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Article

Climate Risk Preparedness: A Survey of Takaful Operators in Malaysia

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ABSTRACT - This study explores the readiness of takaful operators in Malaysia and investigates the challenges and opportunities associated with incorporating climate parameters into their existing risk management frameworks. Survey findings indicate a widespread recognition among respondents of the importance of climate risk assessment for takaful operations while revealing a neutral stance on the efficacy of current risk management strategies in addressing unforeseen climate-related risks. Critical impediments identified include internal data deficiencies, skills gaps within the workforce, and regulatory constraints concerning climate risk adaptation. In addition, respondents notably favour direct climate-specific metrics, such as flood models and rainfall intensity, for quantifying climate impacts. These results underscore the pressing need for Malaysian takaful operators to integrate climate risk parameters into their frameworks, reflecting an increasing acknowledgment of climate-related financial risks. Recommendations include enhancing data collection and analysis capabilities, bolstering workforce proficiency in climate risk assessment, and fostering partnerships to innovate risk management tools and practices. The study holds significant implications for policymakers and stakeholders seeking to fortify resilience and sustainability within the takaful industry amidst evolving climate dynamics.

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Climate change, Climate risk, Malaysia, Risk management, Takaful.

INTRODUCTION

Addressing climate change exposure is critical for the stability of businesses and organisations worldwide (World Economic Forum, 2024), and takaful operators are no exception. To effectively manage this challenge, takaful operators must incorporate climate risks into their financial models and business decisions. This includes integrating climate risk parameters for prudent pricing of takaful products, considering potential future costs of climate change impacts. More specifically, the pricing of takaful products should reflect the cost of carbon emissions and the expenses associated with adapting to climate change impacts. In addition, conducting stress test assessments is another crucial strategy. These assessments enable takaful operators to evaluate their resilience and solvency in the face of climate-related shocks. By incorporating climate risks into stress-test scenarios, takaful operators can gain a more real-time understanding of potential losses they might face in a changing climate.

For takaful operators in Malaysia, integrating climate risk parameters into their business models is not just a strategic imperative but a necessity to ensure the country's resilience in the face of escalating environmental uncertainties. In December 2021, Malaysia was hit by the worst-ever flood in the nation's modern history. More than 400,000 people were affected and displaced

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across multiple states, and it is estimated that the economic losses were between RM5.3 billion and RM6.5 billion (Bernama, 2022). Of the losses, insurance and takaful providers in Malaysia only covered between RM1.5 billion and RM2.0 billion, or between 20% and 30% (Olano, 2022).

The climate profile of Malaysia is characterised by a tropical rainforest climate, with an annual mean temperature of 24.5 degrees Celsius (Kardooni et al*.,* 2018). The country experiences high precipitation levels, with an average monthly precipitation of 3085.5 mm. Malaysia is vulnerable to various climate-related hazards, including floods, coastal floods, epidemics, droughts, and tsunamis. The country's vulnerability to these hazards is reflected in its Risk Index, which was recorded at 3.4 in 2022 and is predicted to increase to 3.5 and 3.6 in 2050 and 2080, respectively (Madnor et al*.,* 2024). These climate characteristics underscore the critical need for Malaysian takaful operators to integrate climate change mitigation and adaptation into their governance and controls to effectively monitor and address the risks posed by climate hazards, ensuring resilience and long-term sustainability. This is parallel with the directives from Bank Negara Malaysia (BNM), which urge financial institutions to respond to climate risks (BNM, 2022) adequately.

However, the takaful industry in Malaysia is still in the nascent stages of understanding and managing climate-related risks. As highlighted by Ernst & Young (2020), Malaysian publicly listed companies exhibit limited focus on climate risk reporting, lack detailed climate risk management strategies, and do not incorporate climate risk into their scenario analyses. For many financial institutions, including takaful operators, climate risk remains uncharted territory compared to traditional risk management practices. The slow adoption of climate risk management indicates that takaful operators in Malaysia are not taking sufficiently bold actions. Most operators are not innovating with takaful products that promote Environmental, Social, and Governance (ESG) principles, suggesting a cautious approach as they wait to see who will pioneer these efforts. For instance, green products like motor takaful specifically designed for Electric Vehicles (EVs) are almost nonexistent in the market. Etiqa Takaful, as of today, is the only Malaysian takaful operator adhering to the United Nations' Principles for Sustainable Insurance (PSI) under the UN Environment Programme Finance Initiative (UNEP FI). In contrast, many other takaful operators may have a limited understanding of the potential impact of climate risks on their business operations.

Admittedly, estimating the impact of climate risks can be costly and time-consuming, often beyond the expertise of some takaful operators. Unlike large insurance companies with global operations, takaful operators may not have the resources or expertise for in-depth research and analysis in this area (Klynveld Peat Marwick Goerdeler, 2023). Climate risks are complex and multifaceted, requiring a high level of technical expertise to understand fully. The complexity of climate risk involves various contributing factors and the intricate relationships between these hazards (Simpson et al*.,* 2021). Note that climate change risks can stem from the potential consequences and the actions taken in response. These hazards may be compounded or cascade, posing challenges for assessment and effective management. Furthermore, the hazards associated with climate change are influenced by interconnected physical, ecological, social, and economic elements, which vary across sectors and geographies.

