

# **MOUNTAIN CLIMBING RISK ASSESSMENT AND MANAGEMENT FRAMEWORK AS A RISK REDUCTION AMONG CLIMBERS IN MALAYSIA**

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## **ABSTRACT**

Mountain climbing, trekking and hiking are terms that often used by outdoor recreation enthusiasts in Malaysia. The segregation depends on the distance, difficulty and technicality of the activity involved. In general, altitude scaling activities in Permanent Reserved Forests (PRFs) in Peninsular Malaysia is classified as mountain climbing. Between the year 2017 to 2021, there has been 1,413 cases of people reported missing and injured in the PRFs. In order to suppress the number, Malim Gunung Perhutanan (MGP) was introduced by the Forestry Department Peninsular Malaysia (FDPM). They are trained with the knowledge and skills in navigating and reaching the summits of mountains and back safely. MGP was introduced into the Malaysian mountain landscape in 2020 and until now 1,877 trained individuals have been registered as MGP. They have in-depth knowledge of the local terrain, weather conditions, potential safety and health hazards, and its risks. In order to formulate the framework, FDPM gathered expertise from related agencies combined with the department and MGP on-ground experience on mountain climbing management. Safety and health risk assessment and management is crucial for planning mountain climbing activities to ensure specific risk factors for the chosen trails and appropriate strategies to mitigate those risks are identified. Critical elements in the framework accounted for weather conditions, terrain difficulty, equipment reliability, and individual hiker's emotional and physical capabilities. The framework is an important tool for the department to identify the type of training needed ensuring MGP do have the necessary knowledge, skills, and attitude to handle situational-related scenarios through a systematic approach. Thus, this paper highlights a comprehensive framework which contribute to the development of Mountain Guide Risk Assessment and Management Guideline (MoGRAM).

**Key words:** Mountain climbing, Malim Gunung Perhutanan, Risk Management

## **INTRODUCTION**

The Forestry Department of Peninsular Malaysia has introduced the Mountain Guide Program (MGP) as a strategic initiative to enhance safety and promote sustainable mountaineering practices in the region. Given the diverse and often challenging terrains of Malaysia's mountainous landscapes, the program focuses on training and certifying mountain guides to ensure they are well-equipped to lead climbers safely. This includes imparting skills in navigation, emergency response, and environmental conservation. The MGP not only plays a crucial role in reducing the risks associated with mountaineering but also contributes to the preservation of the natural environment and supports sustainable tourism by fostering responsible trekking practices.

Mountain climbing in Malaysia presents various risks due to its diverse terrains, unpredictable weather, and the physical demands of the activity, necessitating a comprehensive risk assessment and management framework to enhance safety and reduce potential hazards among climbers.

Mountain climbing is an inherently risky activity that requires careful planning and management to ensure the safety of the climbers. While the thrill and challenge of towering peaks attract many adventurous individuals, the potential for accidents and injuries poses a significant concern. Developing a comprehensive risk management framework is crucial to mitigate these risks and enhance the overall safety and satisfaction of mountain climbing activities.

Risk assessment is a crucial aspect of project management, as it helps identify, analyze, and mitigate potential risks that could impact the success of an activities (Cervone, 2006). One approach to risk assessment is the use of a risk assessment matrix, which provides a structured way to evaluate the likelihood and impact of identified risks. Prior using the matrix, a structured rubric is recommended as guidance. The choice between a holistic rubric and an analytical rubric in assessment is a crucial decision that assessors must make to effectively evaluate performance activities. Holistic rubrics provide an overall, universal assessment of a participant's work, while analytical rubrics break down the assessment into distinct criteria (Boettger, 2010).

When considering the use of rubrics in assessment, it is important to ensure that the criteria used are appropriate and aligned with the intended assessment. As Dawson (Dawson, 2015) summarizes, rubric design should consider factors such as specificity, scoring strategy, quality levels, and accompanying feedback information. Research has also highlighted the importance of creating valid and reliable rubrics, which can be a challenge for instructors. Rubrics must be carefully constructed to ensure that they accurately measure what they are intended to measure and that they are applied consistently across assessors.

