UNIVERSITI PUTRA MALAYSIA

ECONOMIC EFFECTS OF FLOOD DISASTER AMONG SMALLHOLDER FARMERS IN KELANTAN, MALAYSIA

ABDUSSALAM ADAMU JEGA

FP 2018 73

ECONOMIC EFFECTS OF FLOOD DISASTER AMONG SMALLHOLDER FARMERS IN KELANTAN, MALAYSIA

By

ABDUSSALAM ADAMU JEGA

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in Fulfillment of the Requirements for the Degree of Doctor of Philosophy

June 2018

DEDICATION

This thesis is dedicated to the service of Allah towards earning his bountiful blessings and pleasures.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

ECONOMIC EFFECTS OF FLOOD DISASTER AMONG SMALLHOLDER FARMERS IN KELANTAN, MALAYSIA

By

ABDUSSALAM ADAMU JEGA

June 2018

Chairman : Associate Professor Norsida Man, PhD
Faculty : Agriculture

Out all natural disasters flood remained the most common and frequent in most part of the world constituting the largest economic and social effect. Smallholder farmers who solely depend on agriculture for their livelihoods are the major vulnerable group to its cascading effect. Hence, this demonstrated the importance of governments' policy responses in terms of mitigation and recovery to help in reducing flood damage and its social consequences. This study, therefore, investigates the economic effect of flood disaster among Kelantan state smallholder farmers and the level and/or extent of policy responses provided by governments in terms of mitigation and recovery, aimed at moderating/reducing flood disaster adverse effect on their livelihoods. The 2014/2015 flood disaster which was termed the most significant and largest recorded flood in the history of Kelantan state of Peninsular Malaysia, also declared as a 'tsunami-like disaster by National Security Council (NSC) had affected about 70% of the villages who are mostly smallholder farming communities in the state.

This thesis therefore, was guided by an integrated conceptual framework predominantly developed from disaster impact model and incorporated with a construct "livelihood outcomes" from the sustainable livelihoods approach (SLA) to explain how smallholder farmers are socially affected by flood disaster. For this study the framework consist of five variables, flood disaster characteristics as independent variables, livelihood outcomes (food security and income) as dependent variable, direct and indirect effect on agriculture as mediating variables, mitigation strategies and recovery resources as moderating variables and finally socio-economic and demographic factors as control variables. A structured questionnaire was used to interview 385 affected smallholder farmers randomly selected from flood prone areas through a systematic sampling procedure. Descriptive analysis,

paired sample t-test, ordinal logistic regression, Lorenz curve and structural equation modelling were applied in analysing the data using SPSS, Microsoft Excel, STATA and AMOS respectively.

The descriptive findings of the flood disaster direct effect on smallholder farmers' agriculture, revealed that the output of almost all crops, the value of livestock and agricultural assets, declined after being affected by 2014/2015 flood disaster. Hence, despite this flooding effect, 60.8% of the affected smallholder farmers were found be food secured during and after the disaster and their income was not adversely affected as indicated in the ordered logistic and Lorenz curve analysis. The structural equation modelling results also indicated that government policy response in terms of recovery has played a significant role in moderating the adverse flood disaster effect on smallholder farmer's livelihood outcomes. This indicates that prompt government response and other stakeholders in terms of food aid supply, cash transfer, provision of agricultural productive assets and inputs the flood victims contributed a lot in alleviating flood disaster effect on their livelihood outcomes. However, mitigation strategies provided by the government in form of dams' construction, embankments, levees etc. were found not sufficiently enough to prevent the flood disaster physical effect on their agricultural production activities and this indicates that government has paid more attention to reactive (recovery) than proactive (mitigation) measures. The mediation test results revealed that the flood disaster effect on smallholder farmer's agriculture through crop and livestock losses, consequently disrupt their livelihood outcome but on a short-term basis. Based on these results, therefore, it is important to enhance mitigation strategies as a proactive measure, so as to save millions of ringgit from flood disaster effect on agriculture. It was also observed that the level of smallholder farmer's pre and post adaptation strategies were almost moderately carried out, therefore it is important also to further enlighten smallholder farmers using their own resources to adequately undertake adaptation measures so as to complement government interventions against flood disaster. Finally, for study implications, first it could help policymakers to facilitate and improve on the flood disaster management practices to lessen/avoid future effects in the study area and also give an insight to academicians/researchers in applying and/or improving the model while assessing the effect of flood and other natural disasters in future research.

Keywords : floods disaster; agriculture; farmer's livelihood outcome; mitigation and recovery measures; flood economic effect assessment

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KESAN BENCANA BANJIR KEPADA EKONOMI PETANI KECIL-KECILAN DI KELANTAN, MALAYSIA

Oleh

ABDUSSALAM ADAMU JEGA

Jun 2018

Pengerusi : Profesor Madya Norsida Man, PhD
Fakulti : Pertanian

Daripada semua bencana alam, banjir terus kekal sebagai bencana yang paling biasa dan kerap berlaku di kebanyakan bahagian dunia yang menyebabkan kesan ekonomi dan sosial yang paling teruk. Petani dari kalangan pekebun kecil yang bergantung sepenuhnya pada pertanian sebagai mata pencarian mereka ialah kumpulan utama yang mudah terjejas akibat kesan yang menimpa. Ini menunjukkan pentingnya respons dasar kerajaan dari segi mitigasi dan pemulihan untuk membantu dalam mengurangkan kerosakan banjir dan akibat sosialnya. Oleh itu, kajian ini menyelidiki kesan ekonomi akibat bencana banjir terhadap petani dikalangan pekebun kecil Kelantan dan tahap dan/atau sejauh mana respons dasar yang disediakan oleh kerajaan dari segi mitigasi dan pemulihan, bertujuan untuk menyederhanakan / mengurangkan bencana banjir yang memberi kesan buruk pada mata pencarian mereka. Bencana banjir 2014/2015 yang dianggap sebagai banjir yang paling signifikan dan terbesar dalam sejarah negeri Kelantan di Semenanjung Malaysia, juga diisytiharkan sebagai bencana mirip tsunami oleh Majlis Keselamatan Negara (NSC) telah menjejaskan kira-kira 70% daripada kampung-kampung yang kebanyakannya masyarakat petani dikalangan pekebun kecil di negeri tersebut.

Oleh itu, tesis ini dilaksanakan mengikut satu rangka kerja konseptual bersepadu yang sebahagian besarnya dibangunkan daripada model impak bencana dan digabungkan dengan konstruk "hasil punca pendapatan" berdasarkan pendekatan punca pendapatan lestari (SLA) untuk menjelaskan cara petani dikalangan pekebun kecil terjejas secara sosial akibat bencana banjir. Untuk kajian ini, rangka kerja terdiri daripada lima pembolehubah, iaitu, ciri-ciri bencana banjir sebagai pembolehubah bebas, hasil punca pendapatan (keselamatan makanan dan pendapatan) sebagai pemboleh ubah bersandar, kesan langsung dan tidak langsung terhadap pertanian sebagai pemboleh ubah perantaraan, strategi mitigasi dan sumber pemulihan sebagai pemboleh ubah menyederhana dan akhirnya faktor-faktor sosio-ekonomi dan demografi sebagai pemboleh ubah kawalan. Soal selidik berstruktur

digunakan untuk menemuduga sejumlah 385 petani dikalangan pekebun kecil yang terjejas yang dipilih secara rawak dari kawasan mudah dilanda banjir melalui prosedur persampelan sistematik. Analisis deskriptif, ujian-t sampel berpasangan, regresi logistik ordinal, lengkung Lorenz dan pemodelan persamaan struktur, masing-masing digunakan untuk menganalisis data menggunakan SPSS, Microsoft Excel, STATA, dan AMOS.

Penemuan deskriptif kesan langsung bencana banjir kepada petani dikalangan pekebun kecil, mendedahkan bahawa pengeluaran hampir semua tanaman, nilai ternakan dan aset pertanian, merosot selepas terjejas oleh bencana banjir 2014/2015. Oleh itu, walaupun terdapat kesan banjir, 60.8% daripada petani dikalangan pekebun kecil yang terjejas didapati mempunyai makanan yang mencukupi semasa dan selepas bencana dan pendapatan mereka tidak terjejas teruk seperti yang ditunjukkan dalam analisis logistik dan lengkung Lorenz teratur. Keputusan pemodelan persamaan struktur juga menunjukkan bahawa tindak balas dasar kerajaan dari segi pemulihan telah memainkan peranan penting dalam menyederhanakan kesan buruk bencana banjir kepada hasil punca pendapatan petani dikalangan pekebun kecil. Ini menunjukkan bahawa tindak balas kerajaan yang segera serta pihak berkepentingan yang lain daripada segi bekalan bantuan makanan, pemindahan wang tunai, penyediaan aset dan input produktif pertanian kepada mangsa banjir banyak menyumbang dalam mengurangkan kesan bencana banjir terhadap hasil punca pendapatan mereka. Walau bagaimanapun, strategi mitigasi yang disediakan oleh kerajaan dalam bentuk pembinaan empangan, penambakan, permatang dan sebagainya didapati tidak mencukupi untuk mencegah kesan fizikal bencana banjir terhadap aktiviti pengeluaran pertanian mereka dan ini menunjukkan bahawa kerajaan telah memberi perhatian yang lebih kepada langkah-langkah reaktif (pemulihan) berbanding langkah-langkah proaktif (mitigasi). Keputusan ujian pengantaraan menunjukkan bahawa kesan bencana banjir ke atas sektor pertanian petani dikalangan pekebun kecil melalui kerugian tanaman dan ternakan, seterusnya menyebabkan terganggunya hasil punca pendapatan mereka, tetapi secara jangka pendek sahaja. Oleh itu, berdasarkan hasil ini, adalah penting untuk meningkatkan strategi mitigasi sebagai langkah proaktif, untuk menyelamatkan berjuta-juta ringgit yang disebabkan oleh kesan bencana banjir ke atas pertanian. Didapati juga bahawa tahap strategi pra- dan pasca-adaptasi petani dikalangan pekebun kecil hampir-hampir sahaja dijalankan, oleh itu adalah penting juga untuk menerangkan kepada petani dikalangan pekebun kecil supaya menggunakan sumber mereka sendiri untuk melaksanakan tindakan penyesuaian dengan secukupnya untuk melengkapi campur tangan kerajaan terhadap bencana banjir. Akhir sekali, untuk implikasi kajian, pertama sekali ia dapat membantu penggubal dasar untuk memudahkan dan memperbaiki amalan pengurusan bencana banjir untuk mengurangkan / mengelakkan kesan masa depan di kawasan kajian dan juga memberi wawasan kepada ahli akademik / penyelidik dalam memohon dan / atau memperbaiki model semasa menilai kesan banjir dan bencana alam yang lain dalam penyelidikan masa depan.

