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Research paper

Aviation Safety Management: Minimizing the Deleterious Effect of an Aviation Disaster

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Abstract

Safety management of civil aviation industry should be taken assiduously to preserve incalculable human life. Though a comprehensive regulatory framework on safety management has been established at a local and international level to improve the safety standard in the aviation industry, this century has witnessed a rapid increased of aviation disasters due to the continued growth of safety mismanagement. This paper offers a discussion of the risk factor as an essential safety tool in preventing aviation disaster through its compliance with safety regulation and safety standard imposed upon regulatory authority. This paper also intends to discuss the safety doctrine laid down in Integrated Emergency Management Model (IEMM) and Chaos Theory in managing aviation disaster. This paper also tenders a discussion on the current legal position concerning safety management adopted by Malaysian aviation authorities. The reference is made to the State Safety Program (SSP) and Safety Management System (SMS) under Annex 19 of Chicago Convention within the purview of International Civil Aviation Organization (ICAO). The methodology used is the doctrinal research methodology in the discipline of law. The findings of this study serve to validate that Malaysia to the full extent have implemented ICAO Safety Management Manual (SMM); nevertheless, the effectiveness is debatable. Based on the literature, this paper seeks to propose that IEMM and Chaos Theory be made the foundation in establishing Malaysia's regulatory framework and the synchronisation between domestic law and international convention to be made mandatory.

Keywords: *Civil Aviation; Aviation Disaster; Integrated Emergency Management Model (IEMM); Chaos Theory*

1. Introduction

Since the Second World War, increased speed and safety and affordable fares have attracted millions of passengers on board (Jay and Granot, 2002). A demand for luxury-quality, fast and steadfast transportation has been a factor in the increased of flying in the age of modern globalisation. Malaysian has witnessed the birth of another two new airlines Bayu Air and Suasa Airline in 2017, as a response to the increasing demand from the individual flyer and business organisations. However, the expected increase in air traffic over the next decades may put the current safety levels in danger (Meszaros, 2016). The desire to improve efficiency and revenue may result in compromising safety standards and regulations thus lead to the outbreak of aviation disaster. An aviation disaster is a disaster involving an air carrier, which an occurrence took place either by accident or on purpose, which took the air carrier out of its designated course and destination. Managing aviation disaster can be considered as part of crisis management, and is one of the most prominent types of disaster management in transportations, as its effect are rather massive if a disaster of its kind does take place. Aviation disaster management would be in this circumstance, to run the task of minimising the deleterious effects of an aviation disaster using limited resources under extreme time constraints.

Crisis management analyses the necessity of establishing a task force, recognising potential areas of crisis, devising preventive measures and formulating coping policies for situations when these fail and real crisis takes place. Guidelines related to a detailed action plan and the allocation of responsibilities should be recorded in a manual setting out the procedures for managing the crisis, with particular attention given to effective communications machinery (Bland, 1998; Gonzalez-Herrero& Pratt, 1998; ten Berg, 1990). Civil aviation industry, unlike any other transportation industry, is a complicated business that closely associated with risk in its operation (Chen and Li, 2016). For air operator risk is regarded as a central operational feature that the industry has to deal on a regular basis (Stolzer, 2015). Therefore, the functional aspect of safety performance should be considered as one of the primary objectives despite focusing on thick profit margin. Safety management in aviation industry always created new challenges not only to the air operator but the receiver of the service, i.e. the air travellers are also voluntarily subjected to various kinds of risks while travelling on board. Most of the aircraft accidents occurred while flying thus the passengers and crews on board are the primal target group that expose to risk of an accident and in given situation individuals on the ground could also be exposed to the same risk (Janic & Netjasov 2008). Due to this fact, risk management in this industry is considered as significant challenges that need to be regularly and systematically monitored.

It is admitted that when it comes to risk management total elimination of risk is somehow impossible, but it can be mitigated or minimise where possible (D. Rios Insua, 2016). Minimising aviation risk could only be possible with a proper system of safety management because the idea of free risk has evolved around the aspect of safety management (D. Rios Insua, 2016). The literature also indicates that crisis management is the process by which an organisation deals with a significant event that threatens to harm

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the organisation, its stakeholders, or the general public (Shivastava, 1888). Crisis management is said to be a situation-based management system that includes clear roles and responsibilities and process related organisational requirements company-wide (Shivastava, 1888). It is said that the response shall include action in the following areas: Crisis prevention, crisis assessment, crisis handling and crisis termination. The aim of crisis management is to be well prepared for a crisis, ensure a rapid and adequate response to the crisis, maintaining clear lines of reporting and communication in the event of the crisis and agreeing on rules for crisis termination (James, 2010).

