

## Impacts of flood on children and adults' health and ways to sustainable development

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**Abstract:** One of the events that will remain fresh in the minds of Kelantanese is the 2014 massive flood that occurred at the end of that year. Heavy rains fell initiating vast flooding in most areas of Kelantan leading to great destruction of livelihood of local communities. Natural hazard such as floods are not only caused by natural processes but also by human activities. The flood recorded severe fatalities, injuries and exposed many vulnerable to diseases. This paper through critical review of literature considered the long-term impact of floods on human's health as the effects could meaningfully contribute to the worldwide burden of disease. Also, its outcomes are relentless hence need to be adequately comprehended and addressed through sustainability. This study revealed vulnerability to flood inclined ailments as psychological distress in the survivors is liable for a quota of all physical ailments. Hence, sustainable approach to flood preparedness and prevention is instantly needed. Accolades should be given to the Malaysian government for taken bold steps in that direction in recent time but success will be achieved if implementation is in compliance with sustainability agenda spelt in the New Sendai Framework for Disaster Risk Reduction 2015-2030.

### 1. Introduction

The flooding experience of 2014 cannot be forgotten by Malaysians especially the Kelantanese. Precisely, on the 26<sup>th</sup> of December 2014 to January 2, 2015, there was a massive flood in the state of Kelantan, Malaysia. Heavy rains fell initiating great flooding in most regions of Kelantan resulting into great disruption of livelihood of residents [1].

Report had it that across the country, quite a large population of residents were affected by the ugly visitor (flood) and Kelantan state was identified as the most affected among the affected states [2]. In an attempt to describe the scenario, it is not out of place for one to say that the speed of the flood water in the affected regions flowed so fast with vitality equivalent to that of Tsunami, displacing anything that obstruct its channel of flow including buildings and other infrastructures as displayed in figure 1 and figure 2 respectively.





**Figure 1.** Property damaged-House the cars.



**Figure 2.** Tsunami-like disaster damaged another house.

Record has the flood as the worst that hit the country of Malaysia in two centuries (20 decades) with the assumption that surge of such magnitude happens seldom perhaps once in 1000 years. Specifically, for the state of Kelantan, the catastrophe was exceptional in the trace of its existence. The property that was ravaged by the floods comprehensively in parts of peninsular Malaysia is anticipated to cost Putrajaya and the Kelantan state governments more than RM 1billion [3]. Considering the assessment of destruction caused by the natural hazard, it is appropriate to call it a national disaster because of the huge economic loss of approximately USD 0.7 billion that Malaysia as a nation suffered.

It is knowledge widening and truthful that natural hazard such as floods are not caused by natural processes only but also by human activities. A number of investigators have revealed that human activities contribute largely to natural menace like the one under context. For example, Azuhan [4] and Sathiamurthy & Kong [5] unwaveringly blamed the happening of the flood on the unusual rainfall within short interval and illegal exploitation of natural vegetation such as logging activities. The flood caused acute fatalities, injuries and left many residents to diseases.

Great and astonishing floods such as the one under context, subject the elderly, who are in need of assistance relating evacuation and admission to medical amenities, and who perhaps hesitate to abandon their houses, at bigger risk of injury and death [6, 7]. Giving clear proofs that residents of the affected locations actually suffered these discomforts can be observed in the work of Baharuddin *et al* [8] captioned “The Record-Setting Flood of 2014 in Kelantan”. Baharuddin *et al* [8] acknowledged the inflow of flood victims (patients) of Kelantan to Hospital University Sains Malaysia (HUSM) to add to the numbers transferred to HUSM by Hospital Raja Perempuan Zainab 2 (HRPZ2) after the vacation of their health centre on the 25<sup>th</sup> day of December 2014. The transferred patients’ situations were largely critical issues from protracted medical situations namely; acute exacerbation of chronic obstructive airway disease, acute coronary syndrome, sepsis, heart failure, among others. This paper will ponder on the long-term impact of floods on human’s health as the effects could meaningfully contribute to the worldwide burden of disease.

A few researchers such as Ramin & McMichael [9] and Schwartz *et al.* [10] opined that floods may be directly responsible for long term mortality such as increase in diarrheal deaths in developing nations or indirectly, affecting health, food and economic settings, aggravating poverty, starvation and noncommunicable diseases [11]. Furthermore, its consequences are unrelenting therefore need to be better understood and addressed through sustainable approach. Sustainable innovations or ideas like preventive measures and adaptation planning to decline post-flood mortality and morbidity should be holistically pursued.