Kata kunci: bencana banjir; pertanian; punca pendapatan petani; langkah-langkah pengurangan dan pemulihan; penilaian kesan ekonomi banjir

ACKNOWLEDGEMENTS

All praise is due to Allah the lord of the worlds, I seek His refuge and forgiveness and may His peace and blessings be upon the seal of the prophets, Muhammad Sallallahu Alaihi Wasallam, his family, companions and all those who follow them up to the Day of Judgment. Let me first and foremost be thankful and grateful to Allah, for all His uncountable blessings and favors upon me, part of which are the life, belief, good health and ability He granted me to carry out this research.

Let me also aknowledge and sincerely thank my university Kebbi State University of Science and Technolgy Aliero (KSUSTA) for approving my sponsorship and Tertiary, Education Trust Fund (TETFUND) for awarding me schorlarhip to pursue this program.

I would like to sincerely express my profound gratitude to my major supervisor Associate Prof. Dr. Norsida Man of the Department of Agribusiness and Bio Resource Economics Faculty of Agriculture, Universiti Putra Malaysia (UPM), for her immense contributions, challenging observations, her patience and understanding, which led the work to its present state. In addition, her enthusiasm and courage in seeing me through the end of this work was what I particularly found most appealing. I remain ever thankful to her in this regard and I pray to Allah to guide, protect and put her through in all her undertakings.

I would like to also extend my sincere gratitude to the members of my supervisory committee, Assoc. Prof. Dr. Ismail Abd Latif and Dr. Kelly Wong Kai Seng for their valuable suggestions, insightful remark, encouragement and guidance, throughout the journey of this research study. I am also particularly grateful to my lecturers in the department Prof. Dr. Zainal Abidin, Prof. Dr. Datuk Mad Nasir Shamsudeen, Prof. Dr. Mansor, Assoc. Prof. Dr. Amin Mahir Abdullah, Assoc. Prof. Dr. Nolila, Assoc. Prof. Dr. Nitty among others.

I am deeply indebted to my dear mother Hajiya Hassana and my late father Alhaji Adamu, for their parental love and care, particularly at the early stage of my life. I am very grateful to them for giving me sound and moral instructions in my childhood. May Allah in His infinite mercy forgive all their shortcomings and grant them and us, Aljannatul Firdaus. My appreciation and gratitude goes to my lovely wife Maryam and my three daughters Alkhansa, Rukayya, and Nusaiba for their continuous prayers, love, encouragement, understanding and endurance during this study, and to my relatives at home country for their onerous prayers, support and encouragement.

I would like to extend my appreciation to Dr. Saadu Umar Birnin yauri, Usman Hassan and the rest of my colleagues from KSUSTA for their onerous support and encouragement. In addition to Aqilah, Shuhada, Hidayah, Melissa and all those that assisted in the collection of data, which is a very big and tremendous task. I appreciate your support and contribution.

Finally, I would like to acknowledge the support and well wishes from my colleagues most importantly Bala Muhammad, Aishatu Ibrahim Ogiri of facuty of economics and management, Dr. Auwal Abdullah Gindi, Dr. Yahaya Kaka, Dr. Abdullahi Iliyasu, Umar Gazali, Bashir Mukhtar, Suleiman Umar among others.

This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows

Norsida Man, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Ismail Abd Latif, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Kelly Wong Kai Seng, PhD
Senior Lecturer
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

ROBIAH BINTI YUNUS, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

Declaration by graduate student

I hereby confirm that:

- this thesis is my original work;
- quotations, illustrations and citations have been duly referenced;
- this thesis has not been submitted previously or concurrently for any other degree at any institutions;
- intellectual property from the thesis and copyright of thesis are fully-owned by Universiti Putra Malaysia, as according to the Universiti Putra Malaysia (Research) Rules 2012;
- written permission must be obtained from supervisor and the office of Deputy Vice-Chancellor (Research and innovation) before thesis is published (in the form of written, printed or in electronic form) including books, journals, modules, proceedings, popular writings, seminar papers, manuscripts, posters, reports, lecture notes, learning modules or any other materials as stated in the Universiti Putra Malaysia (Research) Rules 2012;
- there is no plagiarism or data falsification/fabrication in the thesis, and scholarly integrity is upheld as according to the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) and the Universiti Putra Malaysia (Research) Rules 2012. The thesis has undergone plagiarism detection software

Signature: _____ Date: _____

Name and Matric No: Abdussalam Adamu Jega, GS44385

Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) were adhered to.

Signature: _____
Name of Chairman of Supervisory Committee: Associate Professor Dr. Norsida Man

Signature: _____
Name of Member of Supervisory Committee: Associate Professor Dr. Ismail Abd Latif

Signature: _____
Name of Member of Supervisory Committee: Dr. Kelly Wong Kai Seng

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AGFI	Adjusted Goodness of Fit Index
AIC	Akaike Information Correction
AMOS	Analysis of Moment Structures
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CGE	Computable General Equilibrium
CR	Construct Reliability
CRED	Centre for Research on the Epidemiology of Disasters
DDMRC	District Disaster Management Relief Committee
DEA	Direct Effect on Agriculture
DID	Drainage and Irrigation Department
DRR	Disaster Risk Reduction
ECCM	Economics of Climate Change for Malaysia
ECCSEA	Economic of Climate Change for South East Asia
EFA	Exploratory Factor Analysis
EMDAT	Emergency Events Database
EPU	Economic Planning Unit
ETP	Economic Transformation Programme
FADT	Food Availability Decline Theory
FAD	Food Availability Disruption
FAMA	Federal Agricultural Marketing Authority
FAO	Food and Agriculture Organization
FDC	Flood Disaster Characteristics

FEI	Flood Effect on Income
FSAD	Food Stability and Accessibility Disruption
FSP	Food Security Policy
FUD	Food Utilization Disruption
GDP	Gross Domestic Product
IEA	Indirect Effect on Agriculture
IFI	Incremental Fit Index
IO	Input-Output Model
IPCC	Intergovernmental Panel on Climate Change
KMO	Kaiser Meyer Olkin
MI	Modification Index
MMD	Malaysian Meteorological Department
MPs	Malaysia Plans
MS	Mitigation Strategies
NAP	National Agricultural Policies
NAPs	National Agricultural Policies
NDMRC	National Disaster Management Relief Committee
NDP	National Development Plans
NDRM	National Disaster Risk Management
NEP	New Economic Policy
NFDRPC	National Flood Disaster Relief and Preparedness Committee
NSC	National Security Council
PNFI	Parsimony Normed Fit index
RM	Ringgit
RMSEA	Root Mean Square Error of Approximation

RRS	Recovery Resources
SAM	Social Accounting Matrix
SDMRC	State Disaster Management Relief Committee
SEM	Structural Equation Modelling
SLA	Sustainable Livelihood Approach
SPSS	Statistical Package for the Social Sciences
STLE	Short Term Livelihood Outcome Effect
TLI	Tucker – Lewis Index
UN	United Nations
UNISDR	United Nations International Strategy for Disaster Reduction
USD	United State Dollar
USDA	United State Department of Agriculture
WDR	World Disaster Report
WHO	World Health Organization
WMO	World Metereological Organization

CHAPTER 1

INTRODUCTION

This chapter starts by presenting the background of the study, flood incidences, historical background of flood disaster, its effects, and government policy responses against flood in Malaysia, need for flood economic effect assessment and an overview of livelihood outcomes in Malaysia. Finally, it discusses the statement of the problem, objectives of the study, significance and scope of the research at hand, conceptual definitions of terms and organization of the study.

1.1 Background of the Study

Floods are the most common and serious natural disasters occurring in most part of the world and it is considered to be one of the greatest weather-related natural disaster causing serious economic effect and negatively impacting on the livelihoods of the affected localities (Akasah and Doraisamy, 2015; Khan, Shaari, Achmad, Baten and Nazaruddin, 2014), it account for about 50% of all economic losses worldwide (Munich Re, 2015). The major harmful effects of flood include direct mortality, widespread damage/losses of crops, livestock and infrastructures, displacement of people and widespread of diseases (Dewan, 2015; Doocy et al., 2013). Several studies have revealed that the flood disaster effect/damage are unmatched among the all other natural disaster happening in the world (Kron, 2005). Both developing and developed countries are exposed to flood disaster effect, as no region in the world is safe from being flooded and affected (Kron, 2005), it poses great risk to advanced countries and sometimes bigger than what it does to developing and least developing countries, although the economic advancement of a country determines its efficiency in combating the flood disaster effects (Kron, 2005). WHO (2002) described flood as the most common and costly natural disaster in Europe in terms of economic damage, while Mileti (1999) argued that floods have become the most costly natural disaster with regards to dollar damage to properties and crops in the United States. However, in developing countries, the likely negative impact of a flood disaster on agriculture has important implications for smallholder farmers, since agriculture is the major contributor to their food production and income (Bandara & Cai, 2014; Gornall et al., 2010).

Malaysia as a very fast developing country aiming of becoming among the developed countries by the year 2020 is fortunate and relatively free from natural disasters such as volcanic eruptions, earthquakes, strong winds and hurricanes, tropical cyclones and typhoons, that are periodically occurring in its neighbouring countries, however, floods remain the only severe type of disaster frequently occurring with increasing intensity in most part of the country in recent decades

especially in east coast causing significant socioeconomic impact to the affected population (Mei et al. 2016). As also argued by Chan (2012) that flood is the most common and severe type of disaster experienced in Malaysia, causing loss of life, significant damage to crops, livestock and fisheries and seriously damaging effect on properties and public infrastructures. Despite massive expenditure by government on flood defense and protection, flood disaster in Malaysia has brought severe impacts on the people, affecting livelihoods and causing substantial financial losses as well as intangible damage (Chan, 2015; Lee and Mohamad, 2014). Without adequate measures, the occurrence of floods could cause displacement of people, damage to infrastructures and negative effect on agricultural production and livelihoods of the affected communities.

The country is prone to annual flooding while experiencing a major flooding event at least once every five years (Lim and Cheong, 2015). There are two (2) main types of flooding in Malaysia, flash and monsoon floods that are seriously impacting the lives and environment of Malaysians (Adnan, 2010). Flood disaster event usually occurs during the monsoonal season in the eastern part of Peninsular Malaysia causing considerable damages to mostly villages living along rivers or coastal flood plains, their agriculture and livelihoods (Alam et al. 2012; Jaafar et al., 2016; Nastis et al. 2012). Smallholder farmers' and unskilled laborers are the population most vulnerable, who also experience decreased incomes, lower food security and rising food prices (Doocy et al. 2013).

The 2014/2015 flood on a catastrophic scale hit Malaysia in almost 11 states with intense prolonged rainfall which displaced more than 250,000 people especially the East Coast Peninsula and East Malaysia (Sabah) causing and economic damage worth RM560 Million (Karim, Hazizan, Diah, Tajuddin and Mustari, 2016; Nordin, 2015). The impact left the nation with expensive and devastating damages that receive numerous support and assistance from national and international organizations (Akasah and Doraisamy, 2015). People in the affected areas lamented that it is the worst flood since 1932 and 1967 (Karim et al., 2016). The flood disaster is said to be the worst in 100 years (Manan and Geleta, 2007). Majority of the vulnerable and risk groups are farmers' communities settling around low lying/riverine areas having minimal income characterized by an inability to protect/cope themselves against flood impacts and improve their livelihood (Mahmudul Md. Alam et al., 2012).

