risks are targeted at addressing company's environment and social risks.

Soomro and Lai (2017) suggest that for a company to implement sustainability risk management, it must incorporate sustainability elements into risk management framework. Risk management framework includes risk identification, risk assessment and analysis, risk response and risk monitoring. These components function as a cycle process to identify and manage all potential risks in a systematic and reliable manner (Bhimani, 2009). By developing such integrated and holistic framework, it is postulated that the company does not only create economic value but also competitive advantage for managing and concerning environmental and social areas (Yilmaz & Flouris, 2010).

Risk identification is the first stage in the process of risk management framework. The aim is to identify and generate a comprehensive list of risks that is specific to the company (de Oliveira et al., 2017). Thus, it is important for the management to understand the company's activities, operating environment, opportunities and threat that they face in attainment of identifying all possible risks (Bharwani & Mathews, 2012). Next, risk assessment and analysis is the process to assess and analyse the probability of occurrence, level of impact and ease of detection of each potential risk that may bring upon company's performance (Giannakis & Papadopoulos, 2016). Risk assessment and analysis are the most important component in risk management framework (Giannakis & Papadopoulos, 2016). This component serves as the basis for making the best possible decision on the strategies and methods to deal with the potential risks (de Oliveira et al., 2017). Only if the company comprehends the causes, sources and consequences of risks, the company can select the most appropriate response. Above all, risk assessment helps in deciding the degree of attention and the level of effort that should be directed towards managing and mitigating different risks in light of their potential impact on the business as a whole (Bharwani & Mathews, 2012).

Risk response is also known as risk mitigation or risk treatment. These terms bear the same meaning of the way organizations respond to the potential risk the organizations encounter. Depending upon the significance and expected impact of the risk, a decision must be made about how the risk will be dealt with. Generally, the strategies to manage risk typically include risk avoidance, risk control, risk sharing, and risk retain. Risk avoidance involves the avoidance of an activity that may lead to exposure to a risk. Risk control, on the other hand, steps can be taken to limit the risks by implementing controls that minimise the adverse impact of a particular risk on the business since complete removal may be impractical or not possible in the case of each risk It involves any attempt to prevent risks through reduction of the probability of a risk event occurring. It may also involve actions to mitigate the consequences (severity) of the risk, or to reduce the probability of a potential consequence to take place. Risk sharing involves when the potential risk cannot be avoided or controlled, it can be mitigated by transferring the risk to a third party through risk financing or purchasing insurance. Risk retain involves the acceptance of the potential damage that will be incurred by the risk event.

Risk monitoring is the final stage involves continuously monitoring the effects of the response strategy to a particular risk, identifying any changes, and then proposing new solutions. The integration of sustainability and risk management is deemed worthwhile for organisations to be able to perceive and evaluate the risks mounting from sustainability issues. Thus, it is essential to understanding the nature of sustainability risks, and the integration of sustainability risks into risk management(Giannakis & Papadopoulos, 2016; Hofmann et al., 2014). The key argument is that if organisations genuinely and proactively adopt SRM, they can achieve "high-quality environmental and social responsibility management" (Anderson and Anderson, 2009).

2.2. Prior literature and theoretical framework

Using risk management framework, Giannakis and Papadopoulos (2016) identified 30 sustainability risks and grouped them into three main categories - environmental, social and economic risks. Hofmann et al. (2014), on the other hand, classified sustainability risks into

social, ecological and ethical risks. Individually, carbon emission, non-compliance with sustainability risk laws and natural disaster dominate the list of most eminent perceived environmental risk, reflecting little noticeable action done by the company (Giannakis and Papadopoulos, 2016). Child labour and unbearable working environment are ranked as the most pressing social risk (Hofmann et al., 2014; Zimmer et al., 2017).

Hofmann et al. (2014) further indicate that sustainability risk provides direct and indirect impact to organization, both may lead damage to the firm. The direct impact is through the boycott or protest by the group of consumers towards company's product. Media and non-government organisations (NGOs) make up the indirect impact to the organisation by monitoring company's environmental and social actions and influencing public perception. Interestingly, although environmental and social risk have higher media exposure and under greater public scrutiny, the result showed that company's priority has been given to environmental and economic risk (Giannakis & Papadopoulos, 2016). This is primarily due to its severity and difficult in detecting social risk, rather than its frequency of occurrence.