In this study, we will explore into the importance of risk assessment in mountain climbing, exploring the key factors that contribute to the risks involved and the strategies that can be applied to minimize them.

## **MATERIAL AND METHODS**

The research methodology for this study involved a comprehensive literature review of existing literature on risk management frameworks, with a specific focus on their application in the context of mountain climbing activities. The Delphi method was used as a structured communication technique in getting information on mountain climbing risks. This structured communication approach relies on a panel of experts to obtain at a group consensus, making it a valuable tool for eliciting opinions and forecasting future events (Khodyakov et al., 2023).

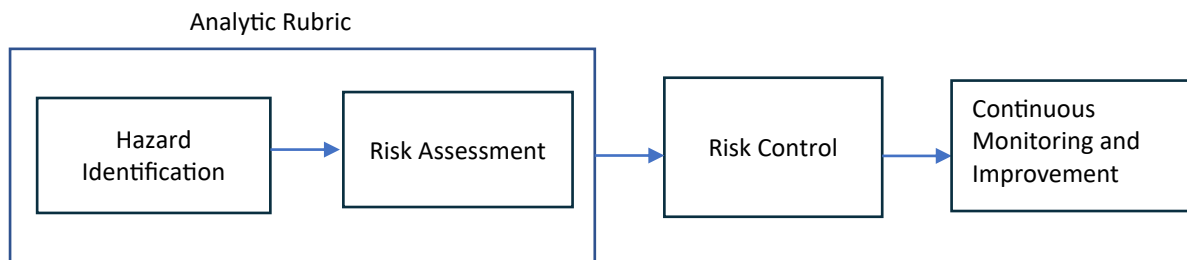
The Delphi technique, involved the interview sessions with both relevant authorities and mountain climbers conducted in December 2023 and continued with the group discussion until August 2024. The Delphi technique begins with the initial development of an assessment criteria focusing on the identified problem by the appointed risk facilitator. Next, an appropriate respondent group known as MGPs was selected, and the earlier prepared assessment form was further discussed by the groups.

MGPs answered the assessment form independently, and they returned it to the facilitators. The feedback from the rubric assessment was summarised and used to develop a feedback summary (Dalkey et al., 1963). After reviewing the feedback summary, the respondents continued to rate priority ideas included in the assessment form. The process was repeated until risk facilitators reached an agreement on the criteria being discussed.

Selection of Delphi Experts who participated in the Delphi method consist of 30 experts from the government authorities which include the Forestry Officers, BOMBA Search and Rescue Officers, Occupational Safety and Health Officer from the Department of Occupational Safety and Health, Public Health Specialist from the Ministry of Health and the Arm Forces, PERKESO and a well experienced Malim Gunung Perhutanan from various states. The proposed rubric assessment form was then distributed to 360 participants. To address the multifaceted nature of risk in mountain climbing, a holistic risk management framework is proposed (Figure 1). It is an overall assessment that considers technical, physical, and psychological difficulties. This framework encompasses the following key criteria as the followings:

- a. Climbing route facilities
- b. History of incident
- c. Hazard profile ((type, classification and category)
- d. MGP competency
- e. MGP mental health
- f. MGP health status

- g. Emergency response
- h. Communication (mobile network coverage)
- i. Weather forecast
- j. Food and water borne diseases
- k. Toilet facilities
- l. Personal protective equipment (PPE)
- m. Personal injury scheme
- n. Carrying weight
- o. Line-up experience



**Figure 1.** Risk Management framework for *Malim Gunung Perhutanan*.

## RESULTS AND DISCUSSION

The analytical rubric based on the Delphi technique results was based on the Likert scale which characterized expert judgements responses representing decided response to indicate their level of agreement on a predefined risk scale.