Table 1.1 : Flood Impact in Malaysia (1965 – 2015)

Duration (Years)	Total Number of People Affected	Total Damage ('000 USD)
1965 – 1975	683,000	63,600
1976 – 1985	18,000	0
1986 – 1995	112,576	11,500
1996 – 2005	96,556	11,000
2006 – 2015	626,926	1,274,000

(Source : EM-DAT CRED 2016)

Among the affected states Kelantan was the worst hit and vulnerable by 2014/2015 flood and nearly all districts were affected (Azimi et al., 2016; Hua, 2015; Jaafar et al., 2016) The flood was unexpected, unusual and particularly the biggest and worst flood for the past 100 years (Wan Ahmad and Abdurahman, 2015). 2014/2015 flood disaster is the most significant and largest recorded flood in the history of Kelantan state and almost all its districts were enormously affected, also termed as a 'tsunami-like disaster' as revealed by Malaysia's National Security Council (NSC) that "2014/2015 floods in Kelantan were the worst recorded in the history of the state". 202, 000 victims were displaced (Baharuddin et al. 2014). It has caused a considerable economic damage to farmers and their livelihood (Tahir et al., 2015). The flood waters rose up to two meters above normal river levels, in some places, even more, destroying and damaging agricultural land and products, houses, infrastructures and other public buildings costing millions of ringgit (see Figure 1.1 below).

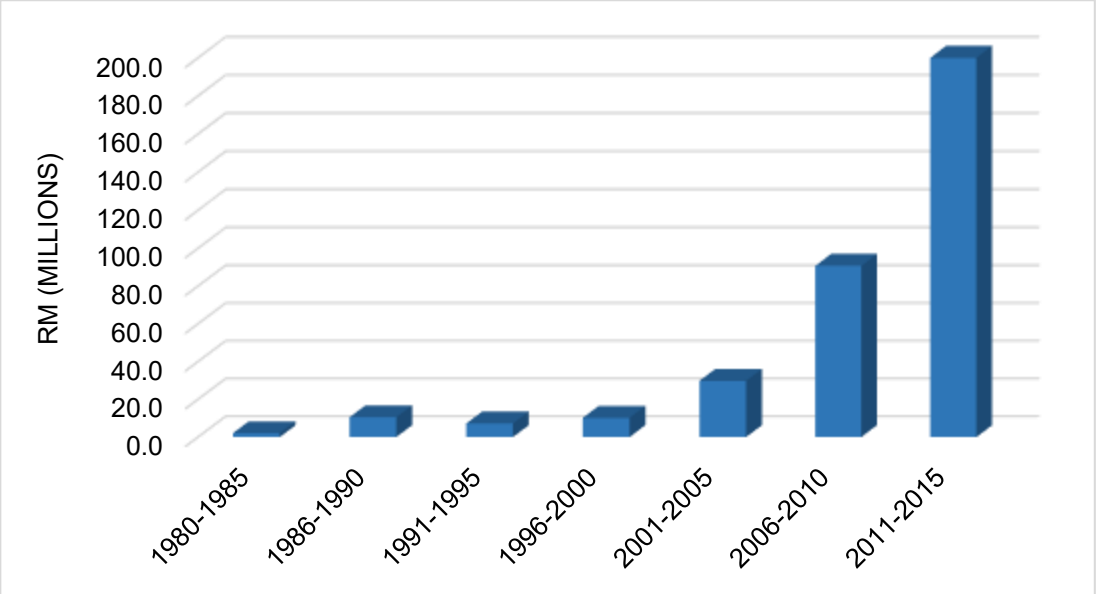

Figure 1.1 : Flood Impact in Kelantan Total Damages/Losses (RM) 1980-2015)
(Source : Based on Abd. Rashid et.al. (2007) and the Center for Public Policy Studies (CPPS) (2015)

Out of all natural disasters flood stands out to be the greatest natural disaster disrupting agricultural production and productivity which consequently affect the livelihood outcomes of small holder farmers across the globe (FAO, 2016; Sivakumar et al. 2005). However, Musah et al. (2013) argued that, flood have significant economic and food security disruption effect, especially on the smallholder farming households as it destroys critical agricultural assets, infrastructures and causes losses in the production of crops, livestock that amount to approximately 22% out of the reported economic effect caused by large and medium scale natural disasters in developing countries (FAO, 2015b). Large scale flood disaster often disrupts both domestic food production and consumption that could potentially lead to food crises in developing countries (Adedeji et al., 2016). Understanding the distributional effects of flood disaster across the affected communities is critical for planning and also identifying the efficacy of mitigation and recovery measures in place (Fothergill and Peek, 2004; Masozera et al. 2006) in addition Masozera et al (2006) argued that, although response and recovery services have been very vital for humanitarian assistance they should be accompanied by adequate mitigation measures so that the enormous flood losses can be reduced.

Considering that, flood disaster effects are not uniform across societies the main problem is to accurately assess the cascading effect posed by the disaster, in which the information obtained can be crucial to relevant agencies to draw up policies for rational flood mitigation and alleviation based on cost-effective measures (Paul, 2011; Smith and Roy, 1998). Agricultural sector, therefore, is crucial to economic development, since it provides wage goods for industrial sectors, and in constituting the demand focal point for consumer goods produced by the industrial sector (Long, 2007), in terms of capital formation and social wellbeing of smallholder farming families, agriculture tends to be the basic sector for their livelihood survival (Long, 2007; Sivakumar et al., 2005) hence any fluctuation in agricultural productivity as a result of flood disaster shock could lead to a cascading effect on their livelihoods. The growing concern on the possible cascading negative effect of natural disasters (floods, cyclones etc.) on smallholder agricultural productions and livelihoods has created a new demands for information from assessment by researchers, as an important segment in supporting decision making processes towards an integrated flood risk management approaches (Sivakumar et al., 2005).

Flood economic effect on agriculture include direct and indirect effects on livelihoods Vis-a-Vis decline in agricultural production, cause unemployment and/or decline in wages, loss of income and lower availability of foods which eventually leads to food inflation (FAO, 2015b; Israel and Briones, 2013a; Kwari, Paul, and Shekarau, 2015). The primary flood problem is the damage to agricultural land, where floodwaters overflow the banks of low capacity channels and inundate or submerge thousands of acres of adjacent crop lands, human beings, and livestock got killed or injured, food stocks with the households got dwindled resulting in food shortages and were not able to feed themselves and their children sufficiently, added to this less responsive public distribution system, declining wages and increase in borrowing by the households which will eventually worsen the food security

situation (Kator, 2015; Mohamed, Othman, Suid, and Zaim, 2015; Posthumus et al., 2009). The rate of flood disasters, whether they occur in advanced, developing nations and less developed nations can destroy people's livelihoods (Sawada and Sothea, 2011) especially smallholder farmers living along the coastal areas of many countries of the world through inundation of coastal areas and island (Sarkar, Begum, Pereira, Jaafar and Saari, 2014). The direct physical effect caused by floods in rural communities is in agricultural production and livelihood of smallholder farmers with the serious implications of lower productivity, food shortages and lower income (FAO, 2015; Rana and Islam, 2015) Similarly the indirect impact as a consequence of direct impact summarized below in Figure 1.2.

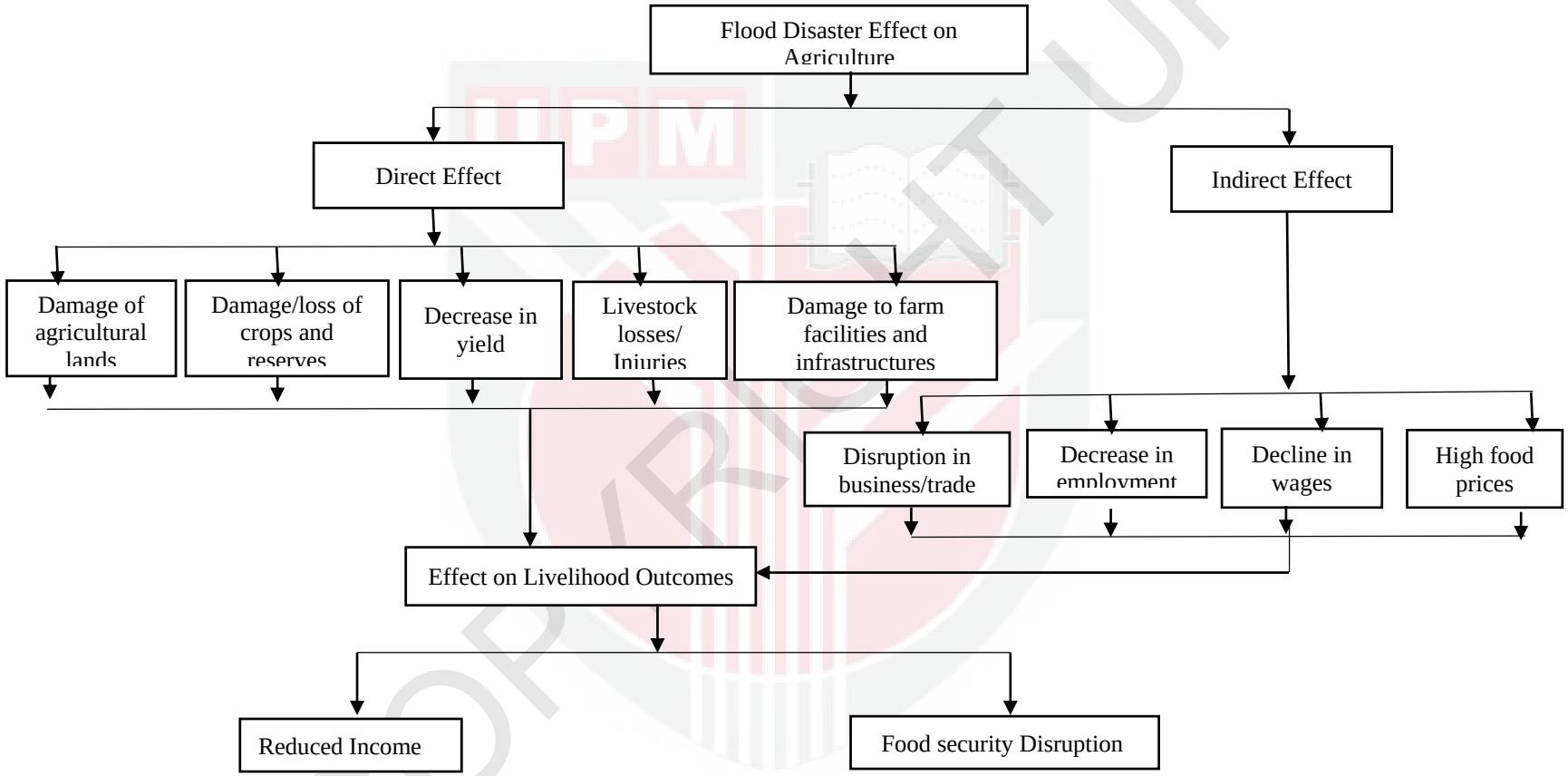

Figure 1.2 : The Impact of Flood Disaster on Agricultural Sector and Livelihood Outcomes of Smallholder Farmers
(Source : Based on FAO, 2015; Châu, 2014 and Alinovi et al. 2010)

Smallholders' agriculture is generally used to denote and describe rural farmers who constitute an estimated population of 400-500 million worldwide representing 85% of the world farms (Harvey et al., 2014; Morton, 2007a). They are considered highly dependent on agriculture for their livelihoods and for whom provides the principal source of income (Harvey et al., 2014). Farmers living across the coastal wetland and river banks are earnestly more vulnerable and face numerous risks to their agricultural production due to floods disaster which in turn undermine their household food and income security (Harvey et al., 2014; Siddiquee, 2012) and any reduction to agricultural productivity can ultimately have significant disruption effect on smallholder farmers food security, income and general well-being (Hertel and Rosch, 2010; Mcdowell and Hess, 2012).