Sakhel (2017) grouped the consequences of ignoring the sustainability issues into three main risk categories, namely market risk, physical risk and regulatory risk. Out of these three risk categories, physical risk and market risk are less impactful in the near future compared to regulatory risk. Regulatory risk is assessed as to give major impact to the organisation due to the immediate financial threat it may bring (Kumarasiri & Gunasekarage, 2017). In addition, the regulatory risk, for example the carbon tax (Kumarasiri & Gunasekarage, 2017), new regulation (Sakhel, 2017) and sustainability compliance (Giannakis & Papadopoulos, 2016) would result in substantial increase in operating cost (Bui & de Villiers, 2017) because the company has to reshuffle its operation to suit the new regulations. Clearly, the regulatory risk emerged from sustainability issues would reduce company's earnings and cash flow, substantially, would impact their future investment, financial decision and finally on the market value (Kumarasiri & Gunasekarage, 2017).

This underscores that although market risks less impactful in the near future, it will certainly inflict damage to the company in the long future (Sakhel, 2017). Two highest risks under market risk are reputation and changing customer behaviour. For example, consumer and community are increasingly concerned for the company to be associated and comply with sustainability-related regulation (Rostamzadeh et al., 2018). Company that is found not complying with sustainability-related regulation or not being seen to be doing enough to minimize their sustainability issues as a result of their business activity will encounter damaged image, increased reputation risk, threat to market competitive position (Kumarasiri & Gunasekarage, 2017). Although the causes of financial risks can be normally attributed to poor or mis-informed managerial decisions that result to business disruptions, sustainability risks may trigger intense stakeholder reactions that may have negative consequences for the firm without causing operational disruptions (Giannakis & Papadopoulos, 2016). Hence, sustainability risk management is seen as a source of competitive advantage in term of identifying and managing sustainability risk to lower company's exposure to reputation risk, to enhance competitive position and to increase business survival and performance (Foerstl, Reuter, Hartmann, & Blome, 2010; Gatzert, 2015; Hofmann et al., 2014).

As firm becomes able to identify, assess and analyse a broader scope of sustainability risk, they can use this information to make right decision to appropriately respond to the sustainability risk. The risk response process depends on how firms perceive the level of impact they analysed in previous process (de Oliveira, Marins, Rocha, & Salomon, 2017; Foerstl et al., 2010). In supply chain concept, Foerstl et al. (2010) revealed that companies prefer to retain supplier that is found to not comply with sustainability criteria rather than terminating the relationship. There are also companies that use risk reduction to respond to the non-compliance with sustainability criteria such as putting a minimum compliance threshold of 65% to be met. Blacklist procedure is set to take place first once company does not meet the threshold value, and termination is followed to avoid buying from non-compliant supplier.

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With respect to risk response in textile company, risk prevention and risk mitigation control are the most likely response to be used for dealing with sustainability risks (Giannakis & Papadopoulos, 2016). It is followed by risk reduction, risk share and the least response, risk retain. Risk retain is the lease response to be employed by companies because they do not want to attract potential conflict with other stakeholders, especially environmentalists and media (Foerstl et al., 2010), in order to maintain their reputation and competitive position (Bui & de Villiers, 2017). In fact, most companies implementing measure to reduce sustainability risk is to counter regulatory risk (Sakhel, 2017). Some popular ways to reduce regulatory risk are by using emission reduction target (Kumarasiri & Gunasekarage, 2017), monitoring regulation reform (Bui & de Villiers, 2017), complying with regulation (Giannakis & Papadopoulos, 2016), and integrating strategy with sustainability (Sakhel, 2017). On the other hands, implementing quality management system, establishing control system, and hiring sustainability specialist are some common control responses under risk prevention (Bui & de Villiers, 2017; Giannakis & Papadopoulos, 2016; Kumarasiri & Gunasekarage, 2017).

