ISBN 978-93-84468-59-0
Proceedings of 2016 2nd International Conference on Disaster Management and Civil Engineering (ICDMCE'2016)
Kyoto (Japan) April 12-13, 2016 pp.7-14

Preparedness of Airports to Natural Disaster: A Review

Norhadizah Mohd Khalid[1], Aini Mat Said[1], Elistina Abu Bakar[1] and Norhasmah Sulaiman[2]

[1]Faculty of Human Ecology
[2]Faculty of Medicine and Health Sciences, University Putra Malaysia

***Abstract*:** *This paper deciphers economic development of airports throughout the world and especially in Malaysia. Lesson learn from event of natural disaster affected the airport. The business continuity; resiliency and preparedness to the airports are discussed.*

Keywords: *airport, natural disaster, preparedness, resilience and business continuity.*

1. Introduction

In this 21st century, natural disasters has affected the worldwide economy directly or indirectly and also generates short and long term impact. The short impact (immediate) has destroyed assets such as buildings, infrastructure and inventories. The long term impact of natural disaster generates losses in economic activities in affected area especially people loss of daily income and companies loss their business and access to markets. Nonetheless, natural disasters have been affected air travel and airport infrastructure and operations. Therefore, the need to take serious thought of the dysfunction of airports into greater consideration in emergency preparedness and business continuity. If they do occurs for any length of time this can cause serious economic loss and disrupt of the airport functions.

Airport plays essential part in global transportation system and airlines industry, connecting cities, countries and communities and brought business together. Throughout the world, airports are divided into six region; African, Asia Pacific, Europe, Latin America-Caribbean, Middle East and North America regions. Among all the regions, the airports in Europe region and North America region gain traffic passenger at 5.2% and 3.2% in 2013 and slightly higher in 2014, while Middle East and Latin America Caribbean have strong passenger traffic in 2014 at 10.3% and 6.2% [1]. Apart from that, one of the regions experienced highest growths of 5.9% over 2013 was Asia Pacific. The Asia Pacific region passenger traffic growth has slowed in 2014 compared to 2013. Globally, 5.7 billion passengers travelled by air in 2014 an increase of 5.1% over 2013 [1]. The international passenger numbers grew by 6% with Asia Pacific recording 5.9% in 2014. Across the globe, demand for domestic air travel rose 5.4% in 2014, with all markets showing expansion [26].

Among the world top 30 airports, 27 of the airports have gained increased in traffic from May 2013 to April 2014 [1]. The increase of the airport traffic is due to decline the price of jet fuel. According to Airport Council International (ACI) report, the average oil prices decreased by 3.9% in 2013 compared to 2012 and dropped even lower per barrel by 6.3% (US$117) in 2014. In the early 2015, the oil prices fluctuated at amount of US$50-60 per barrel. The decline price jet fuel in the world has increase in the passengers to travelling, global business are expanding in terms of drop in air fares and surcharges and it also profitability for airlines will increase and in turn, encourage increased seat offerings and lower fares, increases loads of cargoes and boosting passenger traffic by 7.0% in 2015 [26]. According IMF, the global economy forecast for 2015 is projecting 3.8% growth while Malaysia GDP is expected to grow from 4.5% to 5.5%. While, three of the organization from ACI, ICAO and IATA projected the global passenger traffic growth is 4.7%, 6.3% and 7.0% for 2015.

The passenger kilometres are expected to grow at 5.5% in the Asia- Pacific region in the next 20 years due to aviation and tourism sectors. These sectors are expected to grow to 46.4 million by 2032 increase 91% from 2012 and gives contribution to growth of GDP 209% from 2012 to $1.6 trillion by 2032 [11]. According to United Nations World Tourism Organization's (UWTO), these can be seen in increasing of international tourist where the tourist arrivals rose by 4.7% in 2013 and increase to 5% from January to October 2014. The global passenger traffic grew at rate of 4.6% in 2013 and growth to 4.9% in 2014 is more than the average growth rate in passenger traffic from 2004 to 2014 is at 4.2% [1] as in Figure 1. This show that the increase of international tourist makes the passenger traffic increase, consistent with UNWTO outcomes.