Thus, since agriculture is the main occupation of rural people in developed and developing economies and also an important source of livelihoods (FAO, 2015b; Musah et al., 2013) its holistic and adequate loss and economic effect assessment should be considered as an essential part of improving flood risk management (Kreibich and Thieken, 2008). Lim and Cheong (2015) and Nafari (2013) argued that in order to minimize future flood effect in a sustainable manner, an integrated approach on flood risk management has to be built on sound analysis and assessment of flood hazard of peculiar sector or community, its flood losses and mitigation measures.

Majority of the scholars across the world have identified lack of available and/or adequate data to evaluate the effect/damage to different sectors especially smallholder agriculture in case of floods as the main obstacle for efficient risk management (Molinari et al. 2017; Dunja, 2016). Although flood effect assessment is regarded as a vital portion of flood risk management, it has not adequately received much scientific attention (Merz, Kreibich, Schwarze, and Thieken, 2010) and its consideration within the decision making process of flood risk management is relatively new (Messner et al., 2007).

1.2 Flood Incidences

Floods occurrence has greatly increased in recent decades mostly due to environmental degradation, heavy rainfall, deforestation and intensified land use as a result of increasing population (Tahir et al., 2015) invariably high and intense rainfall is the main factor causing flood disaster impact but other contributory factors might include duration, inundation/depth, and frequency of occurrence (Adnan, 2010; Dassanayake, Burzel, and Oumeraci, 2015; Noratiqah, 2010; Tahir et al., 2015). One-third of the annual natural disasters worldwide is flood related, accompanied by direct physical effect, economic losses, related human health impact and economic well-being of the affected communities (Brody and Brody, 2007; Messner et al., 2007).

Coastal floods globally is becoming more frequent and expensive causing serious and devastating effect in the recent decades and is expected increase due to the effect of rising sea level, heavy rainfall, land degradation and storm surges (Dassanayake et al., 2015) and its consequences contain numerous types of damages which include economic damage on agriculture and landed properties, environmental losses, societal disruption and so on (Jonkman and Vrijling, 2008). The Economic of Climate Change for South East Asia (ECCSEA) reports in one of its study that, being a region with tropical climate, long coastlines, and small islands is geographically vulnerable to climate change risk, especially having high concentration of rural populations and economic activities in low-lying coastal areas where millions of poor people are trapped with disrupted food security and low adaptive capacity (ECCM, 2011). Southeast Asia (Malaysia inclusive) having a tropical climate is characterized by extreme flood that significantly contributed to a decline in the production in food and cash crops for industries, livestock, fish supply and other agricultural products produced in the region and it is predicted to have more critical and severe physical impact on the people, their livelihoods and environment in general (Alam and Siwar, 2010)

As also outlined in the World Disaster Report by IFRC (2016), that flood is the most frequent natural disaster in the world as indicated in Table 1.2 below.

Table 1.2 : Total Number of Reported Disasters by Type all over the World (2006 - 2015)

Disaster Type	**'06**	**'07**	**'08**	**'09**	**'10**	**'11**	**'12**	**'13**	**'14**	**'15**	**Total**
Floods	232	219	174	160	190	160	141	149	140	154	1,719
Droughts	20	13	21	31	27	24	31	13	22	33	235
Storms	77	105	111	87	95	86	90	106	99	114	970
Landslides	20	10	12	28	32	17	13	11	15	19	177
Earthquakes	24	21	23	22	24	30	29	28	26	21	248
Extreme Temperatures	32	25	11	26	34	19	52	17	18	11	245

(Source : World Disaster Report by IFRC, 2016)

In addition floods, droughts and tropical storms affect agriculture (crop) sector most, than all other natural hazards (FAO, 2015) which is vividly clear in Figure 1.3 below.

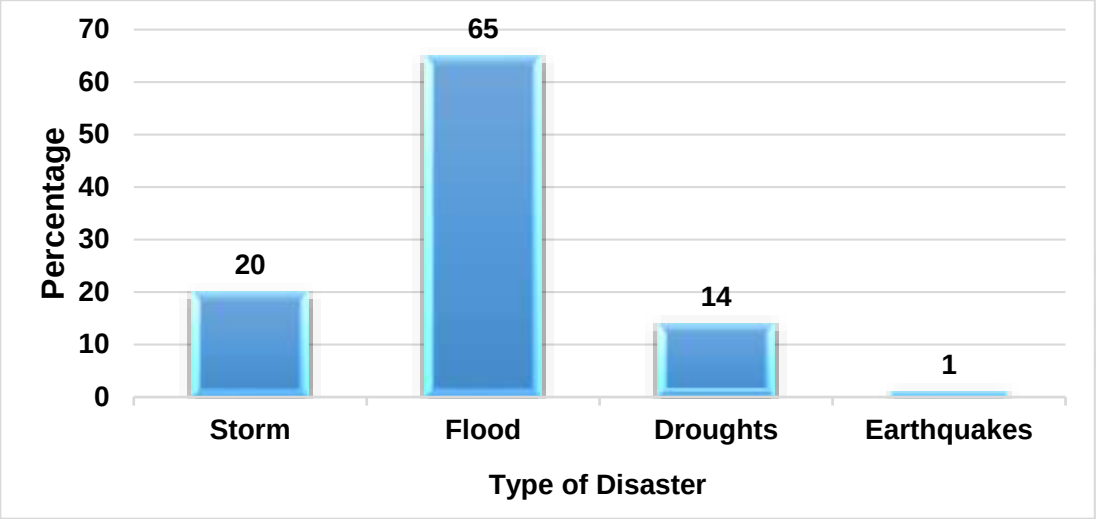

Figure 1.3 : Damage and Loss to Crops by Some Types of Disasters (2006-2016)
(Source : FAO based on data from Post-Disaster Need Assessments)

1.3 Historical Background of Flood Disaster in Malaysia

Historically, Malaysia experienced major floods in the years 1886, 1926, 1963, 1965, 1967, 1969, 1971, 1973, 1979, 1983, 1986, 1987, 1988, 1993, 1995, 1996, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006/2007, 2008, 2009, 2010, 2011, 2013 and recent 2014/2015. Amongst these flood events the 1926 flood was known as the storm forest flood accompanied by a very strong wind, and it destroyed hundreds of square kilometres of low land forests of Kelantan and Terengganu (Chan, 2015; Ernawati Hamdan, et al. 2013). Then in 1967, another devastating flood occurred across Kelantan, Terengganu, Perak and other east coasts communities, damaging agricultural lands, crops, and houses (Ngai Weng Chan, 2015; Nur, Wan, Nor, Zakaria, & Nazir, 2015). Report from DID revealed that about 29, 000 sq. Km or 9% of the total land area and more than 4.82 million people are affected by flood disaster annually (Khan et al., 2014). Four years later in 1971, another flood disaster escalated where it swept many parts of the country, Kelantan and Pahang were severely affected, in terms of crops and property losses and the death of 24 people (Nur et al., 2015). In the year 1996 floods triggered by tropical storm in Keningau (Sabah state) caused an economic damage worth more than RM300 million and claimed 241 lives, however another horrific flood occurred in the year 2000 caused by heavy rains in Kelantan and Terengganu where 15 people were killed and more than 10, 000 people flee their homes (Ngai Weng Chan, 2015). In 2010 flood destroyed an estimated 45,000 hectares of rice fields in Kedah and Perlis that are termed to the “rice bowls” of Malaysia.

1.4 Flood Incidences in Kelantan

Kelantan, on the other hand, has faced a number of severe floods over several past years. Historical data extracted from DID (2003) and EM-DAT (2018) has indicated that Kelantan specifically experienced flood incidences in the years of 1965, 1967, 1983, 1986, 1987, 1988, 1993, 2000, 2001, 2002, 2003, 2004, 2006, 2007, 2008, 2009, 2013, and 2014/2015 floods. Among these incidences, the 2014/205 flood disaster was regarded as the worst ever in the history of Kelantan causing the significant effect to more than 70 per cent of Kelantan's 1.2 million people and paralysed its economic activities and the livelihoods, the worst hit districts include Guamusang, Machang, Pasir Mas, Pasir Puteh, Tumpat, Kota Bharu, Kuala Krai and Tanah Merah. The incidences of these floods can be connected to the geographical terrain of the state as argued by Syed Hussain & Ismail (2013) that, the total area of Kelantan River Basin is about 13,100 km or 85 percent of the state land area, coupled with natural factors such as heavy monsoon rainfall, intense convection rain storms, large-scale land clearing activities for developmental activities and commercial agricultural purposes such as for rubber and oil palm estates were also perceived to be the main reasons for the high incident of flood in the state (Ashikin & Shaari, 2016; Hussain, Nor, & Ismail, 2014). Data given by the EMDAT also indicated that monsoon flooding occurs almost every year in the state of Kelantan as shown in Table 1.3 below.

Table 1.3 : Incidence and Duration of flood in Kelantan

Year	Occurrence (No. of times/year)	Duration (days)
1965	1	-
1967	1	-
1980	1	-
1981	1	-
1982	1	-
1983	1	-
1984	1	-
1986	1	-
1987	1	-
1988	1	-
1990	1	-
1991	1	-
1992	1	-
1993	1	5
1994	1	-
1995	1	-
1996	1	-
1997	1	-
1998	1	-
1999	2	-
2000	2	10
2001	2	-
2002	1	-
2003	2	3
2004	2	8
2006	2	8
2007	2	-
2008	2	2
2009	2	3
2013	1	7
2014	1	14
2015	1	-
2017	1	-

(Source : The Emergency Events Database EM-DAT, 2018)

However, despite various efforts geared toward reducing the severity of flood disaster in Malaysia it is evident that such measures remain insufficient as experienced during the 2014/2015 flood, where closed to 250,000 people were displaced (Lim and Cheong, 2015) as also confirmed by Hussain et al. (2014) that, most communities in Kelantan are still confronted by the problem of the ineffectiveness of flood risk management systems despite government efforts to assists flood victims.