## 2. Literature review

Flooding is the most popular kind of natural disaster globally, and has so become an important point of concern within the developed and developing countries. In Europe, floods have been reported to have affected more than 3.4 million people over the last decade, with number of death extending into the

thousands [12]. The prediction of the WHO Regional Office for Europe [13], is that by the year 2085 flooding could directly affect about 5.5 million people in Europe yearly, if sustainable measures regarding climate change are not taken serious. With tenacious rainfall causing various types of flooding, this affected over 7000 households in the United Kingdom while incurring major disruption to personal livelihoods, property and public transport systems [14]. Flooding affects numerous aspects of man's environment and these include his economic activities; settlements and health.

Flooding is a momentous rise of water level in a stream, lake, reservoir or coastal system that overflows the banks. Otomofa, Okafor, and Obienusi [15] uncovered that there is increasing susceptibility or vulnerability of populations and infrastructure to flooding and flood related hazards. ProVention Consortium [16] expressed that normal floods are anticipated and welcomed as they offer rich soil, water and means of transport, but flooding at a big scale may causes damage to life, built and natural environment.

Floods are complex events by nature, caused by a collection of human exposures, incorrect development planning and climate change [16, 17]. Hence, attempting to describe any form of floods gives prominence to central factors such as weather, climate and climate change. These three words (weather, climate and climate change) are unified. In trying to figure out their meaning, we will examine from the International Strategy for Disaster Reduction (ISDR) perspectives. International Strategy for Disaster Reduction [18] views weather as a set of meteorological settings like rain, wind, snow, temperature and sunshine at a specific time and place. While by disparity, the term climate refers to the overall long-term features of the weather experienced at a certain place. In a more concise expression, Othman [19] addressed climate change as a long term changing tendency of climate. Climate change is a stern issue because its consequences are serious and devastating [1].

Climate change is becoming a global interest in the recent times therefore gaining prominence for recognition. Climate change is affecting the world at large and Asia is of no exception as natural disasters consequences are frequently experienced in this continent. To buttress this statement, Sakar *et al.* [20] confirm that for the past few decades, Malaysia like other nations of the world has experienced climate change through changing rainfall patterns, increasing temperature, and life-threatening weather conditions. These factors lead to growing incidence of climate related disasters which are primarily floods that promotes regular global warming episode.

Worthy of mentioning is the 2014 flood in Malaysia where three states namely; Kelantan, Terengganu, and Pahang experienced unusual and heavy rains that caused great flooding. Among the affected states, Kelantan was the most severe and left with the greatest ravage. The Kelantan flood of 2014 can be regarded as unpredictable and unprecedented. Going by the level of devastation, it is marked the biggest and worst flood in the state in the past 10 decades (century).

Many people were homeless and discomforted. Both social and emotional costs were involved in flooded areas. These costs comprise displacement from homes, the loss of private valuables and the continuing fear and insecurity caused by the ugly experience. Portable water supplies were polluted and lost during episodes of flood. Borneo Post [21] presented that, Kelantan recorded the highest number of evacuees, followed by Terengganu and Pahang respectively as summarized in table 1.

**Table 1.** Summation of evacuees in states hit by 2014 flood.

S/N	States	Total Number of Evacuees
1	Kelantan	20,468-24,765
2	Terengganu	21,606
3	Pahang	10,825

As vulnerability to floods is inescapable, relentless attention through sustainable development or approach has to be dedicated to lessening hazard connected with its happening especially the long-term effects. This can be achieved through the introduction or adoption of adequate planning to enhance operational capabilities and preventive steps that are focused at reducing the impacts thereof.

This paper examines the impact of floods on the built environment with emphasis on human's health in Kelantan State, Malaysia.

### 3. Consequences of flood on sustainable development

Floods may be responsible for unsmiling variations in environmental cleanliness and individual health. Huang *et al.* [22] said pollutants over the flooded scenes can be spread by the action of flood with shared characteristics of abating drinkable water supply and conditions of living or place of abode. The shocking consequence of flood on the environment and infrastructure, poor diet, overcrowded accommodations and unhygienic conditions perhaps give rise to the risk of contagious ailments. Vachiramon *et al.* [23] and Balato *et al.* [24] concurred that diseases such as bacterial and fungal skin infections, eczema, urticaria (nettle-rash) and scabies are said to be powered by floods. In another development, Wade *et al.* [25] and Chen *et al.* [26] claimed that floods and heavy precipitation are affiliated to increased gastrointestinal (GI) sicknesses namely; enterovirus infection and bacillary dysentery.