Discussion above indicates that researchers have documented a series of empirical and scientific way to manage sustainability risks using risk management, including risk identification, risk assessment, risk analysis, risk mitigation, etc. (Bui & de Villiers, 2017; Foerstl et al., 2010; Giannakis & Papadopoulos, 2016; Kumarasiri & Gunasekarage, 2017; Sakhel, 2017). However, the discussion of the studies is limited to the risk management in isolated approach. Little attention has been paid to studying the holistic SRM (Abdul Aziz et al., 2016). In fact, the management of sustainability risk has been solely focusing on environmental risk or social risk (see Sakhel, 2017; Zimmer et al., 2017) with no much discussion on the integrated element of sustainability. Therefore, in setting out to shed light to apply a holistic approach to SRM, this study will integrate four risk management components to form a complete SRM and examine how firms use them to manage sustainability risks in a systematic way. Figure 1 presents the sustainability risk management framework for this study.

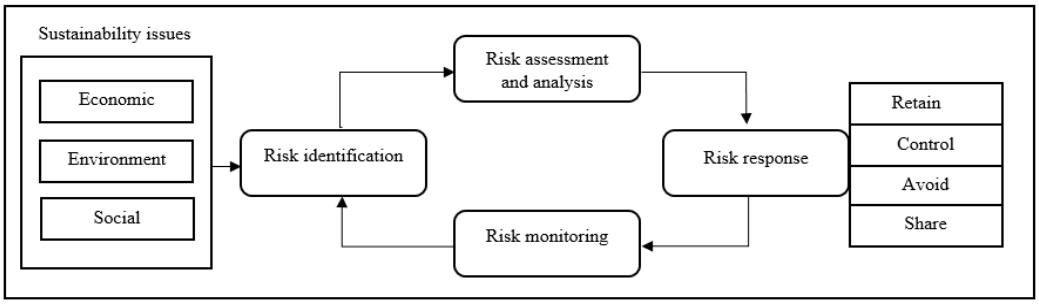

Figure 1: Sustainability Risk Management Framework

3. Methodology

This is an exploratory study where it seeks to gain useful insights about the management of sustainability risk. The research setting for this study is palm oil mills in Malaysia. Palm oil mills are selected because they are the place where basic and main unit of oil palm production and process (crude palm oil) are taken place. On top of that the sustainability certifications and schemes requiring sustainable palm oil to be produced mostly focused on the palm oil mills (MPOB, 2010, p. 7). Hence, it is worthwhile to study the sustainability risk management by focusing on Malaysian palm oil mills. As a preliminary step, palm oil mills located in Johor is the focus of this study since this state is the largest contributions of crude palm oil production in peninsular Malaysia (MPOB, 2019).

3.1. Sample and data collection

A survey using questionnaire was conducted to explore the sustainability risk management in palm oil mills. As at December 2019, there were 63 palm oil mills in Johor, requiring the 56

mills as the sample size. The sample size was determined by referring to table Krejcie and Morgan (1970). The distribution of the questionnaire to the sample was taken place from January to February 2020. Each questionnaire was accompanied by cover letter that explained the objective of the research and assured the recipients of strict confidentiality. Postage-paid and self-addressed reply envelopes were also included to facilitate the respondents to return the completed questionnaire.

3.2. Measurement of SRM

The process of deriving the items to measure SRM includes an extensive literature review in relevant areas of environmental accounting, risk management and sustainability. Sustainability risk management was measured by 36 items divided into three dimensions of sustainability – economics (13 items), environment (13 items) and social (10 items) adapted from Giannakis and Papadopoulos (2016), Hofmann et al. (2014) and Anderson and Anderson (2009). The extracted items were then brought into discussions with experts in palm oil mill operations. Sustainability risk management is represented by four components in risk management namely, risk identification, risk assessment and analysis, risk mitigation and risk monitoring. Based on the 36 items, for risk identification, respondents were asked to identify the extent to which these measurement items are sustainability risks that will affect their mill operation. The extent of sustainability risks is measured on a 7-point Likert scale. For risk assessment and analysis, using the same measurement items, respondents were asked to evaluate the level of severity, probability of occurrence and ease of detection of each potential-risk identified earlier. The respondents were instructed to provide answer based on 7-point Likert. Once sustainability risks have been identified, assessed and analysed, respondents were required to indicate potential risk response for each individual risk. The measure will be derived through four risk response strategies: avoidance, retention, sharing, and control. Finally, risk monitoring, respondents were asked to indicate, using 7-point Likert scale.