1.5 An Overview of Flood Disaster Effect in Malaysia and Kelantan State in Particular

Floods are the most severe of all disasters affecting Malaysia as it occurs every year (Chan, 2012b; Wan Ahmad and Abdurahman, 2015) with monsoon as the serious flood followed by a flash and tidal floods (Ngai Weng Chan, 2015). The monsoon which is the most serious flood occurs mainly from Northeast monsoon during the months of November to March with heavy rains to the east coasts states of the Peninsular Malaysia (Khan et al., 2014; Nur et al., 2015).

Based on the literature, Monsoon and flash floods are the most severe climate-related natural disasters in Malaysia, with a flood-prone area of about 29,000 km2 affecting more than 4.82 million people (22 % of the population) and inflicting annual damage of USD 298.29 million (Wan Ahmad and Abdurahman, 2015)**.** With annual heavy monsoon rains averaging more than 3,000 mm and such a large flood-prone area, flood risk is indeed high, most notably in riverine areas and coastal flat lands and with such a large population living in flood prone areas, flood exposure is high as well (Ngai Weng Chan, 2015)**.** Since, the great 1967 floods, some notable factors were identified as the major contributors to flood disaster occurrence in Kelantan, these include intense and torrential rain, closing of estuary by sand bars, poor conditions of various drainage systems, low ground level along main river banks, indiscriminate felling of trees for logging and other developments (Jaafar et al., 2016).

Flood intensity in Malaysia is increasing rapidly in recent decades mostly due to the nature of the county's physical as well as human geography (topography, settlements, and land use patterns) (Islam et al., 2016). and have been having adverse impacts on food production (Alam et al., 2016). Climate change is real and its impact is being felt in Malaysia e.g. flood disaster, haze etc. which causes reduction and losses in revenue, productivity and health risk of the people (ECCM, 2011). Flood is the most frequent and costly natural disaster in terms of economic damage and socio-economic well-being of Malaysians and causes as much as 62.5% damage (see Figure 1.4) of all natural disasters occurring in Malaysia (Khan et al., 2014).

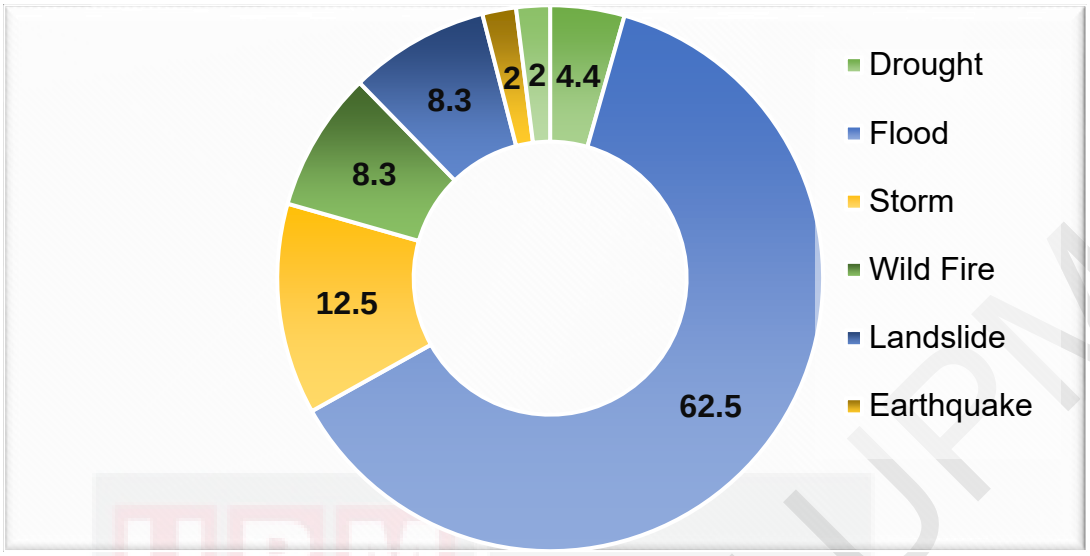

Figure 1.4 : Malaysia's Reported Losses from 1990-2014
(Source : Malaysia Disaster Reference Handbook, 2016)

It has become a common feature in the lives of a significant number of Malaysians, with a flood prone area of about 29,000 km2 affecting more than 4.82 million people (22% of the population) and inflicting annual damage of USD 298.29 million (Iya, Gasim, Toriman, and Abdullahi, 2014). Of all the disasters in Malaysia, floods are most severe and frequent, that affects millions of people and exacerbate greatest economic damage which accounts for a significant number of casualties, property and crop damage and other intangible losses (Ngai Weng Chan, 2012a) and subsequently has negative impact on victims incomes, nutrition and food security (Ashraf, Iftikhar, Shahbaz and Khan, 2013). Malaysia had experienced in the last decades an increased damage and losses as a result of flood disaster e.g. in 2006 the losses are estimated at RM300 million with Johor recording the highest cost in damages at RM250 million followed by Kelantan with RM150 million (ECCM, 2011).

The reported cost of damages, caused by the recent 2014/2015 flood disaster in the most affected states, shows that the state of Kelantan, Pahang, and Terengganu are the largely affected (as shown in Table 1.4 below) in Peninsular Malaysia.

Table 1.4 : Total Amount of Estimated Damages in 2014/2015 Floods

Affected States	Cost of Damages (Millions RM)
Kelantan Pahang Terengganu	204
Johor Melaka Negeri Sembilan	78
Perak Kedah Perlis	55.6

(Source : Zainal Abidin et al, 2015)

The rising and increasing intensity of rainfall causing flood disaster serves as the major challenge for agriculture and rural livelihoods in Malaysia, as it is the economic sector most vulnerable and majorly practiced by rural poor compared to urban residents (Hamdan, Kari, Othman, and Samsi, 2012). In Malaysia, at least one third of the county's population depends on the agricultural sector for their livelihoods and the majority of the smallholder farmers live in rural areas with agriculture sector as the main source for their livelihood (Mahendra Dev, 2011; Syaheera and Shaari, 2017). The national aggregate effect of a flood disaster on agricultural production in Malaysia is likely to be small to moderate, however, regional, state or local effects could be significant as the flood disaster effects vary considerably across the regions, states or locals. Though National Agricultural Policies (NAP) and other plans have achieved a lot in transforming the Malaysian agricultural sector, but were constrained and not fully successfully achieved their stated objectives due to some certain challenges, one of which is climate change especially flood disaster that significantly affects the agriculture sector in term of production as well as impacting the social economics problem to the people involved in the sector and the nation as a whole (Devendra, 2012). Chang (2012) opined that floods are the single most severe of all disasters in Malaysia, it accounts for a significant number of casualties, property and crop damage and other intangible losses. Economic losses in Malaysia are projected to be the interruption of economic activities, principally agriculture production, along with vulnerable stretches of coastline as a result of direct inundation (Sarkar et al., 2014).

In general agricultural production is sensitive to climate change and food security is sensitive to agricultural production; floods, therefore, have devastating economic consequences for agricultural production and impact could be immediately transmitted to food security and livelihood. According to the United Nations (2010), many hundreds of millions of people throughout the world, particularly those living in the developing countries, are threatened by floods disaster and tropical storms.

The palm oil and rubber output in Malaysia have said to be dropped to at least 30% during 2014/2015 floods, prices escalated and their export to other countries disrupted (Akasah and Doraisamy, 2015). USDA (2015) argued that the recent floods on the East Coast Peninsular Malaysia may result in agricultural production declining up to 15% for the year 2015, daily harvest down by 50% and the three most affected states (Kelantan, Terengganu and Pahang) by flooding account for the 17% of the total national production and 35% of Malaysia's agricultural output. According to the Malaysia Agriculture and Agro-based Industry Minister, Datuk Seri I.S Yaakoob (2015), RM194 million were lost due to damage to agricultural produce in 2014/2015 floods, 15,403 farmers, livestock breeders, and fishermen were mostly affected, involving 16,342 hectares of agricultural land (Malaymailonline, 2015). From these assertions so far, it is apparent that agricultural sector in Malaysia is vulnerable to weather-related natural disaster, especially flood, that causes serious damage and losses to agricultural products, displacement of people, damage to infrastructures and the environment in general.

Kelantan State of Peninsular Malaysia is largely an agricultural state, where a majority of the households depend on smallholder agriculture as their primary source of livelihood, though high and prosperous socio-economic activities are in major towns of Kota Bharu, Pasir Mas, Tenah Merah and Kuala Krai with economic activities including industrial, commercial and service sectors. Flood occurrence is synonymous to the State (Kelantan) due to its significant intensity/frequency caused by heavy rainfall during the monsoon, which starts from November to March every year (Hussain et al., 2014; Khan et al., 2014). Kelantan is prone to annual flooding and experiencing a major flooding at least once in every five years due to its proximity to coastlines and rivers (Lim and Cheong, 2015). The 1927 and 1967 floods are considered as the major devastating flood ever witnessed in Kelantan history and it has been reported that at least 70% of the villages in Kelantan or nearly half of the State population were affected (Baharuddin et al., 2015) and about 50% of the total land area and 60% of the total population in Kelantan are threatened by flood (Jiang, Deng, Chen, Wu, and Li, 2009).

According to Minister of Agriculture and Agro-industry Datuk Seri Ismail Sabri Yaacob (2015), flood disaster has destroyed 11,099 hectares of agricultural land whereby more than 6,309 farmers, fishermen, and breeders were affected together with the destruction of agricultural assets and infrastructures. He argued that RM105 million losses were reported in an agricultural sector of Kelantan as a result of the devastating flood. The categorization of estimated losses involves paddy (RM35 million), livestock (RM2.02 million), fruits (RM2.1 million), aquaculture (RM20.1 million), agro-based industries (RM12.2 million) and assets (RM28.5 million).

Without adequate measures, the occurrence of floods could cause displacement of people, damaged infrastructures, and losses of agricultural production from eroded/inundated lands. Monetarily, it is difficult to estimate the quantum but a conservative figure of RM 100 million has been used to estimate the average flood

damage per year. In a major flood, people's coping mechanisms are totally ineffective and they are forced to rely on government relief for recovery and a flood depth of 3m is not uncommon, and hundreds of thousands of people are often evacuated.

1.6 An Overview of Malaysian Agriculture and Flood Disaster Effect

Agriculture has been the mainstay of Malaysian economy at the beginning of independence, as it contributed 43.72% to the GDP, generated 58.3% of the total employment and about 50% to export earnings, but this contribution of agriculture to the GDP declined from 43.72 percent in 1960 to 8.43 per cent in 2015 (Devendra, 2012). As a result of this declining trend, climate change factor is now becoming a key threat to agriculture and food security which is the major farmers' aspiration for a better livelihood (Devendra, 2012; Ngai, 1997).