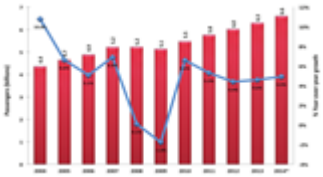

Fig.1: Total worldwide passengers (2004-2014)
Source: ACI Annual report, 2014

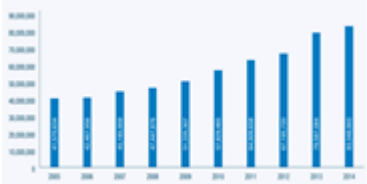

Fig. 2: Passenger Movement at MAHB Airports (2005- 2014)
Source: MAHB, 2014

Most regions showed signs of weakness after several years of flat growth in relation year-over-year growth rates in air cargo volumes in 2013. The air cargo market in the last quarter of 2013 into 2014 has awakened by net increase in global demand for foreign goods and commodities. Air cargo traffic increased in 2013 by almost 1% and volumes are increase by over 4% in 2014 [32]. By regions, the Middle East the greatest gain air cargo volumes growth almost 9% with Asia Pacific increased by 6% in 2014 [1]. Malaysia is located in Asia Pacific region where totals passenger traffic at Malaysia Airports' facilities reached 83.3 million passengers for the first time, rising 4.7% in 2014. International passenger traffic rose 4.9%, while domestic passenger traffic grew by 4.5% in 2014, compared to 2013. Malaysia Airports has recorded increase of 7.3% from 2013 to 791,562 commercial aircraft movements in 2014. According to ACI, the cargo movement in Malaysia airports growth up to 7.5% to 1,007,463 metric tonnes in 2014 was faster than global growth rate which was 4.7% in 2014 [26] as in Figure 2.

2. Natural disasters of the airports

Worldwide, natural disasters were affected nearly 700 million people (Figure 3) and 450 natural disaster (Figure 4) events were recorded by CRED according to International Monetary Fund (IMF) study. Accordingly, the damages have risen from an estimated $20 billion up to $100 billion on average per year in from 1990s to 2010. As a result of the upward trend of the natural disaster is expected to gives impact on people living in concentrated coastal areas and more exposed to natural disasters, and climate change. In Figure 5, natural disaster were affected more than 200 million people and killed more than 70,000 people of world total annually and this amount represent 90% of affected people and 65% of people killed in the world totals [25]. Asian-Pacific countries continue to suffer in economic losses from disasters caused by natural hazards. Nonetheless, Asia is the region mostly suffer from disasters where in 2007, 37% of the disasters occurred in this region [24] caused by natural hazards. The disasters gives great impact in economic, death, environmental damage, and severe for social development.

Fig. 3: Number of natural disasters, Worldwide (CRED)
Source : IMF

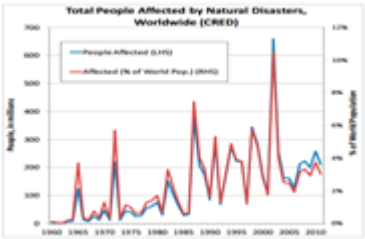

Fig. 4: Total people affected by natural disaster, worldwide (CRED) Source : IMF

The Asian region is most vulnerable to the impact of many types of disasters including floods, cyclones, earthquakes, drought, storm surges, tsunamis and haze. The vulnerability to disaster impact was due to increasing of urbanization and poverty [36], migration pattern and population growth of people resident to the high risk areas especially in coastal areas. This give a great impact to the airports that mostly located at the coastal areas such as Don Muang Airport, Thailand flooded in 2011, New Orleans Lakefront airport flooded by Hurricane Katrina and Great East Japan Earthquake inundated Sendai airport. The disasters will occur at unexpected scale [2] [3] if no action will be taken.