Despite these constraints, takaful operators face mounting regulatory pressure to explore and manage climate risks. Regulators increasingly recognise the critical importance of climate risk management in the financial sector and mandate that takaful operators demonstrate their capability to manage these risks effectively. Nevertheless, there is a conspicuous gap in the literature concerning the readiness of takaful operators in Malaysia to adopt climate risk parameters in their operations. To date, no prior studies have attempted to explore or evaluate the preparedness of Malaysian takaful operators to implement climate risk management practices. This lack of research hampers the ability to understand the current state of readiness, identify barriers, and develop targeted strategies to enhance the adoption of climate risk parameters within the takaful industry. This study aims to address this gap by surveying takaful operators in Malaysia, inquiring about their readiness, and gathering insights into the opportunities and challenges they face in integrating

climate risk management into their business models.

Our findings underscore a growing recognition among takaful operators of the imperative to align their risk management protocols with the pervasive influence of climate risks. However, they face significant challenges in this endeavour, including the complexity of climate risk parameters, the lack of credible data, and a shortage of skilled personnel. Despite these obstacles, there is a notable shift towards embracing more holistic and forward-thinking risk management paradigms that account for the complex impacts of climate change. This approach aims to enhance organisational resilience and sustainability for takaful operators amid evolving environmental uncertainties.

The remainder of this article is structured in the following way. Section 2 reviews the literature on the development of the takaful industry in Malaysia. Subsequently, Section 3 explains the methodology and sample that participated in the survey. Section 4 discusses the results of the survey. Meanwhile, Section 5 concludes the paper.

LITERATURE REVIEW

Development of the Malaysian takaful industry

The development of the takaful industry in Malaysia began in the early 1980s, driven by the need for a Shariah-compliant alternative to conventional insurance (Sherif & Shaairi, 2013; Sharifuddin et al*.,* 2016). This initiative aligned with the Malaysian National Fatwa, which declared conventional insurance haram due to elements prohibited in Islam, such as extreme uncertainty and investments in unethical activities. Consequently, Syarikat Takaful Malaysia Sdn Bhd was established to provide insurance solutions that conform to Islamic religious beliefs and principles (Husin & Rahman, 2013). The company has since grown and expanded, becoming one of the leading takaful providers in the country.

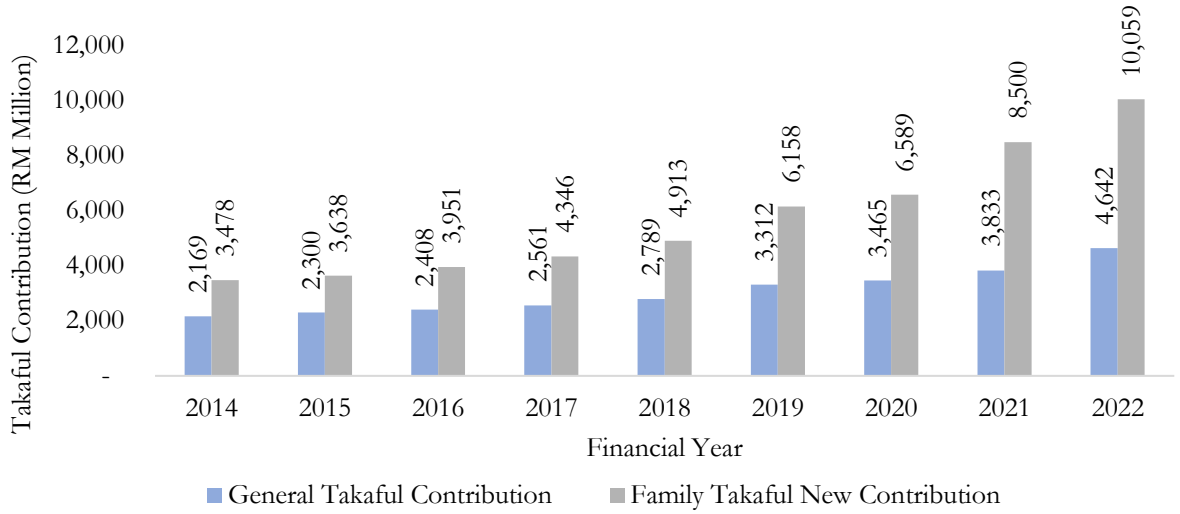
Nearly 40 years since its inception, the takaful market in Malaysia has evolved into a vital component of the Islamic financial sector (Hassan et al*.,* 2018; Nasir et al*.,* 2023). As of May 2023, Malaysia hosts 15 takaful operators offering general and family takaful products. Table 1 below lists the registered takaful operators in Malaysia and their respective business areas.

Table 1: List of takaful companies in Malaysia

No.	Company Name	Business Nature
1	Zurich Takaful Malaysia Berhad	Family Takaful
2	Zurich General Takaful Malaysia Berhad	General Takaful
3	Takaful Ikhlas General Berhad	General Takaful
4	Takaful Ikhlas Family Berhad	Family Takaful
5	Syarikat Takaful Malaysia Keluarga Berhad	Family Takaful
6	Syarikat Takaful Malaysia Am Berhad	General Takaful
7	Sun Life Malaysia Takaful Berhad	Family Takaful
8	Prudential BSN Takaful Berhad	Family Takaful
9	Hong Leong MSIG Takaful Berhad	Family Takaful
10	Great Eastern Takaful Berhad	Family Takaful
11	FWD Takaful Berhad	Family Takaful
12	Etiqa General Takaful Berhad	General Takaful
13	Etiqa Family Takaful Berhad	Family Takaful
14	AmMetLife Takaful Berhad	Family Takaful
15	AIA PUBLIC Takaful Berhad	Family Takaful

Source: BNM (2023).