Floods can be viewed as a facilitator or booster to the quick or fast spread of some silent killing health irregularity. Developing countries are said to suffer severe threats of infections particularly residents that are residing in floods-prone areas and elderly and children are the high ranked on vulnerability than any other class within the range of the flooded locations [27]. As water turbidity increases, the elderly and children increase their chances of contacting gastrointestinal (GI) tract infection. For it is a common or usual practice to see children using flooded water as playground without the understanding or knowledge that they are widening their susceptibility of infections [28, 29]. Stating clear need for sustainable development in the management of epidemics in the now and the afterward bearing in mind that the source of the ailments (floods) is unavoidable or unstoppable or inseparable from man. Hence, need to consider impact of flood on health for both children who are the future generation and adult becomes non-substitutable.

#### 3.1 Children's health

It is no longer false but true that the destruction caused by natural disaster on individual is extensive and Raj & Sekar [30] have ranked children as the most exposed class, followed by women, elderly and people with disabilities respectively. Factors such as dislodge from familiar surroundings, loss of parents, witnessing the passing unto glory of their beloved ones, horror of disaster repetitions among others, may be responsible for the high number of vulnerability among children.

Pine and Cohen [31] acknowledged that distress undergone by children in disaster leads to several psychological problems. Despite being prone to this awkward and unavoidable situation, research on children's health in flood occurrence receives little attention. Vranda & Sekar [32] stated that poor recognition and underestimation of the post-disaster psychological effects on children by mental health professionals in flood dominated locations is obvious. This is one of the motivations for this research in the direction of sustainability bearing in mind the popular slogan that "better safe is better than sorry".

Disaster preparedness with distinct orientation to psychosocial aspects through care givers is one of the sure measures to ameliorate the distress of both children and adult affected by any disaster (on-set or slow set) because it decreases the susceptibility factors that curtails the pain of any hazard on the affected person or family. There is need for more research to be conducted on the most vulnerable cohort to flood-related diseases as this can help in preserving them from further contact with both the discovered and yet to be discovered diseases.

#### 3.2 Adult's health

A disaster whichever form it manifests, is the misfortune of a natural or human induced hazard that depressingly shakes people and environment. According to the findings of Vranda & Sekar [32] the wrath of disaster rests on the psychological, social, physical and economic capacities of the victims' i.e. individual, family and community.

It is evident that investigation on the impact of flooding on human's health is not gaining popularity in Malaysia. Even the few that exist regarding methods to diminish the impact of flooding suffer little assessment. This study finds it imperative to reflect on flooding since it has the ability to harm anything regardless of settings (from single house to many houses) and locations (particular or several locations).

According to Alderman *et al.* [11], the predominance of mental disorderliness involving downheartedness, concern and even post-traumatic stress disorder (PTSD) is approximately between 9 to 53 per cent for as long as two years after the flood. When home is flooded, there is possibility for dominance of signs among those with health and financial challenges to increase triple times [33]. This shows that, people with mental conditions before the flood stand a greater risk if anxiety is not controlled. Been affected by flood in the past and the constant thought that it will still surface in the nearest future; largely contribute to poor health [11, 33-35]. Stanke *et al.* [35] proves the existence of some elevating household fury among males and females in the aftermath of flooding. Interruption of daily activities, congested momentary shelter, reflection on owned belongings but lost to flooding, living condition that is so demanding and financial incapability among others, may be affiliated to the violence rising.

According to Reacher *et al.* [36] physical ailments developed following flood is rooted in emotional agony and these have a prolong effects on the behaviour of the survivors. From the above explanations, it can be assumed that feelings after shock such as flooding have negative results on human's well-being. As such, prevention is absolutely non-negotiable. The record of health impairments after flooding is influenced by a number of factors namely:

- The level of devastation caused to properties.
- The record of death and injury sustained.
- The duration of normalcy restoration or recovery.
- Accessibility to insurance and response rate from the insurance managers.
- The state of preparedness prior to flooding, community resilience and social supports network.

### 3.3 Malnutrition

Floods do not only affect human health but also cause malnutrition and absence of morale. Floods affect the agricultural sector by destroying crops, livelihood of the people, and also destroy homes and infrastructures [37]. Thus, it has the capability to reduce agricultural produce thereby causing food shortages in the stricken regions.