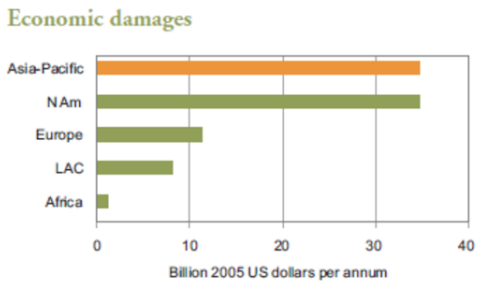

Fig. 5: Average annual economic damage for natural disaster, world regions, 2001-2010
Source: UNESCAP report 2011

The recent disasters in Asian countries such as the devastating earthquake and tsunami in Japan of March 2011 has given high impact to the Sendai area where the tsunami has inundated the coastal communities including the Sendai Airport. The airport was inundated at the first floor causing the airport to stop operation and around 11,000 passenger stranded inside the terminal [21]. Another natural disaster happened on 25 October 2011, Don Muang Airport was closed operation due to monsoon flood where airport runway and runway lighting were flooded. The latest event was Typhoon Haiyan hit the Philippines in November 2013 affected around 800 000 workers, with their source of livelihood damaged or displaced overnight. The natural disaster such as earthquakes are most destructive disaster can affect airports and its' facilities especially the fuel farms. The intense magnitude of an earthquake could theoretically dysfunction of aircraft systems such as ILS system (instrument landing system). Besides that, the earthquake can crack the runway and destruct the Air Traffic Tower and terminal building of the airports. In a major earthquake, airports near the epicenter might not be operational for weeks due to the destruction. This gives high implications for regular passenger, cargo flows and the transport of emergency relief personnel and supplies and highlight the value of preparedness for natural disaster.

Climate change has been the main issue affected the natural disaster to become very extreme. Natural disaster has been increased triple since in the sixties such as earthquake, tsunami, typhoon, floods, droughts and haze. According to IPCC report, surface air temperature are mostly rise between 1°C to 3.5°C lead to rise in sea levels of 15 and 95cm in the next century. The global temperature has been increased by 0.76ºC over the last 150 years [22]. The Intergovernmental Panel of Climate Change (IPCC) has concluded that the climate changes are because of the human activities of releasing of the greenhouse gas to the atmosphere. If there is no changes has been made an estimation of temperature will reach 2.8ºC by the end of the century [23] scenario. The phenomena expected to be occur are sea-level rise, temperature increases, increase in extreme weather and storms; and changes of precipitation and induce flash flood or flood. The impact of climate change to airport is in term of global sea-level rise. The rise of sea-level has been predicted between 0.2 to 0.5meters by the year 2100 [22]. The combination of sea-level rise and increase of storms can build up frequent storm surge and flooding the airports located at coastal area. While low lying coast areas and island will disappear due to the rising sea levels. Most of the international airports are located at the coast are at risk of sea-level rise and there has been reported 34 airports in Europe area are at risk [11].

3. Literature Review

3.1. Business Continuity Management

The Business Continuity Management (BCM) is an emerging practice and appropriate for risk-management process to ensure function of airport operations in face of uncertainty. If the organizations correctly implement the Business Continuity Management, the organization is considered very resilience organizations. Airport business can be disrupted in multiple and unexpected ways. Some disruptions are routine and can easily to overcome and other, however is fatal to conduct and overcome the situations. Disruption can be categories into four that are natural disasters, accidents, negligence and intentional attacks [14]. This disruption can interrupt and threaten the airport operational viability.