Regarding business growth, the takaful industry has steadily gained traction over the years, with increasing public acceptance, as illustrated in Figure 1 below. Contributions to general and family takaful grew significantly, from RM2.17 trillion and RM3.48 trillion in 2014 to RM4.64 trillion and RM10.06 trillion in 2022, respectively. This represents a growth of approximately 114% for general takaful and 189% for family takaful over the nine years.



Source: ISM Statistical Yearbook Insurance & Takaful

Figure 1: Takaful contribution in Malaysia, 2014-2022

Despite the rapid growth of the takaful business in Malaysia, the takaful market is considerably still small compared to the overall insurance market. As reported by Faizalhaini (2023) on the Malaysian Takaful Association's website, at the end of 2022, the market share of general takaful and family takaful were 21.2% and 18.3%, respectively.

Risk management in takaful

With the growth of and risks associated with takaful continuously emerging in Malaysia, the Risk-Based Capital (RBC) framework was introduced as part of a broader initiative to enhance the robustness and resilience of the financial sector. RBC was first implemented for conventional insurers in 2009 and later extended to takaful operators in 2014, incorporating considerations for Islamic financial principles to replace the minimum solvency requirement that came into effect in 2006 (Yusof et al., 2015). The framework ensures that insurers and takaful operators maintain adequate capital levels to meet their obligations and withstand financial shocks. This regulatory approach aligns capital requirements with an individual company's risk profile, considering various risk factors such as underwriting, market, credit, and operational risks.

Despite its benefits, the RBC framework has faced challenges, particularly in addressing the risks associated with takaful operations and the evolving landscape of climate change and sustainability risks. A study by Yusof et al. (2016) highlighted the need to improve the RBC framework, especially in addressing major risk types such as catastrophe and liquidity risks. This should also extend to climate risks.

With the current RBC regime not accounting for the specific risks posed by climate change, integrating climate change considerations into risk management practices remains underdeveloped. Financial institutions, including takaful operators, are increasingly aware of climate risks. However, many have yet to develop comprehensive strategies to address them (Zulfaka & Kassim, 2021). The study also recommended that financial institutions, including takaful operators, begin hiring dedicated teams to manage the financial risks arising from climate change.

One area of research focuses on the real estate sector, where climate change is expected to lead to increased variability in rainfall, temperature, and other natural disaster risks, posing threats of property damage and rising repair costs (Shahid et al., 2017). These findings underscore the importance of insurance companies developing robust risk management strategies that account for climate-related variables. Nevertheless, many takaful operators have yet to comprehensively incorporate these elements into their risk management frameworks, even though general employees surveyed in financial institutions exhibit a high level of awareness regarding climate change, acknowledge its impacts and perceive it as an immediate concern due to its link to financial risks (Zulfaka & Kassim, 2021). Climate-related events such as floods and droughts are expected to increase in frequency and severity, affecting the financial performance of insurers and the overall economic stability of the region (Shahid et al., 2017). Despite this, research specifically targeting the impact of climate change on the insurance and takaful industries in Malaysia remains limited.

Climate risk management landscape in Malaysia

In December 2022, BNM (2022) published a Policy Document on Climate Risk Management and Scenario Analysis (CRMSA), marking a crucial milestone in the financial sector's efforts to bolster resilience against climate-related risks and facilitate a seamless transition to a low-carbon economy. This landmark document establishes a comprehensive framework encompassing essential principles and regulations to govern the operations of financial institutions in Malaysia. Recognizing the urgency of addressing climate risks, the policy employs a phased implementation strategy, with specific components taking effect immediately upon issuance. Full compliance, including scenario analysis and disclosure requirements, is mandated by December 31, 2024, granting financial institutions sufficient time to adapt and develop the necessary capacity for effective implementation.

The policy underscores the importance of robust governance, requiring financial entities to delineate clear roles and responsibilities within their organisational structures to manage climate risks effectively. Furthermore, it advocates for integrating climate risks into financial institutions' overarching business strategy and risk management framework, fostering a comprehensive approach to addressing potential threats and capitalizing on opportunities arising from climate-related developments.

More recently, BNM also published a discussion paper outlining a comprehensive framework and methodology for conducting an industry-wide Climate Risk Stress Testing (CRST) exercise in February 2024. This exercise aims to evaluate the resilience of Malaysian financial institutions, including licensed banks, investment banks, Islamic banks, prescribed development financial institutions, takaful operators, and licensed insurers, to both physical and transition risks from various climate scenarios. By implementing this CRST exercise, BNM seeks to enhance the financial sector's understanding of potential climate-related risks and ensure the stability and sustainability of Malaysia's financial landscape.

The key requirements under the CRMSA

The CRMSA mandates effective oversight by the Board and Senior Management concerning climate risk resilience, constituting a critical requirement for organisational governance within the financial sector. This oversight entails establishing robust mechanisms for identifying, assessing, and mitigating climate-related risks, ensuring that financial institutions dedicate adequate attention to enhancing resilience against environmental uncertainties.