There are numerous schemes involves in aviation safety management such as technical point of technological integration (Ochieng et. al, 2003, Maurino et. al, 2016), the flight operation, economic and management strategy (Soekkha, 1997; Cui & Li, 2015), quantitative risk assessment modelling (Huan-Jyh Shyur, 2007; Lee, 2006), safety information (Kim, 2016) and aviation linguistic aspect (Alderson, 2009). The latest model to mitigate aviation risk is based on qualitative evaluation model that will enable airlines to identify human errors and select an intervention strategy so as to reduce the unnecessary risks in the industry (Chen, Lin & Yu, 2017). Damage control was the most significant part and purpose of aviation disaster management when the disaster had occurred, and it can only be achieved through a system of careful planning and decisive execution. According to Tamara Cabur in her study on Air France Response Analysis to AF447 Crash, the proposed model of crisis management by Burnett J.J was to be applied into air disaster crisis management (Cabur, 2010). Whereby as an initial stage, organisations need to study on how they deal with crisis especially on how companies resolved them. Besides that crisis prescriptions approach can be adopted, it emphasises on delineating prescription for crisis identification and resolution. Which mean an airline company need to come out with guidelines such as by setting up a strategy in advance, responding quickly, training spokesperson in advance, seeking third party support and centralising the spokesperson's function (Burnett, 1998).

Despite all the above mentioned, aviation safety management could also be related to the rule of law (Huang, 2009) whereby it is believed that risk in aviation industry could also be reduced by observance with legal mandate imposed by the domestic or international regulatory bodies such as International Air Transport Association (IATA) or International Civil Aviation Organization (ICAO). For the law to exist, it must be created and founded on a legal framework, which would provide the guidelines on parties involved, duties and obligations of such parties, and extent of participation and contribution that is legally expected under such law. Therefore, it is crucial to ensure that state authority and air operator complied with the stringent rules and practices governing aviation safety. The service providers must splurge their limited resources in augmenting the safety operation. The first part of this paper will highlight on the concept of risk and deleterious effects in the civil aviation industry and safety management that is critical in minimising aviation disaster. The second part focuses on to examine the international security regulation. Thirdly, this paper will discuss the safety standard adopted by the authorities in Malaysia. The final part of this paper will propose that IEMM and Chaos Theory be made the foundation in establishing Malaysia's regulatory framework. This paper employs qualitative research design.

2. Risk, Effects and Safety Management

The concept of risk itself is treacherous in the sense that there is no precise definition of risk. According to Milan Janic (2000), risk can be defined as the probability of occurrence of a hazardous event in given period. It also could be considered as the possibility that an individual or group be impaired through the effect of the particular action. Besides, the term risk is usually linked with a negative connotation in which it is related to the possibility of loss or injury, the potential for having a negative impact, and the likelihood of an undesirable event (Hampton, 2009).

Aviation risk is commonly associated with a disaster such as aviation accidents or incidents that caused by known and unknown reasons which can be classified as human errors, mechanical failures, hazardous weather, the act of terrorism and military or semi-military operations. During the first twelve years of modern commercial air travel (1948-1960), there were twenty-nine successful hijackings. For six years (1961-1967), there were a total of sixteen hijackings. Then, in 1968 alone, there were thirty successful hijackings of aircraft out of which seventeen of were registered in United States. The motives for aircraft hijacking have been diverse. The earliest incidents usually involved political refugees seeking a safe haven. Persons rebelling against the political environment hijacked aircraft from Cuba to the United States, and similar reasons prompted hijackings in the opposite direction. Many of the Cuban hijackings in 1970s were not motivated by a political purpose; rather, they were the actions of unbalanced individuals seeking an outlet for frustration and derepression. During the early 1970s a series of hijackings occurred in which the dominant motive was to obtain money by holding passengers hostage for ransom. But after the late 1960s, as the Cuban hijackings decreased in frequency, the total number of aircraft hijackings, regardless of motive, began to decline. The most recent series of hijackings was also prompted by political motives but of a different nature than those of the Cold War era. The hijackings of the late 1970s and the first half of the 1980s were made in an attempt to promote political objectives relating to existing international conflicts. In cases of shoot down they were common in the 1980s. For example, in 1988, Iran Air Flight 655 was shot down by the United States Navy with a SAM launched from the guided missile cruiser USS Vincennes. Iran sued the United States in the International Court of Justice; in 1996, the American government, without apologizing or admitting guilt, agreed to pay nearly $62 million to the victims' families. Next, Korean Air Lines (KAL) Flight 007 was shot down by Russian fighter jets using air-to-air missiles in 1983. KAL 007 had strayed twice over Soviet airspace and was shot down as an intruder. Next, Ukrainian military shot down a Russian airliner flying from Novosibirsk to Tel Aviv in 2001. Ukraine had been conducting a massive military exercise including shooting missiles at drones; one missile locked onto the Russian airliner off the Crimean coast. Ukraine paid $15.6 million to the victims' families. The most recent one is the downing of Malaysia Airlines Flight MH17 by Ukraine separatist. The above events demonstrate deleterious effects of aviation disaster caused by the act of terrorism and military or semi-military operations.