Agriculture still remains the most important sector and backbone of the Malaysian economy as the actual value of output and productivity has continued to increase (as shown in Figure 1.5 below) despite its minimal contribution to Malaysia's GDP in the last two to three decades. In addition, it continues to supply food for an increasing population, create employment opportunities and increase income for rural people, deepen linkages with other sectors of the economy and provide foreign exchange for the government.

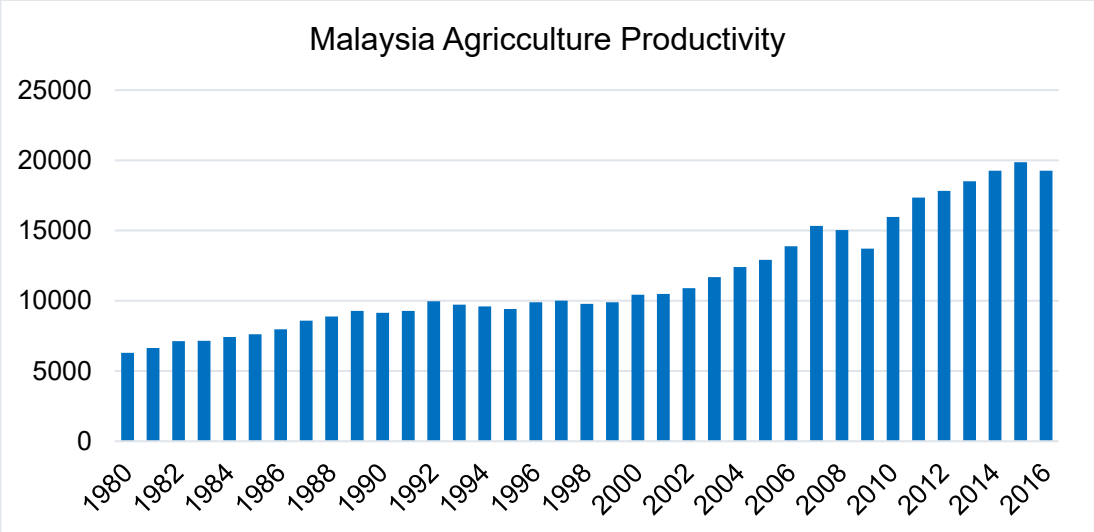

Figure 1.5 : Agriculture Value Added per Worker at Constant USD
(Source : Global Economy, 2017)

Agricultural sector remains one of the sectors greatly affected by flood disasters in terms of crop losses and livestock, damage to infrastructures and drop in agricultural productivity (Baharuddin, 2007; Jabin et al., 2015), it is not only critical for food supply, also remains a source of livelihoods across the planet (FAO, 2014). It has been reported from many previous studies that flood disaster as a result of climate change variability negatively affects agricultural production in Malaysia (Jabin et al., 2015; Lee and Mohamad, 2014; Alam et al., 2016; Sarkar et al., 2014). Flood agricultural losses/damage has increased in Malaysia despite local, state and local effort and encouragement to structurally mitigate the cascading effect of flood disaster, just as reported with similar trend in USA and other developed and developing countries in the world (Atreya et al 2013; Downton and Miller, 2002; IPCC, 2001). According to FAO (2015), flood disaster effect on agriculture can result to direct effect on livelihoods (food security and income) through unemployment, and/or decline in wages vis-à-vis high food prices, low household's purchasing capacity leading to non-affordability and accessibility of adequate food.

Kelantan State of peninsular Malaysia has become prone to flood disasters, and this is potentially due to climate change variability, rapid changes in land use in relation to conversion of agricultural land (rubber and oil palm) and logging activities have been reported, in addition to weaknesses in development planning and monitoring (Adnan, 2010). The major economic activities in Kelantan are agriculturally based, with paddy rice production as the major and important farming activity, rubber, oil palm, and tobacco, other important farming activities consist of fishing and livestock and livestock farming. Although rice production is the most important source of income to the smallholder farmers, the average yield is below the national average and over the years agricultural productivity is slowly decreasing (Ismail, 1996) attributed to the problems of proper maintenance of farms and crops and projects sites filled with sea water as a result of floods (Buang, 2009). According to Shamshuddin et al. (2016), the river levees were once fertile for the production of food and cash crops, but the 2014/2015 flood had destroyed not only the crops but also the land on the river bank. What was the immediate cause of this catastrophe? The farmers in the area seemed to believe that the damage could have been less if the land on the other side of the river was not disturbed by extensive development.

1.7 Policy Responses/Action of Government to Floods

According to Devereux (2006) policy responses to flood effect on agriculture are mitigation strategies used to mitigate/moderate the devastating impact of flood on agriculture, and provision of recovery resources which involve enhancing farmers' access to agricultural inputs such as improved seeds, farm tools, credits, and fertilizers to boost production and minimize crop losses as result of the disaster. While Dewan (2015) opined that policy responses to flood disaster are governmental and non-governmental efforts and programmes to aimed at minimizing the adverse effect of the flood.

In Malaysia mitigation in form of structural flood measures and recovery are the key component of government policy responses to flood disasters, in addition to recovery and response strategies (Chan, 2000). Although, the effect of large flood disaster cannot be avoided or eliminated, due to its' intensity and magnitude, Malaysian government have in the past established many institutions policies and programmes aimed at mitigating the impact of flooding. Notable among them is the Drainage and Irrigation Department (DID) which is saddled with the implementation of structural and non-structural flood mitigation strategies (Shah, Mustaffa, & Yusof, 2017). Structural involves the construction of artificial structures such as dams, reservoirs, embankments, levees, retention ponds, diversion channels, dredging and deepening major river channels. While the non-structural includes flood warning, flood forecasting, land use planning, flood insurance, resettlement, the creation of public awareness and educational programmes related to flood control (Mohd Yusoff, 2007; Shah et al., 2017). These mitigation strategies were implemented in order to reduce the effect of a flood disaster on the people and their economic activities living along the flood plain areas (Shafiai & Khalid, 2016). Based on the recovery resources needed to meet the flood victims recovery needs, on the other hand, National Disaster Management Relief Committee (NDMRC) was also saddled with the responsibility of planning, coordinating, distributing and supervising the disbursement of available recovery resources, such as food aid, financial assistance, relief materials and other recovery measures for restoring and improving the welfare and quality of life of the affected individuals and communities after a flood disaster (Shafiai & Khalid, 2016; Sukeri, Khalid, & Shafiai, 2015). Even though the effect of large flood disaster cannot be avoided or eliminated, due to its intensity and magnitude, as a developing country, Malaysia's National Disaster Risk Management can be attested to be commendable (Chan, 2012).

Due to the magnitude and intensity of flood disaster in Malaysia and the familiarity with the needs of the country to avoid the damages caused by floods. The government of Malaysia decided to allocate funds from the national budget for the flood mitigation measures in every of its Malaysia plan (five-year plan). And this is done to protect the citizens and their economic activities from the cascading negative effects of flood disasters (Shah et al., 2017). This has also been supported by the speech of the Deputy Prime Minister Tan Sri Muhyiddin Yassin at the Third United Nations World Conference on Disaster Risk Reduction (UNWCDRR, 2015) that, " Disaster Risk Reduction (DRR) has always been in the mainstream of Malaysia's development policy, where substantial resources has been provided to reduces the underlying risk factors and promote sustainable development through the five (5) phases of disaster prevention, mitigation, preparedness, response and recovery that has been given adequate consideration in the current 11th Malaysia plan to tackle the problem of floods and other emerging disasters in a structural and non-structural measures". According to Lee and Mohamad (2014) within each Malaysia plan, millions of ringgit were budgeted on flood disaster management as shown in Figure 1.6 below.

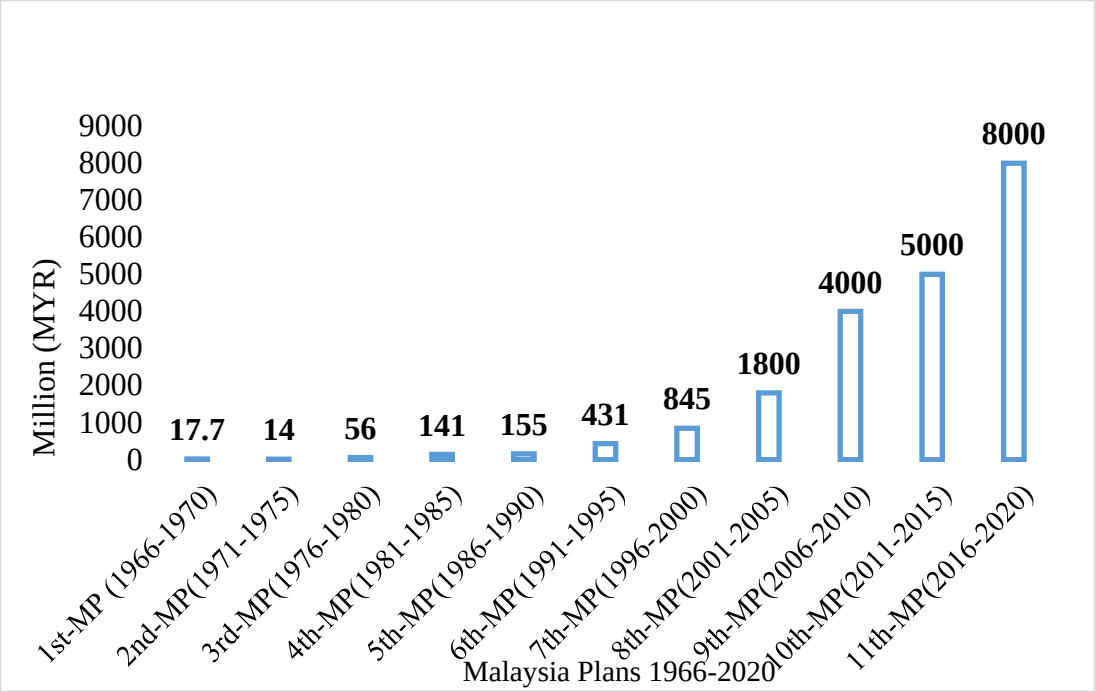

Figure 1.6 : Budget allocation for Flood Mitigation Expenditure in Malaysia, based on Malaysia Plans
(Source : Based on Drainage and Irrigation Department, Malaysia from Chan, 1997; Lee & Mohamad, 2014; Shah et al, 2017)

1.8 Review of Policy Natural Disaster Risk Management in Malaysia: The Case of Floods

National Disaster Risk Management (NDRM) is a concept and practice of reducing disaster risk through a systematic application of policies and strategies so as to analyze and reduce the causal factors of disasters (IPCC, 2001; UN, 2013). It encompasses the whole range of initiatives and actions such as policy promulgation, strategic planning, administrative, financial and decision making processes with particular reference to the entire disaster cycle (Bhandari, 2014). Immediate measures are undertaken with the priority to lessen the effect of the disaster through mitigation, preparedness, response and recovery activities (Thieken et al., 2007). Although, it is inevitable as reported from empirical literature that, all the negative effects emanated from a natural disaster can be counteracted and/or eliminated (IPCC, 2001; Lim and Cheong, 2015; Moe and Pathranarakul, 2006; Thieken et al., 2007) but effective disaster management can be made before, during and after disaster strikes through adequate mitigation, preparation, response and recovery measures (Alexander, 2000; Paul, 2011). As shown in Figure 1.7 below.