As shown in Table 1, the specific wording of the criteria scale points includes options such as "low," "medium," "high," and "extremely high." In the context of risk assessment, this approach can be particularly beneficial, as it enables the incorporation of diverse viewpoints and the consideration of complex, multifaceted factors that may influence the assessment of risk (Khodyakov et al., 2023).

**Table 1.** Criteria scale point use for MGP selection.

Criteria	Low	Medium	High	Extremely High
Climbing route facilities	Equiped and well maintained	Equiped and not well maintained	Equiped but not maintained	Not equiped
History of incident	No reported cases	Reported any minor injury cases	Reported anyserious injury cases (physical incident; animal attack; natural disaster)	Reported any fatality cases (physical incident; animal attack; natural disaster)
Hazard profile (type, classification and category)	Hazard profile completely available	Hazard profile partly available		Hazard profile not available
MGP Competency	Valid licence			Without licence or Expired licence
MGP Mental Health	Result of DASS 21 normal/mild	Result of DASS 21 moderate	Result of DASS 21 severe	Result of DASS 21 extremely severe

Criteria	Low	Medium	High	Extremely High
MGP Health Status	Physically fit	Injury-free	Reported comorbidities	Reported severe comorbidities
Emergency Response	Quick response by lead agencies ≤ 30 minutes	Emergency Response	Quick response by lead agencies ≤ 30 minutes	Emergency Response
Communication (mobile network coverage)	Excellent network coverage	< 25% area reported poor network coverage	≥ 75% area reported poor network coverage	No network coverage
Weather forecast	Sunny	Cloudy	Heavy rain or strong wind	Continuous heavy rain for several days; Strong lightning
Food and water borne diseases	Drinking water and food without cross contamination	Consuming cooked food ≤ 4 hours	No pre-heating facilities / consuming contaminated food	Untreated water or uncooked food
Toilet facilities	Available and well maintained	Available but not well maintained		Not available at all
Personal Protective Equipment (PPE)	PPEs are certified by relevant authorities and still valid			Evidence of damages or inefficiency or not suitable or not certified or already expired.
Personal injury scheme	Covered by personal injury scheme			Personal injury scheme not available
Carrying weight	Carrying weight <5% of body weight	Carrying weight between 5-15% of body weight	Carrying weight between 15-30% of body weight	Carrying weight >30% of body weight
Line-up experience	Having theoretical knowledge, skills and climbing experience	Having theoretical knowledge with limited practical experience	Having theoretical knowledge but without practical experience	Without formal knowledge, skills and climbing experience

### Understanding the risk assessment criteria for mountain climbing

Criteria to be assessed and communicated to the line-up includes the climbing route facilities, history of incident, hazard profile (type, classification and category), MGPs competency, MGPs mental health, MGPs health status, emergency response, communication (mobile network coverage), weather forecast, food and water borne diseases, toilet facilities, personal protective equipment (PPE), personal injury scheme, carrying weight and line-up experience.

### Climbing route facilities

Climbing route facilities can be assessed based on the overall equipment or facilities provided by the relevant agencies. Most have comparatively easy routes and others are incredibly challenging. This criteria also

similar to other studies which stated the difficulty of this activities can vary greatly depending on the path or route chosen. The complexity of the terrain, the steepness of the incline, and the presence of obstacles can all contribute to the overall difficulty of a mountain climb (Ewert, 1985), (Harper & Robinson, 2005). Factors such as the steepness of the terrain, the presence of loose or unstable rock, and the risk of weather-related hazards can all affect the level of difficulty (Ewert et al., 2020) (Langseth & Salvesen, 2018) (Ewert, 1985) (Dhar, 2019). Hence, a well equipped as well as periodically maintained route or path will lower the risk of any potential incident.