As witnessed in neighbouring countries to Malaysia such as People's Republic of Bangladesh, selected parts of Australia and the continent of Africa, floods overwhelm land and destroy agricultural harvests [11]. Kelantan in particular was not spared in the recent strike of flood in the year 2014. As Shamshuddin *et al.* [2] confirmed that this actually happened in Kelantan during the 2014 flood. As their report shows devastation of agricultural plots regularly used for cultivation thereby causing immeasurable damage to farmers. Furthermore, natural grasses in the environment were absolutely destroyed leaving nothing for the surviving livestock to graze. With the report, one would say that the lucky and innocent livestock who might have survived the disaster had no means of feeding enough thereby reducing their economic value if they are to be sold or exchanged for money.

The recent work of Shamshuddin *et al.* [2] corresponds with the assertion of Austin and Baharudin [38] that Agriculture which contributes approximately 10 per cent of Malaysia's Gross Domestic Products and gives sustenance of livelihoods to minimum one- third population of Malaysia is been threatened by flood [38]. This implies that, the agricultural sector can be affected in terms of production and the people employed under this would have their socio-economic life depressed as well. It is appropriate to say that flooding in Malaysia is a potential threat to food security and agriculture which is capable of causing malnutrition if not appropriately controlled. Ambu [39] expressed that increased rate of malnutrition is a function of floods that affect food safety. From the foregoing, it is eminent for natural disaster specifically flood which is predominant in Malaysia, to be



incorporated into the existing crucial framework for malnourishment. Urgent steps should be taking in the direction of sustainability in order to salvage the affected regions from subsequent or future hardships or difficulties.

#### 4. Sustainable development as the way forward

With increasing dependency on fossil-fuels and a lessening supply of resources, people need innovative, cutting-edge approaches from appropriate stakeholders to make a real difference for sustainable development. The challenge is to solve matter regarding the needs of citizen in a sustainable manner, so as to generate continuing development and activities that meet the needs of the people and protecting, sustaining and enhancing the human and natural resources for the future [40, 41]. Apart from that, the recognition of sustainable development as a current trend and global pursuit has driven this study to map out some strategies to reduce the negative outcomes of flooding on human health in the study area. These strategies are highlighted as follow:

- Develop a comprehensive list of the vulnerable class as identified in this paper that may need help and medical assistance.
- Mark top risk geographical areas and key buildings such as health care facilities.
- Creation of online data for sharing flood risk data with relevant organisation.
- Provide prior news of flooding through the design and implementation of early warning system.
- Facilitate community engagement and supports in the recovery phase.
- Recovery needs should be freely accessed by flood victims and advice in that direction.
- Educate stakeholders to understand the frustration of flood victims and should work in tolerance with them in the quest to better their living conditions.
- Empower the affected people to guaranty sustenance of livelihoods.

#### 5. Conclusion

The flood of 2014 had unforgettable marks on the residents of Kelantan states. It created multiple risks to all stakeholders with the flood victims carrying the brunt of it. Its impact cut across the physical, psychosocial and economic lives in a significant way. Report reveals vulnerability to flood diseases as psychological distress in the survivors is guilty for a quota of all physical ailments. Sustainability plan has the potential to reduce vulnerability and realize opportunities associated with flood effects and menaces. Thus, the strategies above should be looked into. Accolades should be given to the Malaysian government who has taken bold steps in recent time, to uncover the long-term impacts of 2014 flood as well as to fashion out safety measures for the future. Government should ensure strict implementation of reports in compliance with the Sendai Framework for Disaster Risk Reduction 2015-2030 targets.

#### 6. References

- [1] Ahmad W I W and Abdurahman S M 2015 Kelantan flood 2014: Reflections from relief aid mission to Kampung Kemubu, Kelantan, *Med. J. Soc. Sc.* **6** 340-44
- [2] Shamshuddin J, Panhwar Q A, Othman R and Ismail R 2016 Effects of December 2014 great flood on the physico-chemical properties of the soils in the Kelantan plains Malaysia, *J. Wat. Res. and Prot.* **8** 263-76
- [3] Berita Harian 2014 *Amaran Hujan Lebat Peringkat Tinggi di Kelantan, Terengganu* Retrieved on December 24, 2016 from <http://www.utusan.com.my/berita/nasional/amaran-hujan-lebat-di-kelantan-terengganu-1.36974>
- [4] Azuhan M 2015 Kelantan flood-divine vs anthropogenic causes *Proc. Nat. Geoscience Conf. (Kota Bharu)* (Kuala Lumpur: Geological Society of Malaysia) pp 2-5
- [5] Sathiamurthy E and Kong Y H 2015 Kelantan state great flood event in December 2014-hydrology perspective *Proc. Nat. Geoscience Conf. (Kota Bharu)* (Kuala Lumpur: Geological Society of Malaysia) pp 41-42