Crisis management has a strong linked to BCM in a management practice [11] where in the frame of crisis management, the BCM are developed. Both, BCM and crisis management are different in terms of management process. The crisis management is more to socio-centric (government, public bodies) while BCM is business centric (organization, customers, suppliers etc.) [12]. BCM is promoted to provide the outputs of processes and services that can be delivered in the face of risk [8]. Many BCM standards and best practice framework exist using the Australian Standard for BCM (HB292:2006) as a guidance model such as the British Standard (PA56) and the American Standard (NFPA 1600).

Business continuity of airports is most challenging and complex when it gives negative impact to the consumer, passengers and tourist in delayed of the flight; the passengers and consumers stranded for days due to weather phenomenon and natural disaster; and also closure of airport due to terrorist attack. As for example the 9/11 has make the number of passengers traveling through the airport dropped from 13.3 million in 2001 to 12.9 million in 2002[14],due to effect of terrorism on public perception on flying, economic downturn and competing of regional airports. Due to the terrorism, the airport has to be close for temporary. The economic impact of the closure has cost $330 million per day to the airport and $27 million to state and local tax revenue [35].The closure has cost the individual business at the airport loss of 60% over the fiscal year. The surrounding small business owners and Hyde airport losses was estimated in the tens of thousands of dollars [40].

In the aviation industry, there has been a limited application of this process. The concept of continuity approaches was examined on how to improve logistics flows in airports [18]. BCM has been used on Air New Zealand to demonstrate on how the airline would survive [16]. Studies of airports use BCM was widely discussed in the benefits if airport continuity in terms of protecting the critical airport infrastructure. The study [18] on continuity of the airports are concentrated more on security. Other studies discussing on airport continuity approach, is not the same criteria as the BCM process but both shares same similarities of the goal is to sure the functionality of the airports continued during crisis situation. During natural disaster, airports are often used as a center for receiving and distributing aid and food besides as a temporary shelter. One of the study [37], deliberates the important to preserve airport operation in a natural disaster situation. While another study [19] the Toronto Pearson international airport on how they develop pandemic response plan from lesson learn of SAR event.

3.2. Resilience

Resilience has been defined in variety of ways and has been used in many fields. UNISDR definition of resilience means the ability of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain to its essential basic functioning and structures. The social system must capable of organizing itself to increase capacity for learning from past disasters and improve risk reduction measures for better future protection [39]. Most definition of resilience emphasize on a capacity to be able to adapt the disturbance, stress or adversity [30] and return to normal condition at a time required [5]. Resilience is also taken into account on how to reduce or avoid losses, restrain the impact of disaster with minimal recovery [7][27][38].

In hazard research, generally, resilience is more focused on engineered and social systems. The focused are on pre-event measures to prevent from hazards damage and losses and post-event strategies to cope with and

minimize disaster impacts [6][38]. The use of resilience as an outcome or a process is an important in disaster reduction [9]. When resilience is considered as an outcome, it define as the ability to be at equilibrium with hazard event and embedded within vulnerability [27] meanwhile the process is in terms of continual learning and make better decisions in handling the hazards [9]. In global change perspective, resilience often embedded with adaptive capacity or mitigation [6][33][34][38].

Airport resilience is the airports ability to plan for, recover from and response to disaster or disruption within limited impact on the services and function of the airport and as resources to the community. The idea of airport resilience has getting more attention nationally due to high impact of extreme events such as typhoon, storms, flood, earthquake, tsunami and volcanic eruption. The airport's has to be able to response in the events become more critical for an example, Japan earthquake and tsunami 2011 has cancelled 131 services, affecting 32,700 passengers, while 24 flights were diverted for all Nippon Airways. According to Japan's government, the total cost of the damage caused by the tsunami would be at about 25 trillion yen – or U.S. $309 billion which is the most costly disaster since the World War II.