Additionally, financial institutions are expected to integrate climate-related risks into their business strategies, which is essential for informed decision-making amidst the transition towards a low-carbon economy. Institutions must carefully consider these risks alongside traditional business considerations, aligning their strategic objectives with broader sustainability imperatives.

Continuous investment in technical and data capabilities is indispensable for comprehensively reporting material climate-related risks. Financial institutions must leverage

advanced analytics and data-driven insights to identify and evaluate climate risks effectively, enhancing their capacity to report these risks with scenario analysis, which is currently underutilised (Ernst & Young, 2020).

Furthermore, financial institutions are required to provide comprehensive and reliable disclosures to ensure stakeholder awareness and confidence in their practices for managing climate-related risks and opportunities. Transparent communication regarding the organisation's climate risk management strategies and initiatives is essential, fostering trust and accountability and enhancing stakeholder engagement and support.

The imperative of CRMSA for Takaful operators

CRMSA ought to be an essential component of the overall risk management of financial institutions, including takaful operators, for several compelling reasons.

First, the CRMSA framework is instrumental in strengthening the resilience of financial institutions. By effectively managing climate risks, takaful companies can bolster their ability to withstand and recover from disruptions to their operations, assets, and investments. This resilience is crucial for meeting future obligations to takaful participants.

Second, adherence to climate risk management guidelines and the conduct of scenario analyses are vital for ensuring regulatory compliance. By aligning with evolving regulatory requirements and industry standards, takaful operators can demonstrate their preparedness to navigate the increasingly stringent regulatory landscape concerning climate-related risks.

Third, CRMSA enables takaful companies to make strategic decisions based on their risk appetite and business objectives. Understanding and analysing climate risks, particularly through scenario analysis, empowers institutions to anticipate and respond proactively to emerging challenges and opportunities (Schäfer et al*.,* 2019; Taylor, 2023). This is especially important in transitioning towards a low-carbon economy and aligning with national climate goals.

Fourth, transparent disclosure of climate-related risks and proactive risk management measures can enhance stakeholder confidence. By openly communicating the potential impacts of climate change and the steps taken to mitigate associated risks, takaful operators can cultivate trust and credibility among stakeholders, including investors, customers, and regulators. This transparency reinforces their commitment to sustainability and responsible business practices.

Lastly, integrating climate risk management into business strategies is imperative for ensuring long-term sustainability (Thistlethwaite & Wood, 2018). By systematically identifying and mitigating risks associated with climate change, takaful operators can safeguard their financial stability and resilience, contributing to a more sustainable future for the institution and the broader economy.

METHODOLOGY

This study adopts a qualitative and exploratory approach, focusing on understanding climate risk management practices within takaful operators in Malaysia. The study utilises survey questionnaires to gather comprehensive insights into various aspects of respondents' perceptions and understanding of risk management and climate risks in the takaful industry. The list of the questions is provided in **Appendix 1**.

The questionnaire is designed to elicit detailed information about the respondents' professional backgrounds, including their roles and affiliations within the takaful sector in Malaysia. This approach enables the segmentation of responses based on organisational hierarchies and areas of expertise, facilitating a nuanced analysis of how different demographic factors may influence perceptions of risk management and climate risks within takaful operators.

Furthermore, the questionnaire includes inquiries into the respondents' years of experience in the takaful industry, providing valuable context regarding the level of expertise and tenure within the sampled population. By categorizing respondents based on their duration of professional

experience, the study aims to identify potential correlations between tenure and perceptions of risk management and climate risks. This shed light on the role of experience in shaping individuals' perspectives within the takaful sector.

Additionally, the questionnaire contains items to assess respondents' understanding of risk management principles and climate risks specific to the takaful industry. These inquiries seek to gauge the depth of knowledge and awareness among respondents regarding the theoretical underpinnings and practical implications of risk management practices and climate-related challenges within the context of takaful operations in Malaysia.

Moreover, respondents are invited to share their views on climate risk management within takaful operators in Malaysia, providing insights into diverse opinions, perspectives, and priorities regarding the industry's approach to addressing climate-related risks. This questionnaire section aims to uncover perceived strengths, weaknesses, opportunities, and threats associated with current climate risk management strategies and initiatives within the takaful sector.

The questionnaire also incorporates an open-ended format, encouraging respondents to articulate their opinions, concerns, and suggestions regarding risk management and climate risks specific to the takaful industry. This qualitative component allows for exploring nuanced viewpoints and identifying emerging themes or issues that may not be captured through closed-ended questions alone. By soliciting in-depth responses from participants, the study aims to enrich its findings and generate actionable insights for enhancing risk management and climate resilience efforts within takaful operators in Malaysia.

The survey respondents are limited to individuals with working experience in risk management in Malaysia's takaful operators. This targeted approach ensures that the survey captures insights and perspectives specifically related to risk management and climate resilience within the takaful industry in Malaysia. In total, 67 respondents from 12 takaful operators participated in the survey. The majority of respondents (82%) have more than five years of experience in the takaful industry. Notably, over 50% of the respondents occupy positions of Assistant Manager or higher, indicating a predominantly senior and managerial-level representation within the sample.

RESULT

Climate risk awareness

Are you familiar with information related to climate risk?