## History of incident

This criteria refers to any reported incident in the past that causing any fatality cases, physical injuries due to fall, animal attack and natural disaster. Low risk indicates no incident ever happened in that particular mountain. In comparison, higher risk shows an evidencace of reported incident. To effectively assess and mitigate risks, the risk assessors have long recognized the importance of historical data on mountain climbing incidents and accidents (Lattimore, 1993) (Trends in Organized Crime, 2013). By analyzing patterns and trends in past incidents, MGPs and rescue teams can better understand the factors that contribute to mountain climbing emergencies and develop more targeted strategies for prevention and response.

## Hazard profile

The hazard profile highlited the importance of identifying their spesific type of hazard (safety, health and environment), classification of hazard (physical, chemical, biological, ergonomics and psychosocial) and its category (obvious, developing, transient and concealed). Harper and Robinson (2005), also highlights the importance of hazard identification, risk assessment, and risk management to climbers, without necessarily exposing them to significant danger. Another study emphasizes the need for outdoor professionals to improve inclusivity standards and develop decision-making approaches that can negotiate the complexity of risk control measures (Carson et al., 2020).

## MGP Competency

### *MGP Mental Health and Health Status*

The DASS-21 is the short form of the DASS-42, a self-report scale designed to measure the negative emotional states of depression, anxiety, and stress. This criterion enables MGPs to assess their mental health status prior mountain climbing.

<b>Severity</b>	<b>Depression</b>	<b>Anxiety</b>	<b>Stress</b>
Normal	0 - 9	0 - 7	0-14
Mild	10 - 13	8 - 9	15-18
Moderate	14 – 20	10 – 14	19 – 25
Severe	21 – 27	15 – 19	26 – 33
Extremely Severe	28+	20+	34+

This criterion is in line with the World Health Report to strengthen mental health care systems, highlighting the complexity of the etiology and consequences of mental illness (Kokane et al., 2021). The emphasis on mental health as a pressing global health initiative requires a comprehensive strategy that not only includes strategies for treating mental disorders but also addresses the social determinants of mental health. (Chisholm, 2015) (Rahman & Prince, 2009) (Kokane et al., 2021).

## Emergency response

This criteria encompassed how fast and efficient the emergency repsonse rspnded to any unwanted situation. Low risk indicates a quick response by the lead agencies which the response time is within 30 minutes. Extremely high risk indicates higher difficulties in reaching the area and requires more time and additional transportaion mechanism such as the helicopter. Similarly study by Lee et al., (2018) explained on

the key challenges in mountain rescue is the often-remote location of incidents, which can make timely response and access to medical care difficult. To address this, a range of emergency response time can further determine the different level of risk.

### **Food and water borne diseases**

The food and water borne diseases criteria refers to the possibility of climbers to get infected due to the contaminated food or water. Low risk indicating drinking water and food are safe to be consume and without any cross contamination while extremely risk reflecting untreated water/uncooked food or already contaminated. According to the Mountain agriculture: Opportunities for harnessing Zero Hunger in Asia (2019), one of the primary concerns in mountain environments is the limited access to water and the potential for food contamination. Proper water infrastructure and treatment methods are crucial to mitigate the risk of waterborne illnesses. Mountain communities often face significant barriers to accessing clean water, and this issue is exacerbated by the impacts of climate change, leading to increased uncertainty around water availability. To address this, food safety assessment is essential to be considered in the assessment.

### **Personal Protective Equipment (PPE)**

It is crucial to select personal protective equipment that is tailored to the specific demands of mountain climbing, as this activity can expose climbers to a variety of hazards. (Protect Yourself With PPE, 2018). There is a need for climbers to be well-informed and diligent in the selection and use of personal protective equipment to ensure their safety during mountain climbing activities. Proper clothing selection can help mitigate physiological strain and risks such as hypothermia during outdoor activities.

### **CONCLUSION**

In conclusion, the development of a risk assessment matrix using an analytical rubric approach is a powerful tool for project managers to identify, analyze, and manage risks. . Effective risk assessment and management are critical for ensuring the safety of climbers and minimizing the potential for harm. By using a structured and objective evaluation process, project managers can ensure that the most critical risks are addressed and that resources are allocated effectively.

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