In general, safety is a complex and uncertain issue since it may involve different determining variable (Esipov, 2003) and not a quantifiable entity that relies more on personal judgement (Vick, 2002). Safety Management Manual issued by ICAO defined aviation safety as the state in which the possibility of harm to persons or of property damage is reduced to and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management (ICAO, 2013). It is a treacherous concept whereby it indices of an involved collaboration between man, machine and environment. According to the literature, it is essential to understand the safety culture in relation to identifying hazards, mitigate and managing risk and find solutions to the potential problem before the actual accidents and incidents occur (Iordache & Balan, 2016). However, the risk is an uncertain element even an airline has an excellent safety record it does not mean that its safe or would not crash (IATA Operational Safety Audit, 2015). This is what had happened to Malaysia Airlines Berhad, even its operation is in line the industry performance and with highest operational safety standard but unfortunately, in 2014, Malaysia Airlines Berhad have to deal with two severe blows, the disappearance of MH370 and the shooting down of MH17 (Gaurav Raghuvanshi, 2014). The industry players believe that risk of aviation accidents or incidents may be avoided by employing better technology, adequate human and organisation management and

efficient safety system (Soekkha, 1997; Cui & Li, 2015). Regrettably, aviation security does not solely depend on the technical or technological aspect of aviation engineering per se, but conformity with regulations is also considered as essential and should be adhered.

In the nonexistence of safety regulations that mandate the aircraft to be inspected for airworthiness or registration for air operator certificate for operational competence and examination of pilots' fitness would escalate risks element in this industry. By imposing the various legal mandate on the regulatory regimes, it would minimise the deleterious effect of an aviation disaster. Law is a mechanism that responds to reduce risks by imposing safety rules and regulation.

2.1. Safety Regulations under International Conventions

2.1.1. The Chicago Convention 1972

The Chicago Convention is the primary source of public international air law (Milde, 2008), has established ICAO and is often regarded as the "Constitution" (Dempsey, 2008) of international civil aviation. It is supported by 19 Annexes which contains the Standard and Recommended Practices adopted by the ICAO. Unfortunately, the Annexes do not have the legal binding force because annexes are not international treaties as States only agreed to undertake to collaborate in securing the uniformity (Ainul Hafiza et al., 2015; Milde, 2008). The SARPs are designated as Annexes to the Chicago Convention for convenience (Chicago Convention, Article 54 (1)) and Annexes do not actually become part of the Convention. (Milde, 2001). The newest addition to this convention is Annex 19 which was introduced in November 2013. Annex 19 is dedicated to safety management of aviation industry and to enhance safety management provisions at the State level so as to minimising flight risks (ICOA, 2003). It promotes the implementation of State Safety Program (SSP) and Safety Management Systems (SMS) to ensure a high level of safety responsibilities among the member states. The safety management SARPs are intended to assist States in managing aviation safety risks, in coordination with their Service Providers. It supports the continued evolution of a proactive strategy to improve safety performance (ICAO, Safety). The foundation of this proactive safety strategy is based on the implementation of Safety Management Manual (SMM). SMM among others consists guidelines on State Safety Programme (SSP) that systematically address safety risks, in agreement with the implementation of the safety management systems (SMS) by the service providers (ICAO, Safety). Chapter 3 of Annex 19 outlines the security management responsibilities of the State through the compliance of ICAO SARPs.