One of the focal points of the survey pertains to respondents' awareness of climate risk within the context of takaful operators. The participants were presented with a range of options to gauge their familiarity, including "Yes," "No," and "Maybe." The findings presented in Table 2 reveal that a significant majority, comprising 76% of the respondents, indicated familiarity with or previous access to information regarding climate risk. This statistic implies a substantial awareness among the surveyed Takaful practitioners concerning the potential impacts and implications of climate-related factors on their respective organisations.

Additionally, a notable proportion, constituting 21% of the respondents, expressed uncertainty, suggesting that they may have heard about climate risks but lack definitive knowledge or familiarity. This indicates a degree of ambiguity or variability in the extent of understanding among this segment of the respondents.

In contrast, a negligible minority, approximately 3% of the respondents, reported no prior exposure or awareness of climate risks. Meanwhile, this segment is small, but it warrants attention as it highlights a potential gap in knowledge or information dissemination regarding climate-related issues within certain takaful operators.

Table 2: Respondents' designation and their familiarity with climate risk topics

Designation	Yes	No	Maybe
Executive/Senior Executive	11	1	4
Asst. Manager/Manager	13	1	2
Middle Management (e.g., Head of Department/Senior Manager, Head of Unit, etc.)	16	0	5
Senior Management (e.g., Chief, Vice President, Head of Division, etc.)	10	0	3
Wealth Planning Director	1	0	0
Total (Number)	51	2	14
Total (Percentage)	76%	3%	21%

Do you have experience performing risk management tasks pertaining to climate?

In addition to gauging their awareness of climate risks, respondents were further prompted to indicate their current involvement in risk analysis, risk management, or activities associated with climate risk mitigation and adaptation. Analysis of the responses reveals a notable level of engagement among Malaysian takaful practitioners.

Specifically, as shown in Figure 2, 64% of respondents affirmed their active involvement, either directly or indirectly, in endeavours related to the study of climate risks. This finding underscores a significant proportion of individuals within the sample who are directly engaged with or affected by climate risk-related initiatives within their professional capacities.

Further delineation of this subset reveals that among those who responded affirmatively, 10% are directly involved in the study of climate risks, indicating a hands-on approach to analysing and addressing these issues within their roles. Conversely, the majority, constituting 54% of respondents, are indirectly associated with climate risk study activities, suggesting a broader organisational involvement or tangential engagement with climate risk-related tasks.

However, a notable segment of respondents exhibited uncertainty regarding their involvement, as evidenced by their selection of responses such as "sometimes" or "maybe." This subgroup, comprising 30% of the respondents, reflects a degree of ambiguity or variability in the extent of their participation in climate risk-related endeavours, suggesting a need for further clarification or assessment of their roles within the context of such initiatives.

In addition, a minority segment, comprising 6% of respondents, explicitly stated their lack of involvement in climate risk study activities. Other than that, this cohort is relatively small. Their acknowledgment of non-involvement underscores the importance of recognizing varying degrees of engagement and expertise within the takaful industry in Malaysia.

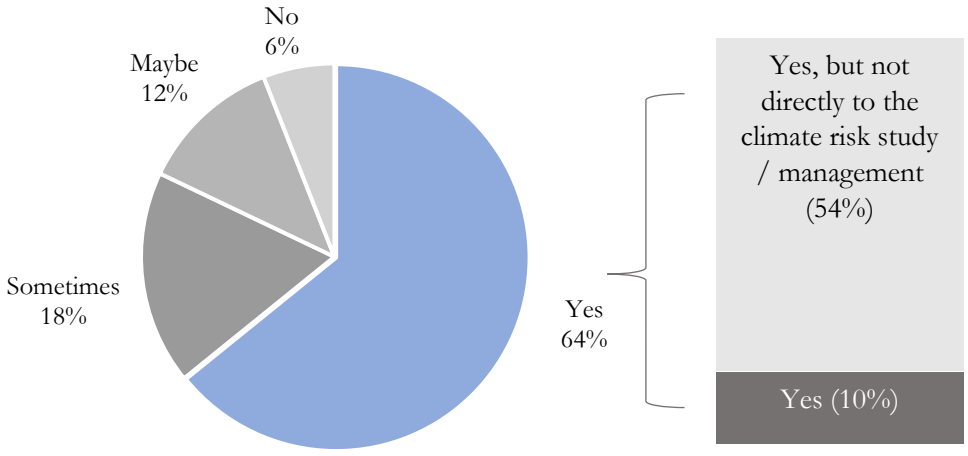


Figure 2: Respondent's exposure to tasks related to managing climate risks

Importance and effectiveness in measuring and addressing of climate-related risks

In your opinion, how important is incorporating climate risk parameters into risk management for a takaful company?

Our findings shed light on the importance of incorporating climate risk criteria into risk management in takaful operators. A substantial majority of survey participants, totalling 85% of the participants in the survey, acknowledged the significance of integrating climate risk parameters into their risk management policies and practices, emphasizing that it was either "important" or "very important," as illustrated in Figure 3. This is in line with the work of Jewson et al. (2023), which suggests that the relevance of climate risk management lies in its ability to furnish a thorough dataset that precisely measures the repercussions of climate change on river floods and the resulting destruction in Europe. Their findings assist insurers in modifying their flood risk models, enhancing their ability to manage and price insurance and reinsurance in Europe more effectively.