3.2. Data analysis

The analysis was steered by the four sequential stages of risk management framework, which include risk identification, risk assessment and analysis, risk mitigation and risk monitoring. Means score was used to analyse risk identifaction and risk monitoring stages. Median score was used to indicate the most risk response strategies used by the mills to respond to the sustainability risks. Finally, Failure Mode Effect Analysis (FMEA) was applied for risk assessment and analysis stage. FMEA is an established technique that can be used to assess, and analyse risks arise in business environment (Giannakis & Papadopoulus, 2016). It can be used to evaluate and measure risk factors in a systematic way, without the need of complex statistical methods. Survey participants were asked to assess the severity (S), probability of occurrence (O) and ease of detection (D) of each risk they identified in risk identification stage.

The important analysis in the FMEA is Risk Priority Number (RPN). Following the and assessment of sustainability risks, FMEA proceeds with risk analysis process by calculating risk index score based on the severity (S), probability of occurrence (O) and ease of detection (D) of each sustainability risk. Multiplication of these components (S*O*D) enables the prioritisation of sustainability risks based on risk priority numbers (RPNi=Si*Pi*Di*, where i=risk factor). The higher the RPN, the greater the risk of that event. Once sustainability risks have been identified, assessed and analysed, the analysis part proceeds with the risk mitigation and risk monitoring (Baynal, Sari, & Akpinar, 2018).

4. Results and Findings

Of 56 questionnaires sent, a total of 19 were returned by the surveyed mills. After further screening process, 6 questionnaires were disregarded due to incomplete, leaving in total 13 usable questionnaire for further analysis. The response rate of 23% is deemed appropriate as this study focuses on to provide preliminary results of SRM practices.

The respondents come from mill managers (46%), assistant managers (38%), safety officer (8%) and certification officer (8%). Majority of the respondents possess bachelor's degree (54%) and the remaining graduated with diploma (46%), indicating that most of the respondents are well educated. In addition, more than 75% of the respondents have been working in the current position for almost 10 years. The results suggest that the managers have vast experience in palm oil mills particularly, and in the industry generally.

Regarding palm oil mills, more than 45% of the surveyed mills is owned by private companies. The remaining mills are owned by government (23.1%) and independent owned (30.8%) respectively. Most of them have been established in the industry for more than 15 years (69.2%). Finally, more than 90% of the surveyed mills are certified Roundtable Sustainable Palm Oil (RSPO) and Malaysian Sustainable Palm Oil (MSPO), and they have been audited at least once a year (100%).

4.1. Risk identification

Table 1 reveals palm oil mills perception of sustainability issues that may expose them to the sustainability risks. As a group, palm oil mill perceive that economic issues are the largest threat to expose them to the sustainability risk (mean=4.793). It is followed by environmental risk (mean=3.740) and social risk (2.892) respectively. This indicate that economic risks are the largest concern of palm oil mills with regard to their survival in the industry.

On individual risk level, price volatility of CPO is seen as the leading economic issues (mean=5.769). When the CPO price is not stable, it may indirectly affect the CPO profit, indicating it as second highest amongst economic issues (mean= 5.692). In addition, introduction of new sustainable palm oil regulation (mean=5.385) and increased duty import for Malaysian CPO are also considered leading issues to the palm oil mills. Admitting the benefits of having sustainable palm oil certifications, as it will enhance Malaysian palm oil reputation by producing sustainable CPO, palm oil mills will have to face additional costs in order to get the certification. This is evidence in the Table 1 as increased production costs is the main issues among palm oil mills (mean=5.539).

Table 1 Risk identification

Sustainability issues	Mean	Std. Dev.
Economics issues		
Increased production costs	5.539	1.0500
Price volatility of crude palm oil (CPO)	5.769	1.2352
Low crude palm oil profit	5.692	1.1821
Low amount of oil extraction rate	4.846	1.6251
Low CPO yield	4.692	1.6013
Low amount of CPO sold	4.923	1.3205
Oil Losses per Fresh Fruit Bunch (FFB)	4.154	1.6756
Surplus of palm oil inventories	4.000	2.0817
Penalties for sustainability related issues	3.615	1.9382
False claim on Malaysian palm oil production and process	3.923	2.0191
Boycott of Malaysian palm oil products	4.692	2.2130
Increased duty import for Malaysian crude palm oil	5.077	1.7541
Introduction of new sustainable palm oil regulation (e.g. MSPO)	5.385	1.3253
Mean	**4.793**	
Environmental issues		
Excessive freshwater consumption	3.692	1.7505
Water pollution due to palm oil waste	4.231	1.6408
Water scarcity in producing palm oil	3.923	1.4979
High percentage of dust concentration (boiler emission)	4.000	1.4720