2.1.2. ICAO Safety Management Manual; the State Safety Programme (SSP) the Safety Management Systems (SMS)

In general, the ultimate goal of the SMM is to eliminate aviation disasters (Safety Management Manual, 2013). SMM is intended to provide States with guidance on the development and implementation of a SSP, in accordance with the SARPs contained in Annex 1; Personnel Licensing, Annex 6; Operation of Aircraft, Annex 8; Airworthiness of Aircraft, Annex 11; Air Traffic Services, Annex 13; Aircraft Accident and Incident Investigation and Annex 14; Aerodromes (Safety Management Manual, 2018). The objective of SSP is to ensure that countries can achieve an acceptable level of safety performance in civil aviation (Safety Management Manual, 2013). There are four principal components of SSP namely safety policy and objectives, safety risk management, safety assurance and safety promotion. The failing point of Annexe 19 is that it silent on the security level that should be established by the state. Its only provides guideline for an acceptable standard of safety performance in the Safety Management Manual. In addition to the SSP, Chapter 4 of Annex 19 requires the service provider inter alia airline companies, approved training organisation, maintenance organisation to implement the SMS framework into their operation which involves a systematic approach to managing safety, risk and hazard. The SMS also incorporates few critical processes in reducing aviation risk namely safety reporting, hazard identification, performance measurement, risk management and security assurance. SMM provides guidance material for the establishment of SMS requirements by States as well as for SMS development and implementation by affected product and service providers.

2.1.3. ICAO Unity; 2018 Annex Amendment

The recent amendment to ICAO Annexes illustrates ICAO commitment towards safety management. Among others, amendment towards Annex 10 enhanced safety through improved transmission and introduces new hybrid surveillance functionality for Surveillance and airborne collision avoidance systems (ACAS) and expected to ensure compatibility of surveillance systems and reduce radio frequency pollution. The new system identified as Global navigation satellite system (GNSS) and instrument landing system (ILS) has also been introduced where it will enhance the protection of ILS signals from blockage and interference caused by fixed objects or vehicles. The recent amendment also introduces space weather advisory information services and the improvement of the provision of information by meteorological watch offices. Amendments to Annex 8 meanwhile provides for clearer SARPs concerning: Suspension and revocation of Type Certificate; Security Sensitive Airworthiness Directives; transfer and suspension and revocation of a type certificate; and Eligibility, issuance and continued validity of a Certificate of Airworthiness. In details, the amendment clarifies the continuing airworthiness responsibilities of a State of Design and the States of Registry regarding the issuance of a certificate of airworthiness.

2.2. Safety Management under Domestic Legislations

Despite the Safety Management Manual issued by ICAO, state authority and air operator must also conform to the international safety regulations. According to Huang Jiefang (2008), regulations and standard procedures are enacted to avoid injuries to persons and property as well as deprivation of man most valuable attribute which is life. Whereby he believed that law and regulations could be an element to reduce aviation risks and enhance safety. Unfortunately, as the aviation industry has expanded, the issue concerning compliance with safety regulations among the service providers was disputed particularly after three disastrous events involving local claimants. The civil aviation industry is a profit-driven industry; therefore, it leads to the question of whether safety is the top priority for a service provider or is it just a promotional theme to attract air travellers using their services. It is also disputed that whether the claimants especially the newly established airlines are willing to invest a significant amount of money for safety purposes (Cui & Li, 2015). The next part of this paper will continue with the discussion on compliance by the state authority and service providers in Malaysia concerning adherence to the aviation security regulations either at the domestic level or international level.

2.2.1. Malaysian Civil Aviation Act 1969

Domestically, there are three separate bodies that responsible for the aviation governance namely the Ministry of Transport, the Department of Civil Aviation and the newly established independent entity known as Malaysian Aviation Commission (MAVCOM). However, matters related to aviation safety vested under the exclusive purview of Ministry of Transport and Department of Civil Aviation for which they are responsible for enacting and enforcing any relevant legal framework that concern aviation industry including the safety standard and practises. The principal statutory frameworks governing commercial aviation in Malaysia

are Civil Aviation Act 1969 and the Civil Aviation Regulation 2016. These two important documents are supported by directives from the Director General or Secretary of the Ministry of Transport. It should be noted that domestic aviation laws must be concurrent with the international standards and practices since Malaysia is one of the signatories' countries to Chicago Convention.

Article 12 of the convention spells out that, that each contracting states undertake to keep its regulations in these respects uniforms, to the highest possible extent, with those established from time to time under this Convention. Also, Article 37 stated that each contracting states must undertake the highest practicable degree of uniformity in regulations, standards, procedures, and organisation about aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation. In response to this, Section 3 of Malaysian Civil Aviation Act 1969 gives power to effects Chicago Convention and to regulate civil aviation as stated under the Civil Aviation Regulation 2016.