Looking at it more closely, a substantial proportion of respondents (43%) indicated that incorporating climate risk parameters is "very important," reflecting a high level of awareness regarding climate-related vulnerabilities and their significance. This strong endorsement supports the integration of climate risk parameters into the risk management practices of takaful companies. The recognition of this importance underscores the need for these organisations to prioritise climate risk in their strategic planning and operational processes.

How effective is your organisation's existing risk management in measuring and addressing climate-related risks?

However, there is a notable contrast regarding the effectiveness of these organisations in managing unforeseen climate-related risks. Only 7.5% of respondents rated these organisations as "very effective" in this regard. This marked disparity underscores a significant gap between the recognised importance of incorporating climate risk parameters and the perceived effectiveness of the current risk management practices. The low effectiveness rating indicates that while the need is acknowledged, the execution and outcomes are not meeting expectations.

The findings suggest that while there is a clear understanding of the critical need to address climate risks, these measures' actual implementation and efficacy fall short. This gap highlights potential areas for improvement within the sector, suggesting that takaful companies need to enhance their risk management frameworks to address better and mitigate unforeseen climate-related risks. Moreover, the discrepancy between importance and effectiveness calls for a comprehensive review of existing practices and a commitment to making necessary improvements.

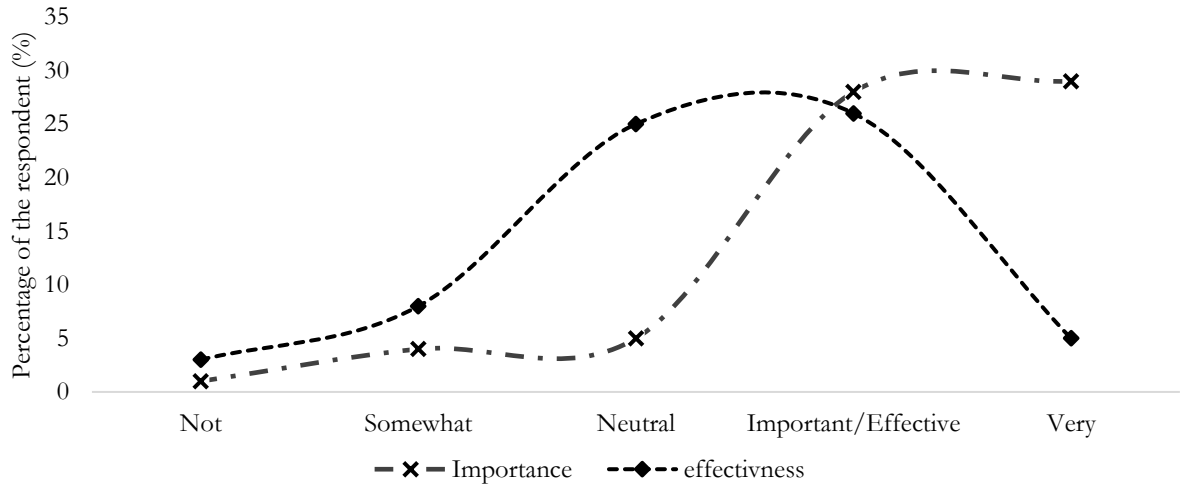


Figure 3: Importance of climate risk parameters and their effectiveness

Challenges faced by takaful operators in incorporating climate risk parameters

What are the challenges faced by your organisation in incorporating climate risk parameters in their risk management analysis?

This study further delves into the challenges encountered by takaful operators in Malaysia when integrating climate risk parameters into their risk management frameworks. Respondents were asked to identify the obstacles they face in assimilating climate risk variables into their procedures, with the option to select multiple challenges. The choices included lacking internal data to support a climate risk study, the need to upskill current employees, excessive capital expenditure, prolonged system development timelines, and an overreliance on consultants or reinsurers. These options are selected by the author's expertise and experience in the field, along with a comprehensive review of previous studies and policy papers on the topic. The analysis of the responses in Figure 4 indicates that the most significant barriers are the unavailability of pertinent internal data necessary for climate risk assessment and the critical need for new skills within the existing workforce. These findings underscore the complexity of incorporating climate risk parameters, which is compounded by information scarcity and workforce proficiency limitations. These results align with the findings of Madnor et al. (2024), which highlight a severe deficiency in the quality, quantity, and breadth of data related to climate risk adaptation. Inadequate reporting structures and a lack of transparency regarding data resources at all levels further exacerbate this deficiency.

In addition to structured inquiries, an open-ended questionnaire was employed to gather qualitative insights from respondents regarding the challenges takaful companies face in Malaysia. This open-ended approach was designed to capture additional perspectives and identify potential challenges not addressed in the structured questionnaire. The responses obtained were then meticulously scrutinised and categorised into cohesive themes to facilitate a comprehensive analysis. The emergent themes included: "the complexity of parameters," "roles of the regulator," "costly development," "low degree of awareness," "still in the early stages," and "others."