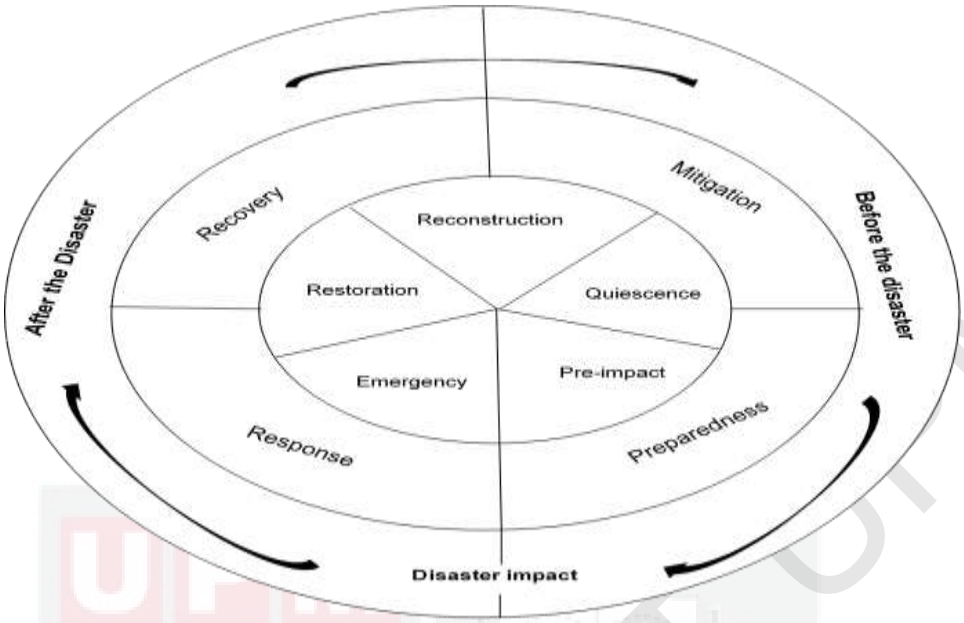

Figure 1.7 : Disaster Management Cycle
(Source : Alexander D, 2000)

Disaster management cycle provides a vital framework by showcasing the role of governments and relevant stakeholders in planning, organizing, coordinating and mobilizing resources for disaster management (Moe and Pathranarakul, 2006; Thieken et al., 2007).

Several studies and reports in Malaysia (ASEAN, 2015; CFE-DM, 2016; Chan, 2012a; Lim and Cheong, 2015) has proven that natural disaster management activities were and still undertaken by government and it's relevant agencies such as National Security Council (NSC) which determines policies and mechanisms for disaster prevention, mitigation and preparedness, response, recovery and reconstructions as enshrined in its directive 20; National Disaster Management Relief Committee (NDMRC) and its sister agencies, State Disaster Management Relief Committee (SDMRC), District Disaster Management Relief Committee (DDMRC) are responsible for organizing, coordinating and providing relief materials and operation before, during and after the disaster; National Flood Disaster Relief and Preparedness Committee (NFDRPC). Its main task is to ensure that all flood victims are adequately assisted especially in terms of aid; Drainage and Irrigation Department (DID) is responsible for flood management by monitoring river flow, oversee flood mitigation and giving real-time update on flood occurrence; Malaysian Meteorological Department (MMD) is responsible for providing adequate flood and storm warning to the public. Despite these numerous policies, strategies, and measures set in place, they have not been entirely successful, but as a developing country, Malaysia's National Disaster Risk Management can be attested to be commendable (Chan, 2012). As earlier stated that the effect of large flood disaster cannot be avoided or eliminated but reduced, since it's intensity and magnitude

cannot be perfectly forcasted and predicted accurately despite recent technological advancement. The organizational structure for the management and coordination of natural disaster in Malaysia is in top-down approach, which is from Prime Minister's office down to district officer (CFE-DM, 2016; Chan, 2012a; Sukeri et al 2015) where NSC under the Prime Minister office is responsible for policies and mechanisms aimed at disaster prevention, mitigation, and preparedness, response and recovery. The second level is the state followed by the district disaster management and relief committee. As shown in Figure 1.8 below.

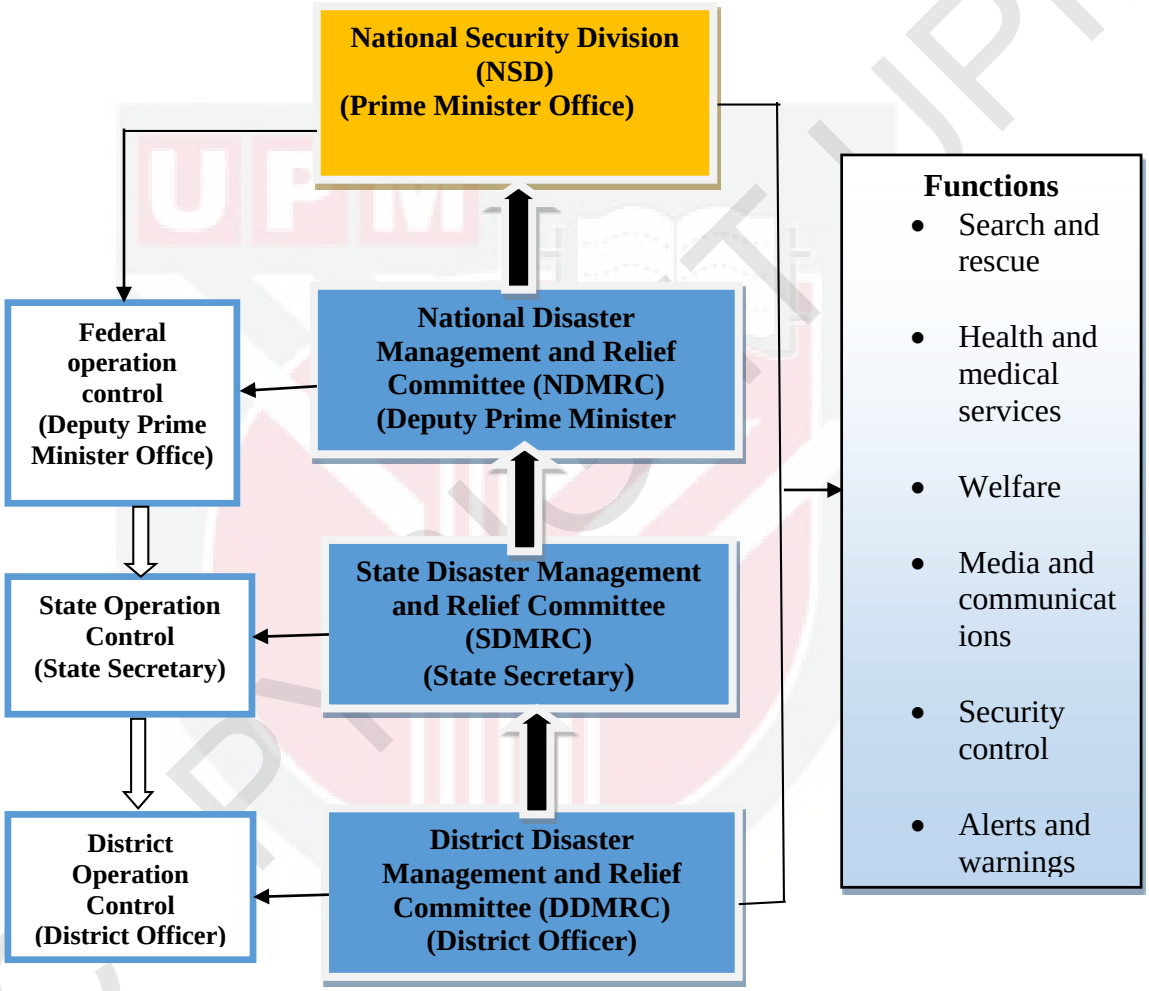

Figure 1.8 : Disaster Management Framework in Malaysia
(Source **:** Based on the Center for Public Policy Studies CPPS 2015 CFE-DM 2016 and Sukeri et al., 2015)

This framework outlines how government and other relevant authorities developed a disaster delivery system in terms of mitigation, preparation, response and quicker recovery from disaster effect in order to reduce losses and give a succor to the affected communities (Sukeri et al., 2015). In addition to having an integrated system of disaster management with emphasis on the concerted and coordinated

actions through combined and coordinated response of the various agencies to handle the disaster efficiently and bringing the situation back to normalcy.

1.9 Policy Action of Flood Disaster Management in Kelantan

Several flood mitigation initiatives have been undertaken by both the federal and state agencies, to sustainably reduce flood damage in Kelantan state in both short and long term basis, particularly the Department of Irrigation and Drainage, under the Ministry of Natural Resources and Environment. Among such projects are the construction of flood plains, river improvement and rehabilitation, river dredging cantilever walls, tidal barrages, tidal gates, river channels and levees, pumping stations, debris removal systems, monsoon drains, retention and detention ponds, and dams, as indicated in Table 1.5 below.

Table 1.5 : Major Flood Mitigation Projects Implemented by Department of Irrigation and Drainage (DID) In Kelantan, Malaysia

Flood Mitigation Project	Type of Mitigation Works	Project Completion	Nature of Flooding Mitigated		Remarks
			Localized	Wide spread	
Program Mencegah Banjir Kemasin/Semerak	Flood Mitigation Agricultural Upgrading				
Kemasin Phase: 1		1991		✓	Commenced in 1982
Semerak Phase: 2		On - going			Flood Mitigation Component, Completed in RM7
Mengorek Sungai Jahajan Machang	River Improvement	RM7	✓		
Rancangan Menstabil Tebing Sg. Kelantan di Kg.kedai Buluh & Kg.laut	River Rehabilitation	RM7	✓		
Rancangan Menstabil Tebing Sg. Kelantan di Pasir Pekan	River Rehabilitation	RM7	✓		
RTB Kota Bharu	Urban Drainage Upgrading Bund Protection	On-going	✓		
Rancangan Menstabil Tebing Sg.Golok (KESBAN) Phase 1: Phase 2:	River Rehabilitation Bund Protection	 1997 1999	✓		
Kelantan River Basin, Kelantan (13,000 sq. km)	Construction flood detention dam at Lebir, River improvement, and Dredging, Levee Construction, Bank protection works	1999		✓	

Sungai Kelantan Integrated River Basin Development Project (PLSB), Tumpat, Pasir Mas, Kota Bharu, Tanah Merah and Machang districts in Kelantan	Stabilization of river banks, River dredging works, Environmentally-Friendly Drainage, and construction of reservoirs			✓	Expected to be completed May 2021

With regards to recovery need resources, various levels of government and non-governmental organizations have developed the relief machinery and emergency flood management, and for post-disaster, funding and aid delivery systems to help the victims recover after a disaster occurs (Sukeri et al., 2015). National Security Council (MKN), would provide compensation to the three groups of people whose agriculture produce were affected by the recent floods. He added that the rate of payment would be RM1,800 a hectare for paddy (with a maximum payment for three hectares only), RM700 per buffalo (maximum 10 buffaloes), RM600 for each head of cattle and deer (maximum 10 for both), RM150 per goat (maximum 20), and RM5 per chicken (maximum 100) and RM2 per quail (maximum 200). "Payment for the aquaculture industry will be RM1,500 per pond (maximum two ponds) and caged fish rearing at RM200 per section.