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Excessive emission of sulphur dioxide SO2	3.846	1.7246
Excessive emission of nitrogen dioxide	3.539	1.6641
Mixed raw effluent	3.385	2.0223
Large amount of solid waste (sludge)	4.154	1.8640
Poor Palm oil mill effluent (POME) treatment	3.615	2.1424
Reduced soil quality due to POME	3.615	2.2927
Non-compliance with environmental laws	3.308	2.0569
Inefficient diesel consumption for palm oil processes	3.692	1.9315
Disruption in palm oil process caused by natural disaster (floods, drought, heatwaves)	3.615	1.8947
Mean	**3.740**	
Social issues		
Unfair wages	2.615	1.9382
Excessive working time	3.231	2.1274
Discrimination on employees' background (race, sex, religion, disability, age, politics)	2.692	2.2130
Poor working condition	2.923	2.2159
Healthy and safe working environment	4.231	2.3150
Occupational poisoning case	2.539	2.0662
Occupational disease case	2.462	2.0255
Land ownership conflict	2.154	1.5730
Threat to wildlife caused by palm oil process	2.769	1.9644
Pandemic	3.308	2.5944
Mean	**2.892**	

Water pollution due to palm oil waste (mean=4.231) is the leading issues in environmental risk. It is followed by large amount of solid waste (sludge) (mean=4.154) and high percentage of dust concentration (boiler emission) (mean=4.000). Waste treatments fill up the top environmental risk due to the fact that the production of palm oil generates large amounts of solid waste such as empty fruit bunches (EFB), fibre and palm shells, palm kernel endocarp, palm kernel press cake and liquid effluent, and palm oil mill effluent (POME). These solid wastes if not properly manage would result to major pollution in the form of reduces freshwater and soil quality, which adversely affects local communities (Abdullah et al., 2017). This indicate that palm oil mills in Malaysia are very concern towards the way they treat palm oil waste as to avoid any unnecessary issues emerged. Nevertheless, it is unsurprising to expose that non-compliance with environmental laws is not considered risk to the palm oil mills. This is because the operations of palm oil mills in Malaysia is highly regulated, the mills need to comply with Hazard & Critical Control Points (HACCP) and Environmental Impact Assessment (EIA) requirements (Jamaluddin et al., 2018).

Regarding the social issues, the highest issue is health and safe working environment (mean=4.231). It is followed by pandemic issue (mean=3.308) and excessive working time (mean=3.231). The unfair wages (mean=2.651), discrimination, and poor working condition (mean=2.923) are not the biggest risks to the palm oil mills because employees' well-being is priority for the mills to achieve target production (Abdullah et al., 2017). Overall, the results suggested that the palm oil mills have recognized the sustainability issues that may expose them to unprecedented sustainability risks but have place less concern towards environment and social risks.

4.2. Risks assessment and analysis

FMEA was employed to provide further analysis for risk assessment and analysis. The purpose of employing FMEA is the analyse and identify the highest potential risk so that removal or mitigation can be taken placed in the most cost-effective manner (Zeng, Tam, & Tam, 2010). Table 2 shows the results of FMEA. Overall, palm oil mills see their operations may have major

effect from sustainability risks (mean=4.234). They indicate that sustainability risks occur occasionally (mean=3.066). Surprisingly, palm oil mills perceive that sustainability risks are moderately easy to be detected (mean= 3.041). This might be due to the fact that they operate in highly regulated industry, in which they just only need to follow the practices or schemes introduced by the government agency likes the Malaysian Palm Oil Board (MPOB) to avoid any unnecessary risks occurred in their operations. With regard to each risk category, economic issues are perceived as having the major negative impact to the palm oil mills (mean=4.787); they occur occasionally (mean=3.840) and quite difficult to detect (mean=3.396). Meanwhile, palm oil mills see their operations have lesser impact compared economic and environmental issues. Although stakeholders such as customers, environmentalist pressure groups as well as the media heavily focus on environmental and social issues, the results show that the perceived priority numbers of economic and environmental risks are higher, indicating the fact that companies are still focusing on economic risks.