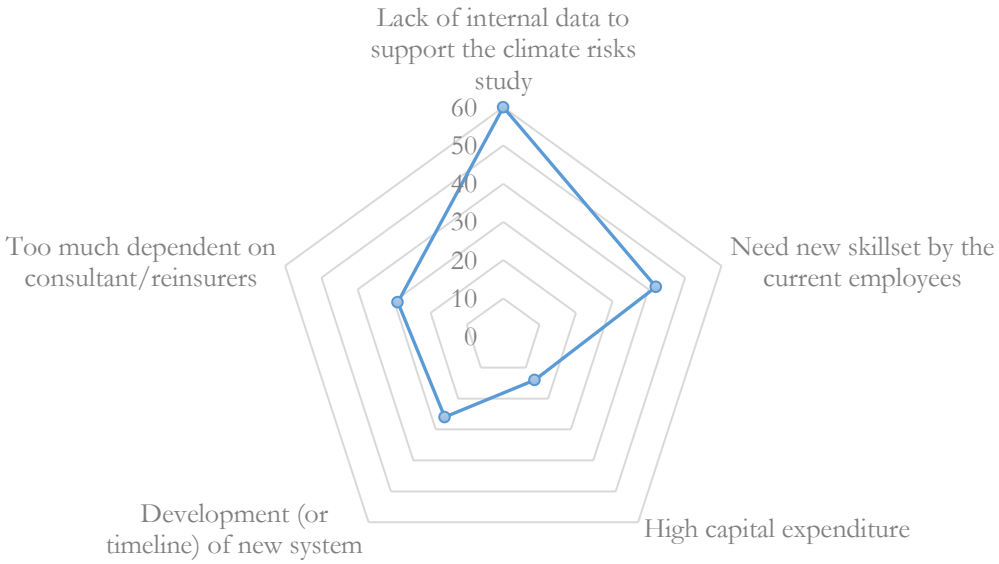


Figure 4: Challenges faced when incorporating climate risk parameters

From the thematic analysis presented in Table 3, it was determined that 45 respondents, or 67%, felt that the complexity of the parameters hinders the adoption of climate risks in takaful and insurance in Malaysia. Among the responses, doubts were expressed about the credibility of the data, such as, "Lack of the data or the data is not credible enough, it will lead to underestimate or overestimate the liabilities to the company." The skill set of personnel also contributes to the

complexity of parameters, with respondents citing challenges such as "skill gap," "inexperience," "no expertise," "lack of understanding of climate risk," and "everyone talks about climate risks, but have very little to no knowledge about it."

Table 3: Thematic analysis of the respondents' views on the challenges of incorporating climate risk parameters

Themes	Respondents
The complexity of parameters	45
Roles of the regulator	7
Costly Development	2
Low Degree of awareness	5
Still in the early stages	1
Others	7
Total	**67**

The second highest contributing factor to the challenges of incorporating climate risks is the regulator's role, with 10.4% (or 7 respondents) providing feedback under this theme. Respondents remarked, "Direct relationship between climate risk and insurance/takaful is yet to be established/properly defined," and "As one of the leading takaful operators/insurers in South East Asia (SEA), it should not be a problem to implement. However, the problem lies with business, governance, and regulators," and "All depends on how serious the regulators want financial institutions to be." These narratives are consistent with a survey by Durrani et al. (2020), which suggested that most central banks and monetary authorities in the Asia-Pacific region are either in the early stages or have not yet begun to address climate and other environmental issues. Research indicates an underestimation of efforts to mitigate natural catastrophe risks and adapt to climate change in federal government development strategies. This gap primarily arises from focusing on the response and recovery stages while neglecting the full span of the disaster management cycle (Madnor et al., 2024).

Quantitative parameters for measuring the impact of climate change

What are the potential quantitative indicators that your organisation can use to measure the financial impact of climate risks?

Accurate and insightful measures for gauging the potential impact of climate risks are essential. This survey aimed to identify the quantitative indicators organisations find valuable in quantifying the financial implications of climate risks. Respondents were queried on potential parameters, ranging from flood models and topography to broader, systemic markers such as sea-level rise, carbon emissions, and rainfall intensity. As illustrated in Figure 5, our study reveals a preference for concrete and direct indicators, with the flood model receiving the highest number of votes (52 votes). The flood model, which evaluates historical data on floods and correlated financial damages, is considered a crucial measure of the potential impact of this primary climate risk. Rainfall intensity garners the second-highest number of votes (50 votes), indicating a profound understanding among respondents of the significance of shifting weather patterns, such as intense rainfall, and the resulting increased frequency of floods, flash floods, and landslides, along with their consequent financial implications. The significance of flood risk is widely acknowledged due to its extensive impact on global populations, surpassing any other natural hazard. Precise evaluations of flood risks are necessary to inform plans for mitigating their impact (Charpentier, 2008; Surminski & Oramas-Dorta, 2014; Sieg et al., 2023). These results highlight the inclination of surveyed organisations towards employing direct, environment-related quantitative measures, specifically flood models and rainfall intensity, to comprehensively understand and quantify the financial fallout of climate risks. Such understanding is instrumental in developing a

comprehensive risk management methodology that efficiently encapsulates the complexities of climate risks.

