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# Analysis of Dive Industry Minimum Requirement Criteria Based on Risk Management

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**Abstract.** Indonesia is one of the most popular scuba diving destinations in the world. The popularity of recreational scuba diving has increased in recent decades. But despite its popularity, this recreation has a high potential danger. The risk of diving hazard must be managed to eliminate or minimize the risk of death, injury, or illness. The purpose of this study is to develop the minimum requirements criteria of the dive industry based on risk management. This study identifies three factors that cause dive risks: workplace environment, human factors and the natural environment. Results of focus group discussion with 108 respondents dive industry included both big and small businesses, locally and foreign owned in Bali, Yogyakarta, Labuan Bajo, Bogor, Depok and Bekasi are arranged 12 elements of risk management of dive hazards which will become the criteria for minimum requirements of the diving industry in Indonesia

## 1. Introduction

Indonesia is the world's largest archipelagic country composed of 17,508 islands and 95,181 coast line (the fourth longest in the world after Canada, America and Russia) is one of the most popular scuba diving destinations in the world. The popularity of recreational scuba diving has increased in some over the past decade. Scuba diving in has been shown to be a valuable segment of marine tourism with estimates for Southeast Asia include Indonesia. The annual global value of scuba diving in Southeast Asia is approximately USD\$ 4.5 billion [1]. But despite its popularity, this recreation has a high potential risk. Based on government data, one in 430.000 Queensland dives result in a fatality, compared to one per 120.000 dives in the rest Australia. In the United States, the rate is one death per 100.000 dives, while in Japan there are 6,5 deaths per 100.000 dives [2]. Information collected by the Division of Workplace Health and Safety from various sources identified 14 deaths and 260 injuries resulting from underwater diving in Queensland between 1990 and 1996 [3]. In line with that, dive industry should be concern to aspects of protection for the safety and security of tourists during recreation. Therefore reducing the risk of danger in diving activities requires good management that must be fulfilled by diving industries in running their business.

### *Risk Management*

Based on ISO 31000:2009, the risk management process is an important part of risk management as it is the implementation of the risk management principles and frameworks that have been developed. The risk management process consists of three main processes, namely the determination of context, risk assessment, and risk management. Determining the context of risk management aims to identify and disclose organizational goals, the environment in which goals are to be achieved, stakeholders



concerned, and diversity of risk criteria. These will help to reveal and assess the nature and complexity of the risk. Determining the context of risk management is closely related to setting goals, strategies, scope and other parameters related to the risk management process of a company. This process shows the relation or relationship between issues that will be managed risk to the company's environment (external & internal), risk management process, and the size or criteria of risk that will be the standard. [4]

The second process is a risk assessment covering a risk identification stage that aims to identify risks that may affect the achievement of organizational goals. Based on identifiable risks a risk list can be prepared for risk measurement to assess the level of risk. The process of risk measurement is a risk analysis that aims to analyze the likelihood and impact of identified risks. The result of measurement is a risk status showing the size of the risk level and the risk map which is the description of the distribution of risk in a map. Another stage in risk assessment is the evaluation of the risk shown in order to compare the risk analysis results with defined risk criteria to serve as the basis for the application of risk management.

The third process in the risk management process is the risk management in the form of planning on mitigating the risks to obtain alternative solutions so that risk handling can be applied effectively and efficiently. Some alternative risk-setting that can be taken, among others, aims to avoid risk, mitigate risks to reduce the possibility or impact, transfer risk to the third party (risk sharing) and accept the risk (risk acceptance). The three processes are accompanied by two other supporting processes of communication and consultation, to ensure the availability of adequate support from each risk management activity, and to make every activity reach its target appropriately. Another process is monitoring and review that aims to ensure that the implementation of risk management goes according to the plan and as a basis for periodic improvement of the risk management process.

## **2. Research Object and Method**

The purpose of this study is to develop the minimum requirements criteria of the dive industry based on risk management. This study limit to dive industry in Indonesia. This research uses qualitative descriptive approach with 2 steps. The first step is observing data about risk factors that can occur in the diving activity based on references and literatures. The second step is primary data collection through focus group discussion with 108 dive industry included both big and small businesses, locally and foreign owned in Bali, Yogyakarta, Labuan Bajo, Bogor, Depok and Bekasi. It discuss about risk management from the factors causing the diving risk to develop the minimum requirements criteria of the dive industry. This highlights the need for a minimum criterion that must be fulfilled by diving industry in Indonesia in running their business. Development these criteria is important to encourage diving tourism in Indonesia.

## **3. Result and Discussion**

The analysis will be divided into two groups: the factors that cause diving risk and diving risk management

### *3.1. Factors Causing the Diving Risk*

Safety should be a concern for the diving tourism industry because diving is an extreme sport that requires training and licensing. This activity has the potential danger of life-threatening. Therefore, the risks of diving must be managed to eliminate or minimize the risk of death, injury, or illness. Effective risk management requires the industry to identify all possible hazards. According Table 1, the risk of diving comes from several factors: workplace environment, human factors and the natural environment based on According to Workplace Health and Safety Electrical Safety Office Workers Compensation Regulator in Australia.