On the individual risk level, increased duty import (RPN=82.792), boycott of Malaysian palm oil (RPN=75.831), introduction of new regulation (RPN=79.581), lower CPO profit (RPN=74.570) and price volatility of CPO (RPN=69.694) dominate the list of the most eminent perceived risks under economic issues. This reveals that the respondents underscore the distressing effect of having strict regulations, particularly from the importing countries, as it can be damaging to the reputation of Malaysia as a top two palm oil producer which may cause a snowball effect to other countries to follow. In fact, one of the reasons for price volatility and lower CPO profit is trade pressure resulting from importing countries regulations.

Among environmental issues, water pollution due to palm oil waste (RPN=61.194), high percentage of dust concentration (boiler emission) (RPN=46.112), poor palm oil mill effluent (POME) treatment (RPN=38.138), excessive emission of sulphur dioxide SO2 (RPN=37.801), large amount of solid waste (sludge) (RPN=35.787) are perceived to have major impact on palm oil mills operations, reflecting the need to mitigate the issues of waste treatment and gas emission properly to avoid becoming a source of major pollution to the environment and society where the palm oil mill operates.

Finally, excessive working time (RPN=29.261) is ranked the most impactful social risk. It is followed by health and safe working environment (29.094), occupational disease case (28.829) and poor working condition (RPN=28.314). This highlight the increasing awareness of social equality, work-life balance and conducive working environment among the employees, requiring palm oil mills to draw effective measures to deal with these social issues.

Table 2 Risk assessment and analysis

Sustainability issues	Severity	Occurrence	Detectability	RPN (S*O*D)
Environmental issues				
Increased production costs	4.846	4.308	3.231	67.446
Price volatility of crude palm oil (CPO)	5.077	4.462	3.077	69.694
Low crude palm oil profit	5.154	4.539	3.231	75.570
Low amount of oil extraction rate	4.846	3.615	3.000	52.563
Low CPO yield	4.846	3.615	3.000	52.563
Low amount of CPO sold	4.846	3.846	3.462	64.520
Oil Losses per Fresh Fruit Bunch (FFB)	4.308	3.615	3.308	51.514
Surplus of palm oil inventories	4.000	3.769	3.077	46.390
Penalties for sustainability related issues	4.231	2.615	3.692	40.856
False claim on Malaysian palm oil production and process	5.000	3.077	3.615	55.621

Boycott of Malaysian palm oil products	5.231	3.846	3.769	75.831
Increased duty import for Malaysian crude palm oil	5.077	4.000	4.077	82.792
Introduction of new sustainable palm oil regulation (e.g. MSPO)	4.769	4.615	3.615	79.581
Mean	**4.787**	**3.840**	**3.396**	**62.438**
Environmental issues				
Excessive freshwater consumption	3.615	3.000	3.000	32.539
Water pollution due to palm oil waste	4.462	4.692	2.923	61.194
Water scarcity in producing palm oil	4.231	3.000	2.615	33.196
High percentage of dust concentration (boiler emission)	4.769	2.923	3.308	46.112
Excessive emission of sulphur dioxide SO2	4.385	2.385	3.615	37.801
Excessive emission of nitrogen dioxide	4.077	2.308	3.462	32.567
Mixed raw effluent	3.923	2.308	2.539	22.982
Large amount of solid waste (sludge)	4.308	3.000	2.769	35.787
Poor Palm oil mill effluent (POME) treatment	4.385	2.692	3.231	38.138
Reduced soil quality due to POME	4.077	2.385	3.231	31.409
Non-compliance with environmental laws	4.077	2.846	2.462	28.562
Inefficient diesel consumption for palm oil processes	4.077	2.923	2.692	32.085
Disruption in palm oil process caused by natural disaster (floods, drought, heatwaves)	4.000	3.077	2.615	32.189
Mean	**4.183**	**2.888**	**2.959**	**35.740**
Social issues				
Unfair wages	3.769	2.231	2.385	20.051
Excessive working time	3.769	3.154	2.462	29.261
Discrimination on employees' background (race, sex, religion, disability, age, politics)	3.462	2.385	2.462	20.318
Poor working condition	3.692	2.769	2.769	28.314
Healthy and safe working environment	3.615	3.077	2.615	29.094
Occupational poisoning case	3.769	1.846	3.000	20.876
Occupational disease case	4.000	2.231	3.231	28.829
Land ownership conflict	3.615	1.846	3.077	20.538
Threat to wildlife caused by palm oil process	3.846	2.385	3.077	28.220
Pandemic from palm oil process	3.769	2.769	2.615	27.299
Mean	**3.731**	**2.469**	**2.769**	
Mean overall	**4.234**	**3.066**	**3.041**	