In Malaysia, Annex 19 of the Chicago Convention has been embedded into the Civil Aviation Regulation 2016 through the legislative amendment on 15 April 2016. Part XXIII was incorporated in the Regulation, and it is dedicated to safety programme and safety management system. According to Regulation 166, the Secretary General of the Ministry of Transport needs to establish the Malaysian Safety Programme for the control of civil aviation security in Malaysia as regulated under Regulation 166. This is consistent with the requirement SSP as prescribed in Chapter 3 of Annex 19. Annex 19 not only imposed responsibility toward the state authority whereby service providers also need to formulate the SMS as required under Chapter 4 of Annex 19. Regulation 167 further enunciated that the SMS must be following the requirement as may be determined by the Director General of Civil Aviation Department. It is not disputed that the new regulations were satisfactorily drafted to reflect the absorption of Annex 19 into the domestic law, but it is disputed as to whether such safety programme does in reality exist?

The SSP mandates the member states to establish a national safety legislative framework to define how the state will conduct the management in their respective jurisdiction (Ilson, 2014). In Malaysia, the national safety legislative framework is available in a separate documents whereby each legislation was formulated independently, for instance, Civil Aviation Act 1969, Civil Aviation Regulation 2016, Aviation Offences Act 1984, newly enacted Rules of the Air 2016, Civil Aviation (Aerodrome Operation) Regulation 2016, Runaway Safety Programme, Airport Standard Directive No 106, Airworthiness Standard and Recommended Practices, Runaway Safety Programme. The rationale of having separate safety legislation is because of the different authority responsible for various security aspects such as Ministry of Transport, Department of Civil Aviation, service provider, and airport management. This sort of practice is permitted under the guideline provided in the Safety Management Manual 2013.

2.2.2. The Legal Challenges

The implementation of SMS by the service provider in Malaysia is considered as the non-issue since all currently operated commercial airlines have its own SMS. For Malaysia Airline Berhad and Air Asia X, it is mandatory for both airlines to incorporate SMS in their operation since they are the members of IATA which is subjected to periodical safety audit (IATA, 2015). For other commercial airlines such as Malindo Air and FireFly, though they are non-members of IATA, they still need to implement SMS into its operations as part of the pre-condition imposed by the Department of Civil Aviation before they can obtain their Air Operator Certificate (Department of Civil Aviation, 2008). According to ICAO Safety Report 2015, Malaysia is one of the states that exercising a practical implementation of conventions that concerns civil aviation activities which is above the global average of 62 percent (IATA Operational Safety Audit, 2015). However, the implementation of SMS is regarded as a tremendous challenge for the entire industry due to lack of understanding, uniformity and standardisation of practices.

In maintaining the drive to reduce aviation disaster and increase good reputation in the aviation industry, the Malaysian government has made a good move introducing the recent amendment to the Civil Aviation Regulation 2016. The new amendment is said to be capable of further strengthening the regulatory framework for aviation safety and in return will minimising aviation risk. Among others, DCA under the provision of the Section 24O Civil Aviation Act 1969 has made its very first amendment (Amendment 2006) towards Airport Standards Directive 105; Safety Management System at Aerodromes on 25 April 2016 where it introduces new requirement for Aerodrome Operator to develop and maintain a formal risk management process (Airport Standards Directive 105, 2016). This process must ensure the analysis, assessment and control of risks to an acceptable level. Besides, the risks management process is required to identify hazard concerning probability and severity of occurrence, define the levels of management with authority to make safety risk tolerability decisions and safety controls for each risk assessed as intolerable.

However, then again, the effectiveness of the new legal framework is questioned due to the absence of standardising regulation or directive on safety standard unlike our counterpart the United States. According to a study, the United States has the highest adherence to the international safety standard in aviation (Fitzpatrick, Hunt and Irvine, 2013). To walk in line with the recent development of law particularly Annex 19, the United States has formulated a single SSP meant for national level whereby such document provides detail safety information at federal and state level to ensure effective integration of aviation security standards and practices (Federal Aviation Administration, 2015). Furthermore, in order to maintain their triumph in aviation safety, the FAA also has solidified its national aviation SMS (Ostrowskiet.al., 2014), in January 2015, the FAA has issued the Final Rule (regulatory guidance) directing the application of new SMS to all certified service providers comprises of passenger and cargo airlines (Sigda, 2015). The FAA believes this mandatory guidance as the next evolution of safety doctrine that may preserve the incalculable human life (Ostrowski, 2014). This is what has been missing in Malaysia legislative framework for managing risk in the aviation industry. Therefore, it is highly recommended that the Ministry of Transport or Department of Civil Aviation formulate a single integrated regulatory framework that reflects the four components of safety program as stated in Annex 19.