The most important of airport resiliency is planning. Resiliency planning allows an airport to cope with changing conditions drastically before they arise, manage to deal with issues during events effectively, recover after events and to prevent issues from happening again. As the frequency and intensity of extreme weather events increase, so does the impact to social, financial and environment. In order to be resilient the planning must be more on how long it takes to get back to a normal situation and also how to provides supplies, aid and other items during disasters. Besides planning, learning from the past events is another element of resiliency. By doing this, the same problems are not being replicated in the future events and become more resilience. Without good resiliency planning, airport functioning as receiver of emergency aid has to take longer time for the aid to come through and lives might be at stake.

3.3. Preparedness

Preparedness is different from resilience in the way how the system adapts to its environment [17]. Preparedness of an organization will include plans and procedures in better response and recovery without changing its organizational structure. Preparedness is a continuous process to improve response and recovery of event situation that effect public safety in term of disaster management. Preparedness defined as "actions taken in advance of an emergency to develop operational capabilities and to facilitate an effective response in the event an emergency occurs" [15]. In a view of preparedness is planning, resource identification, warning systems, training, simulations, and other actions taken before disaster happen for improving the safety and effectiveness of response during a disaster [13]. While "preparedness includes such activities as formulating, testing, and exercising disaster plans; providing training for disaster responders and the general public; and communicating with the public and others about disaster vulnerability and what to do to reduce it" [29]. Nonetheless, there are no universal definitions of preparedness. The choices of preparedness definition are depends on the determination of the main objective is to apprehend problems and propose the best action taken [20]. "The purpose of preparedness is to anticipate problems in disasters so that ways can be devised to address the problems effectively and the resources needed for an effective response are in place before hand" has been clarifies [29].

As acknowledge, there are four phases involve in disaster management; prevention, preparedness, response and recovery. As overall, preparedness is the essential phases in disaster management and there have been various reasons for it. A study proclaim that an effective preparedness can reduce injuries, save lives and minimize property damage [29]. Besides that, preparedness enhance the flexibility to response in disruptions of disasters [28] and increase inter-organizational coordination and communication when problems arise [3], strengthen personal relationship [10] and establishes the responsibilities of agencies involved during the disaster response operations [28]. All this can be accomplished through preparedness activities such as drill, disaster exercise and joint planning among the participating agencies (e.g. community officials, state officials, outside agencies, municipalities and first responders). Furthermore, the benefit of preparedness is that it identifies resources (personnel, money, time, equipment, supplies and facilities) and functions (evacuations, damage

assessment, and causality containment) that needed in phase of response and recovery [3]. Preparedness has increased the ability to extemporize during the disaster [20]. For all these reason, therefore, preparedness cannot be overestimated [28].

4. Conclusion

All over the world, airport system all is complex and integrated. Once the airport system is disrupted by extreme event such as natural disaster the whole system affected. Failure to apply business continuity planning for any extreme event can lead wide failure of airport system. One of the most affected actions is airport closure that can cause people stranded with airlines not operated, business affected, goods and medical supplies couldn't be delivered and mostly affected both the airport financial and economical of the country. This can be overcome by improves the level of preparedness of the related agencies by knowing the risk and community encounter and preparing for worst case scenarios [31]. While learning from the past events can becomes more resilience.

5. Acknowledgements

I wish to express my sincere gratitude to Assoc. Prof. Dr. Aini Mat Said for her guidance, encouragement and providing me this opportunity to embark on writing this article. Apart from that I would like to thank to my co-supervisor Dr. Elistina and Dr. Norhasmah for their advice.

6. References

[1] ACI World Office. (2014). ACI Annual Report. Airport Council International (Vol. 53)

[2] Ainuddin, S., & Routray, J. K. (2012). Community resilience framework for an earthquake prone area in Baluchistan. *International Journal of Disaster Risk Reduction, 2, pp. 25-36.*

http://dx.doi.org/10.1016/j.ijdrr.2012.07.003

[3] Auf der Heide, E. *Disaster response: principles of preparation and coordination. In Disaster response: Principles of preparation and coordination*. Canadá. CV Mosby Company, 1989.