4.3. Risks response

Risk response is the process of proposing mitigation strategies to deal with each risk factors assessed and analysed in the previous stage. The respondents were asked to indicate decisions

and actions that they would take to deal with the risks by referring to the four broad risk mitigation strategies which are avoid, control, share and, retain. The results reveal that across four risk categories, risk control and risk avoidance are the most likely mitigation strategies to be employed by the surveyed palm oil mills to deal with sustainability risks. Interestingly, the results show that the most palm oil mills implement risk control and risk avoidance to mitigate environmental and social risks while risk acceptance and risk control dominate the way palm oil mills deal with financial risks.

Reflecting the growing importance of environmental risks, some control and avoid measurements taken by palm oil mills, for example to deal with non-compliance to environmental laws, are complying with sustainable certification such as RSPO and biofuel certification such as International Sustainability and Carbon Certification (ISCC). Recently, MSPO has been introduced in response to a request by various stakeholder for palm oil industry to meet the sustainability criteria. More than 90% of the surveyed palm oil mills is certified by RSPO and MSPO, proving that they are committed to avoid risk from non-compliance with environmental laws. In fact, MPOB also provide assistant to the palm oil mills by launching MPOB Code of Practice (COP) with the objective to ensure the quality of sustainable palm production processes. For example, palm oil mills must ensure that boiler emission and palm oil mill effluent to meet department of environment (DOE) limits all the time in order to avoid risk from waste treatment and gas emission issues. Other than that, the controlling of waste treatment also moves to new direction where there are trends towards installation of zero waste and zero emission systems in mills. It is the investment in new environmental-friendly technologies that can convert waste to wealth (Sustainability Manual, 2015).

Palm oils mills are committed to ensure the social equality of their employees to avoid and control risk arising from social issues. To control and avoid risk that may arise from health and safety working environment (RPN=29.094; 1st ranked), the palm oil mills has established an occupational safety and health Standard Operating Procedure (SPO). The SOP includes an adequate personal protective equipment (PPE) at the workplace to cover all potential risk, appropriate trainings for employees who exposed to pesticides, first aid kit equipped with approved contents, to name a few. In addition, the discrimination on employee's background and unfair wages are not considered a major risk is because palm oil mills have to follow legal and industry standards like labour act where they need to provide equal opportunity and treatment to all employees and to provide discretionary income based on the minimum wages.

With regard to financial risk, most of the mitigation strategies taken by the palm oil mills are risk retention. For example, the palm oil mills have to accept the risk arises from increased duty import or introduction of new sustainability standard as they must follow to ensure their survival. The strict regulation from importing countries and the increasing pressure from various stakeholder that demand sustainable palm oil production are out of palm oil mills' control. Thus, palm oil mills mainly realize that investing towards sustainability certification may help them to tackle to encounter the threat from financial risk.

4.4. Risk monitoring

This is the final stage in risk management framework. The purpose of risk monitoring is to all necessary steps in the previous stages have been correctly taken place. The results in Table 3 indicate that monitoring process has been implemented in the palm oil mills to identify potential risks, to assess and analysis their impact to business operations and to provide adequate and proper response for each of the risk. In addition, the processes of sustainable palm oil in the palm oil mills have been monitored and assessed by internal audit and external assessor.