**Table 1.** Factors causing the diving risk [5]

<b>Workplace environment</b>	<b>Human factors</b>	<b>Natural environment</b>
Physical work environment (e.g. slips trips and falls, fixtures and fittings and housekeeping, noise, confined spaces, lighting and working temperature)	Medical and physical fitness	Diving spot (e.g. non-respirable nature of water, water temperature, current, tide, visibility, depths, time of day, weather, underwater terrain, waves, surge and isolation)
Equipment, materials and substances used (e.g. plant, electrical equipment, hazardous chemicals)	Competence on relevant qualifications, training and information	Chemical or biological hazards
Work tasks and how they are performed (e.g. hazardous manual tasks)	The ability of the individual to understand and act on any advice (e.g. risks to non-English speakers).	Dangerous marine animal such as jellyfish and crocodiles
Work and design management (e.g. fatigue)		

### 3.2. Diving Risk Management

Diving risk management is very necessary to minimize the risk of danger that can occur in diving activities. In contrast, poor management can lead to conflict between resource users, severe habitat degradation, and leakage of revenue out of the local area [1]. This highlights the need for a minimum criterion that must be fulfilled by diving industry in Indonesia in running their business. Development this criteria it is expected to encourage diving tourism in Indonesia.

#### 3.2.1. Workplace Environment

Study of Wilks (1993), while experience shows that some divers will still disobey instructions given during the dive briefing, safety will nevertheless be enhanced if emphasis is placed on local safety procedures to be followed during the dive. One of the critical points that must be stressed in the briefing is the importance of the buddy system [6]. Encouraging divers to work together in their buddy pairs, from planning the dive through to checking equipment and staying together during the dive, can substantially improve safety. In one study on a Great Barrier Reef charter vessel, a majority of the diving incidents observed among certified divers involved dive partners failing to assist each other [7]. Based on the results of focus group discussion of 108 respondents of dive industry formulated there are two elements of diving risk control in the workplace environment are:

- a. Dive guides have knowledge and track record of dive sites
- b. Dive guides have the ability to handle the safety of tourists, including handling underwater emergencies
- c. Dive guides have and briefs on procedures during the dives

#### 3.2.2. Human Factors

Human factor is the biggest cause of diving incident. Studies consistently show that the main cause of diving-related death is a medical problem [8]. Many factors increase a person's medical risk from fatal diving incidents: poor fitness, chronic illness, structural abnormalities of the heart and lungs and multiple risk factors for cardiovascular disease (e.g. obesity, diabetes, hypertension, smoking) [9]. In the experience of dive guides that stressor exercises, pressure, cold and emotional stress are all present during dive and increase the possibility of cardiovascular disease manifesting itself - with heart disease

being the main cause of death in divers [10]. Respondents formulated there are seven element of diving risk management on human factor that are:

- a. Dive guides have competence/licensed from reputable national/international diving training agents
- b. Dive guides have competencies licenses as dive instructors from reputable national/international diving training agencies, especially for the introduction of scuba diving
- c. Have suitable diving equipment include: regulators, buoyancy control device (BCD), diving mask, fins, scuba tanks, wetsuits, scuba weight system and air pipes
- d. Have documented tool for performances of diving equipments
- e. Have the supporting facilities needed in diving activities that include: communication equipment, buoy surface marker, buoy with flag diving flag, diving boat according to dive location, buoys, first aid kit and oxygen according to standard dive safety equipment recommended by agency subs and/or statutory provisions
- f. Have a dive guidance competence training program
- g. Have a health assessment program for diving customer who want to dive

### 3.2.3. Natural Environment

Divers should never forget that every dive is equivalent of entering the wilderness. While most sea creatures are not aggressive towards divers and attacks are very rare, incidents do happen and divers can't afford to forget that wild animals surround them. Divers should not touch underwater animals, including corals. This is not only to protect the diver from injury, but also to protect marine life [11]. Respondents formulated there are seven element of diving risk control on human factor that is:

- a. Have a documented environmentally friendly dive monitoring program
- b. Following the rules of conservation and observation of marine life

## Conclusion

There are 12 minimum criteria that diving industry must meet to be able to reduce the risk of diving activities. Effective risk management depends on cooperation between dive operators and diving customer. The minimum requirements will help dive industry reduce some risks, and they are a welcome initiative if they are made mandatory. At the same time, dive operators must maintain adequate insurance cover. Implementation of this standard by the dive industry will create an image that diving tourism is a safe recreational activity. This research recommends the application of ecotourism principle by the dive industry as an effort to prevent and improve the condition of marine life. Future research can be carried out to identify hazards and risk management for other tourism industries that have a high risk and potentially damage the environment.

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