- [6] Jonkman S N and Kelman I 2005 An analysis of the causes and circumstances of flood disaster deaths, *Disasters* **29** 75-97
- [7] Yeo S W and Blong R J 2010 Fiji's worst natural disaster: The 1931 hurricane and flood, *Disasters* **34** 657-83
- [8] Baharuddin K A, Wahab S F A, AB Rahman N H N, Mohamad N A N, Kamauzaman T H T, Noh A Y M D and Majod M R A 2015 The record-setting flood of 2014 in Kelantan: Challenges and recommendations from an emergency medicine perspective and why the medical campus stood dry, *Malaysian J. of Med. Sc.* **22** 1-7
- [9] Ramin B and McMichael A 2009 Climate change and health in sub-Saharan Africa: A case-based perspective, *EcoHealth* **6** 52-57
- [10] Schwartz B, Harris J, Khan A, Larocque R, Sack D and Malek M 2006 Diarrheal epidemics in Dhaka, Bangladesh, during three consecutive floods: 1988, 1998, and 2004, *American J. Trop. Med. Hyg.* **74** 1067-73
- [11] Alderman K, Turner L R and Tong S 2012 Floods and human health: A systematic review, *Environ. Int.* **4** 37-47
- [12] Jakubicka T, Vos F, Phalkey R and Marx M 2010 *Health impacts of floods in Europe: Data gaps and information needs from a spatial perspective* A MICRODIS report Brussels Centre for Research on the Epidemiology of Disasters (CRED) Retrieved on April 20, 2017 from [http://www.cred.be/sites/default/files/Health\\_impacts\\_of\\_floods\\_in\\_Europe.pdf](http://www.cred.be/sites/default/files/Health_impacts_of_floods_in_Europe.pdf)
- [13] WHO Regional Office for Europe 2017 *Climate change: Data and statistics* Retrieved on April 14, 2017 from <http://www.euro.who.int/en/health-topics/environment-and-health/climate-change/data-and-statistics>
- [14] Muchan K, Lewis M, Hannaford J and Parry S 2015 The winter storms of 2013/2014 in the UK: hydrological responses and impacts, *Weather* **70** 55-61
- [15] Otomofa J O, Okafor B N and Obienusi E A 2015 Evaluation of the impacts of flooding on socio-economic activities in Oleh, Isoko South Local Government Area, Delta State, *J. Environ. and Earth Sc.* **5** 155-71
- [16] ProVention Consortium 2008 *Flood Disasters: Learning from Various Relief and Recovery Operations ALNAP* Retrieved from [www.proventionconsortium.org](http://www.proventionconsortium.org)
- [17] Jha A K, Bloch R and Lamond J 2012 *Cities and flooding: a guide to integrated urban flood risk management for the 21st century* (Washington DC: World Bank Publications) pp 582-620
- [18] International Strategy for Disaster Reduction 2008 *Climate change and disaster reduction* Geneva ISDR Retrieved on May 13, 2017 from <http://eird.org/publicaciones/Climate-Change-DRR.pdf>
- [19] Othman S 2011 *Adaptation to Climate Change and Reducing Natural Disaster Risk: A Study on Country Practices and Lesson Between Malaysia and Japan* Final Research Report (Tokyo: Asian Disaster Reduction Centre (ADRC)) pp 1-67
- [20] Sakar S K, Begum R A, Periera J J and Abdul H J 2013 Addressing disaster risk reduction in Malaysia: Mechanisms and responds *2nd Int. Conf. Env. Agric & Food Sc (ICEAFS 2013) (Kuala Lumpur)* pp 81-85
- [21] Borneo Post 2014 *Government to Carry Out Post Mortem on Floods* Retrieved on December 30, 2016 from <http://www.theborneopost.com/2014/12/31/government-to-carry-out-post-mortem-on-floods/>
- [22] Huang L-Y, Wang Y-C, Wu C-C, Chen Y-C and Huang Y-L 2016 Risk of flood-related diseases of eyes, skin and gastrointestinal tract in Taiwan: A retrospective cohort study, *Plos One* **11** 1-11
- [23] Vachiramon V, Busaracome P, Chongtrakool P and Puavilai S 2008 Skin diseases during floods in Thailand, *J. Med. Assoc. Thai.* **91** 479-84
- [24] Balato N, Megna M, Ayala F, Balato A, Napolitano M and Patruno C 2014 Effects of climate changes on skin diseases, *Expert Rev. Anti Infect. Ther.* **12** 171-81