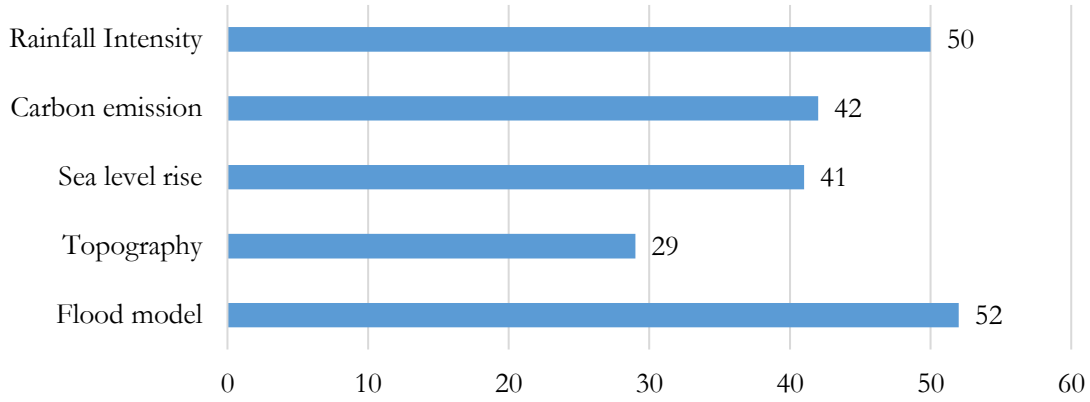


Figure 5: Possible quantitative parameters for measuring the impact of climate risks

Other important elements in climate risk assessment

What are the potential quantitative indicators that your organisation can use to measure the financial impact of climate risks?

Lastly, we solicit additional opinions from respondents through free-text responses in the questionnaires, allowing them to highlight critical elements within the climate risk assessment. To identify common themes, we used a word cloud generator, which visually represents the frequency of words or phrases. Expected terms like "climate," "risks," and "assessment" were prominent in Figure 6 below due to their relevance to the research topic. Interestingly, terms such as "pricing," "reserving," and "underwriting strategy" also emerged significantly.

Respondents emphasised that incorporating climate risk assessments enables more accurate product pricing, improved claims experience, and strategic planning. The term "reserving" indicated the necessity for adequate reserves to cover potential climate-related claims, ensuring financial stability and compliance with regulatory recommendations. Concerns regarding "underwriting strategy" highlighted the need to minimise engagement with carbon-intensive businesses and to implement underwriting exclusions or restrictions driven by regulatory pressures.

These insights underscore the importance of integrating climate risk assessments into pricing, reserving, and underwriting processes. Respondents recognised climate risks as critical in future practices and policies, suggesting a strategic shift towards resilient and sustainable takaful product offerings.

Figure 6: Respondents' feedback on climate risk assessment

CONCLUSION

The primary objective of this study is to assess the preparedness of takaful operators in Malaysia and to gain insights into the opportunities and challenges associated with integrating climate risk management into their operational frameworks. One of the significant findings from the survey is that most respondents consider incorporating climate risk assessment crucial for takaful operators. However, there is a neutral stance on the effectiveness of current risk management strategies in handling unexpected climate-related risks. When quantifying the impact of climate risks, respondents strongly preferred direct, climate-specific parameters, particularly flood models and rainfall intensity. These indicators provide tangible assessments of climate risks, aiding in effective financial forecasting and risk management. The prominence of flood models and rainfall intensity underscores the real-world implications of shifting weather patterns and their profound financial repercussions. This preference demonstrates the industry's capacity to adapt to the practical realities of climate change with a dynamic and informed approach. Additionally, exploring other indicators such as sea-level rise, topography, and carbon emissions could provide a more comprehensive view of an organisation's risk exposure. As the climate risk landscape becomes more complex, utilizing diverse risk measurement tools will be instrumental in achieving a holistic risk management system. This study reaffirms the necessity for organisations, particularly within the insurance and takaful sectors, to integrate climate risk parameters into their risk management strategies. The preference for practical indicators like flood models and rainfall intensity reflects a shift towards addressing observable climate impacts, marking the beginning of a more climate-conscious approach in financial risk management. Our study concludes that while takaful operators in Malaysia are in the early stages of integrating climate risks into their operational frameworks, their importance is clearly recognised. However, there remains a need for more advanced, robust risk management strategies to fully address the growing complexity of climate-related risks.

Based on our survey analysis, several recommendations emerge to enhance the identification and quantification of climate risks. First, organisations should improve data collection and analysis capabilities concerning climate risks. This will enhance resilience and enable informed decision-making. Second, investing in upskilling the workforce to understand and evaluate climate risks is crucial for integrating environmental dimensions into risk management strategies. Third, while flood models and rainfall intensity are popular indicators, exploring other metrics, such as sea-level rise and carbon emissions, will provide a more comprehensive view of climate risks. Finally, collaborating with research institutions and industry experts can bolster understanding of climate risks and foster innovative risk management methodologies.

Continued research and exploration of climate risks, particularly for the takaful industry in Malaysia, are essential. As the impact of climate change intensifies, takaful operators must stay informed and resilient. Future research should focus on advancing risk assessment methodologies, discovering innovative practices, and integrating new technologies to mitigate climate risks effectively. Moreover, further research could explore the financial implications of climate risks on takaful and insurance companies, including potential impacts on profitability and solvency. Comparative analyses with other regions facing similar challenges could offer valuable insights and benchmarks for effective climate risk management. While providing valuable insights, this study has certain limitations, including a relatively small sample size and potential selection bias. Future research should expand the scope to include more diverse samples and assess additional factors influencing climate risk responses to yield more comprehensive findings.

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