[4] Bilham, R., & Hough, S. (2006). Future earthquakes on the Indian subcontinent: inevitable hazard, preventable risk. *South Asian Journal*, *12*(5), pp. 1-9.

[5] Bodin, P., & Wiman, B. (2004). Resilience and other stability concepts in ecology: Notes on their origin, validity, and usefulness. *ESS bulletin*, 2(2), pp. 33-43.

[6] Bruneau, M., Chang, S. E., Eguchi, R. T., Lee, G. C., O'Rourke, T. D., Reinhorn, A. M., ... & von Winterfeldt, D. (2003). A framework to quantitatively assess and enhance the seismic resilience of communities. *Earthquake spectra*, 19(4), pp. 733-752.

http://dx.doi.org/10.1193/1.1623497

[7] Buckle, P., Mars, G., & Smale, S. (2000). New approaches to assessing vulnerability and resilience.

[8] Camastral, M., & Barnes, P. "The application of Business Continuity Management in airport infrastructure". IV International Resseach Society for Public Administration Conference, April 2011, pp. 0–13. Retrieved from http://eprints.qut.edu.au/47358/2/47358.pdf

[9] Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change*, 18(4), pp. 598–606. Available : http://doi.org/10.1016/j.gloenvcha.2008.07.013

http://dx.doi.org/10.1016/j.gloenvcha.2008.07.013

[10] Dynes, R. R. (1994). Community emergency planning: False assumptions and inappropriate analogies.

[11] Eurocontrol (2010). EUROCONTROL Annual report

[12] Gibb, F., & Buchanan, S. (2006). A framework for business continuity management. *International Journal of Information Management*, 26(2), pp. 128-141.

http://dx.doi.org/10.1016/j.ijinfomgt.2005.11.008

[13] Gillespie, D. F., & Streeter, C. L. (1987). Conceptualizating and measuring disaster preparedness. *International Journal of Mass Emergencies and Disasters*, 5(2), pp. 155-176.

[14] Richardson, H.W. and Gordon, P. eds., (2009). *Global business and the terrorist threat*. Edward Elgar Publishing.

http://dx.doi.org/10.4337/9781848449350

[15] Godschalk, D. R. (1991). Disaster mitigation and hazard management.Emergency management: Principles and practice for local government, pp.131-160.

[16] Halliwell, P. (2008). How to distinguish between 'business as usual' and 'significant business disruptions' and plan accordingly. *Journal of business continuity & emergency planning*, 2(2), pp. 118-127.

[17] Hémond, Y., & Robert, B. (2012). Preparedness: the state of the art and future prospects. *Disaster Prevention and Management*, 21(4), pp. 404–417. http://doi.org/10.1108/09653561211256125

http://dx.doi.org/10.1108/09653561211256125

[18] Herbane, B., Elliott, D., & Swartz, E. M. (2004). Business continuity management: time for a strategic role?. *Long Range Planning*, 37(5), pp. 435-457.

http://dx.doi.org/10.1016/j.lrp.2004.07.011

[19] Johanis, D. (2007). How Toronto Pearson International Airport applied lessons from SARS to develop a pandemic response plan. *Journal of Business Continuity & Emergency Planning*, 1(4), pp. 356-368.

[20] Kreps, G. A. (1991). Organizing for emergency management. Emergency management: Principles and practice for local government, pp. 30-54.

[21] Suppasri, A., Koshimura, S., Imai, K., Mas, E., Gokon, H., Muhari, A., & Imamura, F. (2012). Damage characteristic and field survey of the 2011 Great East Japan Tsunami in Miyagi Prefecture. *Coastal Engineering Journal*, *54*(01), pp.1250005.

http://dx.doi.org/10.1142/S0578563412500052

[22] IPCC (2007) Climate change 2007: mitigation of climate change. In: Metz B, Davidson OR, Bosch PR, Dave R, Meyer LA (eds) *Contribution of working group III to the fourth assessment report of the intergovernmental panel on climate change.* Cambridge University Press, Cambridge, pp 851

[23] IPCC Core Writing Team, Pachaury, R.K. & Reisinger, A. (2007) *Contribution of working groups I, II, and III to the fourth assessment report of the intergovernmental panel on climate change*. IPCC, Geneva, Switzerland.