Table 3 Risk monitoring

Monitoring process	Mean	Std. Dev.
My mill always assesses the occurrence of sustainability issues by implementing monitoring process.	5.769	1.301

My mill always assesses the impact of sustainability by implementing monitoring process.	5.692	1.182
My mill continuously monitored the mitigation strategies in dealing with sustainability issues.	5.539	1.127
There is a specialized monitoring group in my mill.	5.154	1.818
The effectiveness of monitoring process of sustainability issues is assessed by the internal audit function.	5.692	1.250
The effectiveness of monitoring process of sustainability issues is assessed by the external assessor.	5.462	1.853

5. Conclusion

The objective of this study is to provide useful insights on the management of sustainability by using risk management framework that includes risk identification, risk assessment and analysis, risk response, and risk monitoring. A list of thirty-six sub sustainability issues has been proposed and classified into three main sustainability categories, which are economic, environment and social. The findings reveal that palm oil mills perceived economic issues are the leading risk that may threaten companies' survival, followed by environment and social issues. In addition, using FMEA, sustainability issues have been assessed to have major impact to palm oil mills operation, to occur occasionally and to moderately easy to be detected. Across all sustainability issues, most of surveyed palm oil mills implement risk control and risk avoidance as a risk response strategy to counter the possible sustainability risk. Finally, palm oil mills have a clear risk monitoring process to monitor the process of identification, assessment, analysis and mitigation of sustainability issues in their business operation as to avoid facing any business risks. Overall, the findings show that the use of risk management framework can facilitate the palm oil mills to manage and identify high and low-sustainability areas in their production of sustainable palm oil.

This study contributes to the literature discussion on the management of sustainability risk from risk management perspective. Previous studies particularly focused on the conceptual and theoretical explanation of SRM. With this perspective, this study advances the literature by establishing that sustainability risk can be identified and assessed. The appropriate risk mitigation strategies could be implemented to tackle those sustainability risk. Finally, monitoring process can be done to ensure necessary steps have been done throughout the risk management process. This results also open-up avenue to propose the factors that may influence the effective sustainability risk management practices. In addition, this study also contributes to the sustainability and risk management literature by integrating the four risk management processes into a complete process. Previous studies have only applied certain risk management processes. By focusing on certain processes, it provides limited scope and offers incomplete picture of the whole. As a result, this study provides useful insights on the overall perspective of the four risk management processes. The findings have managerial implications for managing sustainability issues that may lead to sustainability risks. The findings recommend that palm oil mills can use risk management to minimize the impact of sustainability issues as a results of palm oil production and processes. FMEA is one of the management tools that can assist firm to manage those risk because FMEA a systematic way, without the need of complex statistical methods. In addition, the findings reveal that internal sustainability issues have been identified to have major impact of the business operations.

The findings of this study need to be interpreted in view of several limitations that can be overcome with future research. First, the thirty-six categories of sustainability issues should not be considered as a comprehensive list. The exposure of sustainability issues may differ across companies although they come from similar industry. This has led different companies to have way of risk identification, risk assessment, risk response and risk monitoring towards managing sustainability risk. The effective sustainability risk management may be influenced by and dependent on the internal and external factors where the company operates. Thus, future research

can include any other necessary sustainability issues to reflect the company's operation. In addition, studies can also be conducted to understand the factors that may influence company to implement SRM. Second, the findings of this study are based on a relatively small sample size deriving from three largest producers of oil in Malaysia. As a result of the sample selection, the findings do not represent information from palm oil mills in Malaysia as a whole. Thus, the sample composition may restrict the generalization of this study. For that reason, the results of risk identification, risk assessment and analysis, risk response and risk monitoring should not be generalized to the whole palm oil mills sector, as the level of severity, frequency of occurrence and level of detectability of risks are likely to be unique for a single mill. This is the area of future research could utilize by expending the number of sample size that will represent the overall palm oil mills.

In conclusion, the management of sustainability issues using risk management framework assists firms to identify, assess, analyse, response and monitor the sustainability issues that may expose them to the emerging sustainability risks, including regulatory risk, market risk, boycott risk, social justice risk and reputational risk. Current risk management failed to evaluate and identify those risks which inevitably resulted in operational surprises to the company and place the company survival at risk. SRM is an approach which manages a broad spectrum of emerging risks and financial and non-financial risks arising from sustainability issues for corporate survival. Hence, academics and practitioners would benefit from studies that investigate sustainability risk management topics.

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