To materialise this objective, the state authority must at their best reduce the possibility of harm or damage either toward person or property (Safety Management Manual, 2013). This can be done through a continuing process of hazard identification and safety risk management (Stolzer et al., 2015) whereby it could at least reduce any unwanted air accidents, especially for the new airline companies. For instance, Malaysian Civil Aviation Department has revoked the operating licence that had been granted to Rayani Air only after six months in operation (Hashini, 2016). According to the statement by Civil Aviation Department, the airline has contravened some provisions in the Civil Aviation Regulations 1996. Thus, how the operational license could be initially granted to Rayani Air especially when the company's financial standing is incredibly weak? As reported, the aircraft experienced a few technical problems with the hydraulic system and also with the poor condition of the window (Edward, 2016). Such technical issue may increase if not correctly fix could potentially lead to an aviation accident. For airline operator, it is vital for them to have a secure economic authority so that they could devote ample amount of money for pilots and crews' training and maintenance of faulty aircraft, which may directly improve safety operation of the airline (U.S Department of Transportation, 2015).

Besides that, regulatory authority must continuously evaluate the national security framework for aviation industry so that it is at par with international standard and consistent with the continual

transformation of the industry especially with the advancement of technology. Lastly, it is believed that regulatory authority should be stricter in evaluating safety management system of the service provider before conceding them with Air Operation Certificate as to avoid the operation of the incompetent service provider as in the case of Rayani Air. This may work as a way to minimise the aviation risk thus lead to an occurrence of an aviation disaster. Compliance with the international aviation standard is possible to reduce air danger in the airline industry as it is proven that the accident rate for airlines registered with IOSA is much lower as compared to none IOSA member because of the stringent standard in safety audit (Hounsell, 2015; Peterson, 2015). It may be impossible to eliminate total risk, regardless; complying with the legal mandate can reduce the probability of occurrence of an aviation disaster.

3. Embodying Integrated Emergency Management Model and Chaos Theory

Air travel, though might be the safest mode of transport compared to other modes of transportations, are rather catastrophic in the result if an aviation disaster takes place. The development of theory is critical to any academic discipline as it provides an explanation of the events within their range of observation (Hoovers, 1992). IEMM and Chaos Theory are the most applicable theories that have been used in other civilised nations' crisis management thus should be referred to establishing Malaysia's own aviation disaster management system. Malaysia cannot sit calmly in denial, believing that such disaster cannot and will not retake place after the missing of flight MH370. The goal of crisis management is to prepare for the unforeseen, relying on the belief that "anything that can happen will happen", thus making the establishment of an aviation disaster management system a necessity.

3.1. Integrated Emergency Management Model: Plan and System in Managing Disaster

Rarely our daily routine is disturbed by a major disaster which is sudden and arrays with it overwhelming destruction combined with great death and severe injury in all vicinity. Disaster is something uncertain as to when the disasters are waiting to happen, where and what. Due to this uncertainty and unforeseeability, it is therefore essential to have a proper plan and system for managing disasters. The Noah's ark may be regarded as one of the earliest examples of disaster management, however, only in 1970's the subject of disaster management been developed (Hoover, 1992). Since then there are various types of theories formulated and adopted by experts within and outside the management sciences concerning the studies of disaster management. The objective of disaster management itself is to prevent and mitigate the effect of disaster either economic or human loss (Zaiton, 2012). However, since most disasters are difficult to prevent due to its unforeseeability, damage control becomes the primary goal and priority in crisis management. Based on the available literature the most comprehensive and widely accepted theory in administering and managing disaster is the IEMM (DA Mc Entire, 2004). Therefore, it is proposed that the IEMM should be incorporated as the basis for the development of the framework for Malaysia's aviation disaster management system. The concept of IEMM itself must be explored and understood first before it can be applied.