[24] Institution of Mechanical Engineers (2013). *Natural Disasters: Saving Lives Today, Building Resilience for Tomorrow*. Available: http://uscdn.creamermedia.co.za/assets/articles/attachments/46555_natural_disasters_report_lr.pdf

[25] Jackson, J. (2006). Fatal attraction: living with earthquakes, the growth of villages into megacities, and earthquake vulnerability in the modern world. *Philosophical Transactions. Series A, Mathematical, Physical, and Engineering Sciences*, *364*(1845), pp. 1911–25. Available http://doi.org/10.1098/rsta.2006.1805

http://dx.doi.org/10.1098/rsta.2006.1805

[26] MAHB. (2014). 16th Annual General Meeting.

[27] Manyena, S. B. (2006). The concept of resilience revisited. *Disasters*, 30(4), pp. 434-450.

http://dx.doi.org/10.1111/j.0361-3666.2006.00331.x

[28] McEntire, D. A., & Myers, A. (2004). Preparing communities for disasters: issues and processes for government readiness. *Disaster Prevention and Management*, *13*(2), pp. 140–152. Available http://doi.org/10.1108/09653560410534289

http://dx.doi.org/10.1108/09653560410534289

[29] Mileti, D. (1999). *Disasters by Design:: A Reassessment of Natural Hazards in the United States*. Joseph Henry Press.

[30] Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology*, *41*(1-2), pp. 127–50. Available: http://doi.org/10.1007/s10464-007-9156-6

http://dx.doi.org/10.1007/s10464-007-9156-6

[31] Ofrin, R., & Salunke, S. R. (2006). Disaster preparedness in the South East Asia region. *International Review of Psychiatry*, 18(6), pp. 495-500.

http://dx.doi.org/10.1080/09540260601129255

[32] Oxford Economics. (2011). Economic Benefits from Air Transport in Malaysia.

[33] Paton, D. (2006). Disaster resilience: building capacity to co-exist with natural hazards and their consequences. *Disaster Resilience: An Integrated Approach*. Available: http://books.google.co.uk/books

[34] Paton, D., & Johnston, D. (2001). Disasters and communities: vulnerability, resilience and preparedness. *Disaster Prevention and Management*, *10*(4), pp. 270–277.Available: http://doi.org/10.1108/EUM0000000005930

http://dx.doi.org/10.1108/EUM0000000005930

[35] Rubin, C. B., & Renda-Tanali, I. (2002). Effects of the terrorist attacks of Sept. 11, 2001, on federal emergency management in the US. Journal of the American Society of Professional Emergency Planners, pp. 1-18.

[36] Scheuren, J.-M., Waroux, O. le P. de, Below, R., Guha-Sapir, D., & Ponserre, S. (2007). Annual Disaster Statistical Review.

[37] Smith, J. (2008). Maintaining airport business continuity and operations during disaster response: The role of command and control relationships with emergency management agencies. *Journal of Business Continuity & Emergency Planning*, 3(1), pp. 66-74.

[38] Tierney, K., & Bruneau, M. (2007). Conceptualizing and measuring resilience: A key to disaster loss reduction. TR news, (250).

[39] United Nations. International Strategy for Disaster Reduction Hyogo Framework for Action 2005-2015: Building the Resilience of Nations. Presented at the World Conference on Disaster Reduction (A/CONF.206/6), 2005, pp. 25.

[40] The Washington Post, 2002. "Frustrations Mount Over Clinton Airport's Closure; Hyde Field Pilots, Business Owners Seek Federal Relief," July 25, p. T03