- [25] Wade T J, Sandhu S K, Levy D, Lee S, LeChevallier M W, Katz L and Colford J M 2004 Did a severe flood in the Midwest cause an increase in the incidence of gastrointestinal symptoms?, *American J. Epidemiol* **159** 398-405
- [26] Chen M J, Lin C Y, Wu Y T, Wu P C, Lung S C and Su H J 2012 Effects of extreme precipitation to the distribution of infectious diseases in Taiwan, *Plos One* **7** 1994-2008
- [27] Ahern M, Kovats R S, Wilkinson P, Few R and Matthies F 2005 Global health impacts of floods: epidemiologic evidence, *Epidemiol. Rev.* **27** 36-46
- [28] Gertle M, Dürr M, Renner P, Poppert S, Askar M, Breidenbach J, Frank C, Preußel K, Schielke A, Werber D, Chalmers R, Robinson G, Feuerpfeil I, Tannich E, Gröger C, Stark K and Wilking H 2015 Outbreak of cryptosporidium hominis following river flooding in the city of Halle (Saale), Germany, August 2013, *BMC Infectious Diseases* **15** 1-10
- [29] Schwartz J, Levin R and Goldstein R 2000 Drinking water turbidity and gastrointestinal illness in the elderly of Philadelphia, *J. of Epidemiol.* **54** 45-51
- [30] Raj E A and Sekar K 2011 Psychosocial disaster preparedness program for school children, *Prehosp. Disaster Med.* **26** 83
- [31] Pine D S and Cohen J A 2002 Trauma in children and adolescents: risk and treatment of psychiatric sequelae, *Biological psychiatry* **51** 519-531
- [32] Vranda M N and Sekar K 2011 Assessment of psychosocial impact of flood on children-Indian experience, *Prehosp. Disaster Med.* **26** 83-84
- [33] Murray V, Caldin H, Amlôt R, Stanke C, Lock S, Rowlatt H and Williams R 2011 *The Effects of Flooding on Mental Health* Health Protection Agency report (London: Health Protection Agency)
- [34] Tapsell S M and Tunstall S M 2008 "I wish I'd never heard of banbury": The relationship between 'place' and the health impacts from flooding, *Health Place* **14** 133-54
- [35] Stanke C, Murray V, Amlot R, Nurse J and Williams R 2012 The effects of flooding on mental health: Outcomes and recommendation from a review of the literature, *Plos Current Disasters* **1** 1-17
- [36] Reacher M, McKenzie K, Lane C, Nichols T, Kedge I, Iversen A, Hepple P, Walter T, Laxton C and Simpson J 2004 Health impacts of flooding in Lewes: a comparison of reported gastrointestinal and other illness and mental health in flooded and non-flooded households, *Communicable Disease and Public Health* **7** 1-18
- [37] Padli J, Habibullah M S and Abdul Hamid B 2013 Determinants of flood fatalities: Evidence from a panel data of 79 countries, *Pertanika J. Soc. Sci. and Humanities* **21** 81-98
- [38] Austin O C and Baharuddin A H 2012 Risk in Malaysian agriculture: The need for a strategic approach and a policy refocus, *Kajian Malaysia* **30** 21-50
- [39] Ambu S 2015 Floods-the consequence of human intrusion into nature, *Int. E-J. Sci. Med. and Education* **9** 1-2
- [40] Cléménçon R 2012 From Rio 1992 to Rio 2012 and beyond: Revisiting the role of trade rules and financial transfers for sustainable development, *The J. of Environment & Development* **21** 5-14
- [41] Masrom M A N, Abd Rahim M H I, Ann S C, Mohamed S and Goh K C 2017 A preliminary exploration of the barriers of sustainable refurbishment for commercial building projects in Malaysia *Procedia Engineering* vol 180 (United Kingdom: Elsevier) pp 1363-1371

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