In the early 1980's the United States Federal Emergency Management Agency (FEMA) has introduced a system known as Integrated Emergency Management System (Fiedrich, 2013). Initially, this system was adopted by municipal council in administering crisis whether a human-made or natural disaster occurs within the municipality (FEMA, 2010). This system namely deals with strategic planning before and after the disasters. It is a system that focuses on integrating system between various agencies and institutions. The system offers a strategic plan and proactive approach to increase institution's responsibilities, dedication and better coordination of services among stakeholders involved before and after the incidents. The IEMM covers 13 processes namely hazard analysis, capability assessment, emergency operation planning, capability maintenance, mitigation effort, emergency operation, evaluation, capability shortfalls, multi-year development plan, annual development increment, local, state and federal resources and annual increment (Kelly, 2002) and therefore it is able to cover more complex disasters (Walter, A. Buck, G, 1996). Based on the process as mentioned earlier it seems that IEMM focuses on prevention, protection, mitigation, response and recovery. Having integration in the system, which lists out the obligations of stakeholders and any other parties' contribution, both before and after the occurrence of an aviation disaster, would increase efficiency in the search and rescue effort as well as damage control, which is evidently lacking about the missing Flight MH370. Putting legal obligations to contribute to a planned management framework and system would produce better results than merely expecting supports and cooperation from various parties and neighbouring countries.

IEMM should be applied as the primary model in establishing an aviation disaster management system due to its relevance and compatibility as a theory for managing disasters. In the aviation industry, disaster is considered as somewhat inevitable even a well-managed airlines company with a pristine record can suddenly be thrust into crisis mode (Fickling and Park, 2014). The year of 2014 could be marked as an unfortunate year for Malaysia's aviation industry. The country was stunned by a few occurrences of disasters that killed thousands of innocent lives. The disappearance of MH370 on March 2014, followed by the crashed of MH17 in Eastern Europe and then after a few months Air Asia QZ8501 crashed in the Java Sea (BBC, 2015). Then in 2015, the world has witnessed another three aviation tragedies namely Germanwings A320 crashes in the French Alps, Indonesian Hercules crashes into a residential area in Medan, and the most recent tragedy involving Russian airline crashes over central Sinai (BBC, 2015). There were no single survivors survived in this tragedy. Though the recent accident did not involve local aviation companies, these examples could be used to illustrate the degree of devastation that resulted from these incidents is substantial.

For instance, what devastation would result if for any reason a plane faltered in its approach to the airport, flying over a densely overpopulated city like what had happened to Indonesian Hercules? In this instance, having an integrated disaster management system and an effective emergency response is very crucial to mitigate the carnage and damage which inevitably follow a disaster. According to literature, during the crisis time, the airline company failed to exercise and execute a proper crisis management plan (Kalb, 2013). Asiana Airlines was reported to be in need of serious help with crisis management during the 2013 horrifying crash in San Francisco Airport (Kalb, 2013). Air France tragedy AF447 crash was witnessing another crisis management issue though they did an excellent job in specific areas like dealing with victims and family members their crisis management is not enough regarding its internal stakeholders and media (Cabur, 2010). During the MH370 tragedy, one of the hindrances during the search is the lack of coordination between agencies, where there was miscommunication among various agencies and countries during the search. Due to this, the search has been almost farcical at times and is likely to prompt changes in how various organisations collaborate during emergencies (Schofield, Torr and Perret 2014). It is to be reiterated again that with an established aviation disaster management system, operating under a legal framework pushed and came into fruition by those in Parliament, majority of which are members of the government party, coordination and cooperation between relevant agencies and neighbouring countries could be better, and execution of such disaster management would be better in efficiency.

Emergency management is an area that incorporates the uses of skills in management, science, law enforcement, medicine and other fields of knowledge. In formulating an effective emergency response system, the surrounding legal sphere should be considered. A proper legal framework for managing disaster is an essential instrument since it will ensure proper coordination during disaster situation and each agency is well prepared with their respective duties. A legal framework would transform a mere moral obligation to assist into a legal duty and obligation to contribute and cooperate which would better the carrying out of the emergency response to any occurring disaster or crisis, as argued before.

3.1. Chaos Theory: Predicting Disaster

Besides establishing a system to manage aviation disasters based on IEMM, theory studies should also be done, which can help with predicting disaster, and better the system framework having such theory embodied in it. An effective system must be based on tried and tested theory as its foundation. One of the theories that have been adopted in calculating disaster is Chaos Theory. Chaos Theory is a theory that originates from the field of science and mathematics pioneered by Henri Poincare in 1900 (Cambel and Ali B., 1993). It is a theory that seek to explain the behaviour of dynamical systems that are highly sensitive to initial conditions, an effect which is popularly referred to as the butterfly effect where a small difference in initial conditions (such as those due to rounding errors in numerical computation) yield widely diverging outcomes for chaotic systems, rendering long-term prediction impossible in general (Cambel, Ali B., 1993). It studies the social complexity of non-linear systems and derives from it a number of sets of complicated systems of order. The outcome it predicts is that the systems are unpredictable, but the unpredictability can be represented as overall behaviour, thus even with instability, it gives some degree of predictability (Crossman and Ashley, 2017). Currently, this theory has been applied in different disciplines such as business, public management and even in disaster response management. This is because of this theory capable of providing an explanation as to the aspect of nonlinearity (Kiel, L. Doughlas, 1995) of the world and the functional aspects of instability as a means for adopting new situations. The concept of nonlinearity refers to behaviour in which the relationships between variables cannot be explained as a linear combination whereby it represents a system which is dynamic and disproportionate (Cambel, Ali B., 1993). Furthermore, in nonlinear systems, small changes or small errors can have significant consequences (Farazmand, 2001). Finally, in nonlinear systems outcomes are subject to high levels of uncertainty and unpredictability.

It is believed that the Chaos Theory could be applicable in predicting transportation-related disasters notably aviation disaster since transportation-related disaster represents the nonlinearity of human events Based on the available literature disaster and emergency management is a challenging area because of the inherent nonlinearity of such events. Whereby even we desire to create order and control the situation, disastrous events seem to agitate our best efforts (Kiel, L. Doughlas, 1995). We are unable to predict when, where disaster might occur and the number of casualties or the number of resources or personnel required. In disaster and emergency services management, the outcomes of our errors, oversights, and even our best intentions may only, much later, result in real and unexpected surprises. Whereby based on the nonlinearity of event something that seemingly small and invulnerable may lead to real disaster. It should be noted that in Malaysia there is no specific legislation on emergency management in aviation disaster (Ainul Hafiza et al., 2015). Another available instrument is National Security Council Directive No. 20 1997 or known as the Policy and Mechanism on National Disaster Management and Relief under the purview of National Security Council. Unfortunately, this Directive can only be activated if the disaster took place in a densely populated public area.

The missing of Flight MH370 is evidence that an aviation disaster involving Malaysia's air carrier company took place, thus showing the call for the country to establish an emergency response in a proper aviation disaster management system, which would allow for prompt and decisive decision making, and active and efficient use of resources in administering such disaster if another ever take place. The finding of another debris was possibly belonging to aircraft of flight MH370 on 27th January 2017 at the Mpame Beach, South Africa shows the continuity and unanswered search and rescue effort, which had gone on for a few years now since the aviation disaster occurred. The search, though had been suspended in light of no trace found in the Indian Ocean, may be continued if there is new credible evidence leading to the identification of a specific location of the aircraft. As of now, MH370 remains unfound, and the mystery of its whereabouts unresolved. If there is a slight possibility that the search might be continued, it must be done under an aviation disaster management system. For an effective aviation disaster management system, it must be based on a model that had been proved to be a success and founded on tried and tested the theory as its backbone. It is reiterated again that the IEMM should be the model that Malaysia's aviation disaster management system is based on, and chaos theory should be the underlying principle that carries the study of predicting the unpredictable and such theory should be further researched on by Malaysia's experts and knowledgeable persons relevant to such field of study. It is also argued that Malaysia should have its legal framework on disaster management particularly on aviation disaster, to frame out the legal guidelines that the system is founded on.

4. Conclusion

The yearning for solid returns may result in gambling safety standards and regulations thus lead to the outbreak of aviation disaster. As human life is incalculable price, managing safety must be on the top priority. This paper has illustrated the importance of law as one of the integral element in safety management whereby compliance with the international aviation standard on safety system by the regulatory authority and service provider is mandatory in reducing aviation risks. It is true that it is impossible to reach for zero aircraft accident or incident, but by adhering to safety standard imposed by the relevant international regulatory bodies, it may at least reduce the number of aviation accidents. The 62 percent compliance with the international convention as reported by the IATA in 2015 is not a remarkable statistic and need to be improved. While new systems, tools and methods continue to enter the industry to make aviation safer, Malaysian aviation law must also follow suit the industry's changes to make the regulation and its regulators more avenue for compliances and safer practice. Steps have been taken, as Malaysia to the precise extent have implemented ICAO Safety Management Manual (SMM), it triangulation is still debatable. Unless total synchronisation between domestic law and international convention to be made mandatory, Malaysia will never be on the right legal path. This synchronisation is mandatory in ensuring a safer environment, and the probability of the loss of human life can purely be minimised if not entirely preventable. It is believed that the strong observance of safety mandate either with the international safety standard or national regulations will reduce the aviation risk. Conclusively and collectively, the authors of this paper also believe that a more extensive and in-depth study and research on this proposed establishment of an aviation disaster safety management should be carried out and supported by the government as well as other invested stakeholders.

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