Despite the continuous increase of government financial assistance and subsidy for smallholder farmers, their agricultural land area is decreasing as the farmers often experience adverse impacts of climate variation. Until today, crop failure protection scheme against these risks still not available in Malaysia and farmers have to dig their pockets and rely on the government aids to overcome losses of the crop failure. The government has spent approximately US$ 30 million from 2008 to 2012 to help farmers who were affected by adverse weather conditions by giving the financial aid to compensate their losses (Rahim, Hamid, Wahab, & Amin, 2016).

1.10 Smallholder Farmers' Adaptation in Agriculture

Adaptation strategies are proactive and reactive measures undertaken to prevent and/or reduce the climate change effects, smallholder farmers are always conscious in adapting climate variability. They are actions and adjustments undertaken to maintain the capacity to deal with disruptions and also alleviate the severity of climate change impacts on agriculture and food production (Alam et al., 2017; Banerjee et al., 2013). According to Asrat and Simane (2018), smallholder farmers can undertake adaptation strategies themselves (autonomous adaptation) or adaptation through government policies aimed at promoting appropriate and effective adaptation measures (planned adaptation). Some of the adaptation strategies on agriculture undertaken by smallholder farmers against the impacts of climate change include adjustments in planting dates, planting improved crop

varieties, drainage systems, and land management regimes to maintain yields and soil fertility (Banerjee et al., 2013). Besides long-term adaptation strategies, smallholder farmers experiences, knowledge and perceptions of extreme disasters and their impacts motivate them to follow some precautionary measures which can help to limit losses (Lwin et al., 2015; Thieken et al., 2007).

In Malaysia adaptation for climate change and agricultural production are closely linked in the country's climate change, impact on agriculture, vulnerability, and livelihoods of farmers (Robert, 2011). However governments and other stakeholders in flood disaster management have consistently built local awareness on climate change impacts, that is making climate change relevant to villagers, farmers and fisher folk so as to take proactive measures to adapt to its cascading effect (Hayrol et al., 2013; Robert, 2011). Though the need for smallholder farmers and communities adaptation strategy against flood disaster is rising, little has been discussed with regards to smallholder farmers undertaking adaptive measures against flood as argued by Afroz & Akhtar (2017) that, although the perception of flood disaster impact among smallholder farmers is high, majority do not undertake adaptation measures against it.

1.11 Agricultural Damage (Effect) Assessment

Flood damage refers to all varieties of harm caused by flood disaster (Messner and Meyer, 2006), it encompasses a wide range of effects on different sectors of the economy and human health and life specifically described as the total or partial destruction of physical assets, disruption of basic services and damage to sources of livelihood in the affected community. Flood damages are categorized into tangible and intangible damages, the tangible damages are those that can be measured directly into monetary terms while intangibles are that cannot be measured in monetary values, and tangible damages/effects can further be classified into direct and indirect damage/effects (Dutta et al. 2003; Merz et al., 2010; Messner and Meyer, 2006; Pauline, 2013; Romali and Sulaiman, 2015; Scawthorn et al., 2006). Direct damages are those that occur as a result of physical contact of flood waters with properties, humans, etc. while indirect effect occurs as a consequence of direct effect and it includes business interruptions and public services, example delay in transportation, unemployment etc. (Bremond, 2013; Dutta et al., 2003; FAO, 2015b; Merz et al., 2010; Posthumus et al., 2009).

Direct agricultural damage as a result of flood disaster includes damages/losses of crops and yield reduction, injuries and fatalities on livestock, fisheries and forestry, damage to soil others consist of primary farm infrastructures such as tube wells, store, animal sheds and farm stocks (fertilizer, seeds etc.) and other various agricultural equipment and machineries (Arshad, 2010; Bremond, 2013; Merz et al., 2010; Nafari, 2013; Posthumus et al., 2009). The indirect agricultural damages were reported as increased cost of production, reduced farm productivity, high market price of agricultural produce, decrease in supply of agricultural produce, wage

decline, unemployment, business disruption (Bremond, 2013; Carrera, Standardi, Bosello and Mysiak, 2013; Dutta et al., 2003; Hallegatte and Przyluski, 2010; Israel and Briones, 2013a).

A number of studies (Campbell et al. 2011; Hallegatte and Przyluski, 2010; Tanza, 2008) have categorized the economic effect/impact into direct and indirect effects. They argued that direct effects are usually quantified monetarily with market values, while indirect effects are not easily assessed due to large uncertainties on its costs (Châu, 2014; Hallegatte and Przyluski, 2010).

1.12 Need for Flood Economic Effect Assessment

As reported from different kinds of literature flood economic damage assessment has become a very crucial and important part of decision making process and policy development in flood risk management, and the dominant approach for flood control policies and strategies throughout Europe (Merz et al., 2010; Vetere-Arellano et al. 2003). Romali and Sulaiman (2015) argued that the success of any society's flood disaster management approach depends on the flood damage assessment of the affected economic sector and community concern. Lindell and Prater (2003) outlined four (4) reasons why flood damage assessment is important:

1) Identification of priorities during and after flood disaster and determine if there is a need for external assistance.
2) To identify specific of the communities that have been affected disproportionately.
3) Help policy makers to develop and/or improve an integrated flood risk management.
4) Understanding the fragilities of the affected areas and tailoring the required mitigation measures.

According to Carrera (2013), an assessment of flood disaster effect is essential, since it provides a basis for defining the financial needs to achieve full recovery and reconstruction, and it also helps to determine the type of public assistance needed by the affected community. Merz et al. (2010) argued that perhaps there are areas more susceptible to flood disaster effect than others, flood risk assessment should be taken into account during the planning process. World Metereological Organization (WMO), (2013) opined that, assessment on the extent of flood disaster effect is essential for flood relief coordination to the affected communities in future flood emergencies, as policy makers in most countries based their planning process on flood disaster assessment on areas prone flooding, so as to ensure that future flood risk is avoided or be managed in a tangible manner.

Vetere-Arellano et al. (2003), stated that the results of flood risk assessment can be used in different areas by policy makers and a number of stakeholders in flood disaster management as summarized in Table 1.6 below.

Table 1.6 : Areas where Damage Estimation Results can be used

Area	Usage
Policy making	It could be used to assist policy makers in preparing, revising and updating legislations in order to ensure maximum protection.
Spatial and land use planning	To assist rural and regional planners to adopt proper prevention and mitigation measures in order to prevent and reduce the cascading effect of flood.
Disaster recovery/relief	It helps in prioritizing and better targeting the allocation of disaster recovery and relief resources.
Damage estimation practice	Helps to improve damage estimation techniques in carrying out damage assessment.
Damage estimation research	It could be used to identify areas of research where advances can be made, as well as providing a better understanding of flood disaster and its effect on the society.

(Source : Adopted and modified from Vetere-Arellano et al, 2003)

1.13 An Overview of Livelihood Outcomes in Malaysia

Malaysia had witnessed a rapid development in terms of socio-economic and demographic changes since independence and now tracking to become high income nation by the year 2020 (ETP, 2015) these developments are attributed to the stability in political and economic advancement in recent decades (Shariff and Khor, 2005), according to (Alinovi, Marco, and Erdgin, 2010) livelihood outcomes are capacities and goals to which people aspire such as improved food security and increased income to meet their survival and attain general wellbeing.

Malaysian government had come up with strong economic policies and programs in raising rural incomes and reducing rural poverty since independence (Abdelhak, 2013; Alam et al. 2016; Devendra, 2012), such policies and programmes include New Economic Policy (NEP); National Development Plans (NDP); Malaysia Plans (MPs); Food Security Policy (FSP) and the recent New Economic Model (2011-2015) which Malaysia seeks to achieve high income status by the year 2020. As a result of these continuous policies and programmes, the incidence of poverty/food insecurity has been dramatically and significantly reduced. As indicated in Table 1.7 below, the incidence of poverty in Malaysia as a whole fell to 0.6 in 2014 against 49.3% in 1970; in an urban area, it drops to 0.3 in 2014 as against 21.3 in 1970 while in rural areas it declined to 1.6 in 2014 as against 58.7 in 1970.

Table 1.7 : Incidence of Poverty and Mean Monthly Gross Household Income

	1970	**1976**	**1979**	**1984**	**1987**	**1989**	**1992**	**1995**	**1997**	**1999**	**2002**	**2004**	**2007**	**2009**	**2012**	**2014**
Poverty Incidence Malaysia (%)	49.3	37.7	37.4	20.7	19.4	16.5	12.4	8.7	6.1	8.5	6.0	5.7	3.6	3.8	1.7	0.6
Poverty Incidence Urban (%)	21.3	15.5	17.5	8.5	8.5	7.1	4.7	3.6	2.1	3.3	2.3	2.5	2.0	1.7	1.0	0.3
Poverty Incidence Rural (%)	58.7	45.7	45.8	27.3	24.8	21.1	21.1	14.9	21.2	14.8	13.5	11.9	7.1	8.4	3.4	1.6
Mean Monthly Gross Households Income Malaysia (RM)	264	505	678	1098	1083	1169	1566	2020	2606	2472	3011	3249	3689	4025	5000	6141
Mean Monthly Gross Households Income Urban (RM)	428	843	1045	1573	1488	1606	2032	2589	2032	3103	3652	3956	4356	4705	5742	6833
Mean Monthly Gross Households Income Rural(RM)	200	385	523	842	881	957	1024	1326	1704	1718	1729	1875	2283	2545	3080	3831

(Source : Economic Planning Unit (EPU) Prime Minister's Department, 2017)
Official website www.epu.gov.my

From the Table 1.7 above, it can also be seen that Malaysia has made a dramatic achievement in eradicating poverty and food insecurity to the bare-minimum and witness the rise in gross monthly income ill states within the last four decades, up to a stage where some states like Johor recorded 0% incidence of poverty in 2014, but yet there is income inequality, poverty and food security disruption among the rural households East Coast states of Peninsular Malaysia as reported from empirical literatures (Abdelhak, 2013; Mahmudul Alam et al., 2016; Siwar et al., 2013), in addition to what is reported from Malaysia Economic Planning Unit (EPU) that rural poverty is high in those states as indicated in Figure 1.9 below.

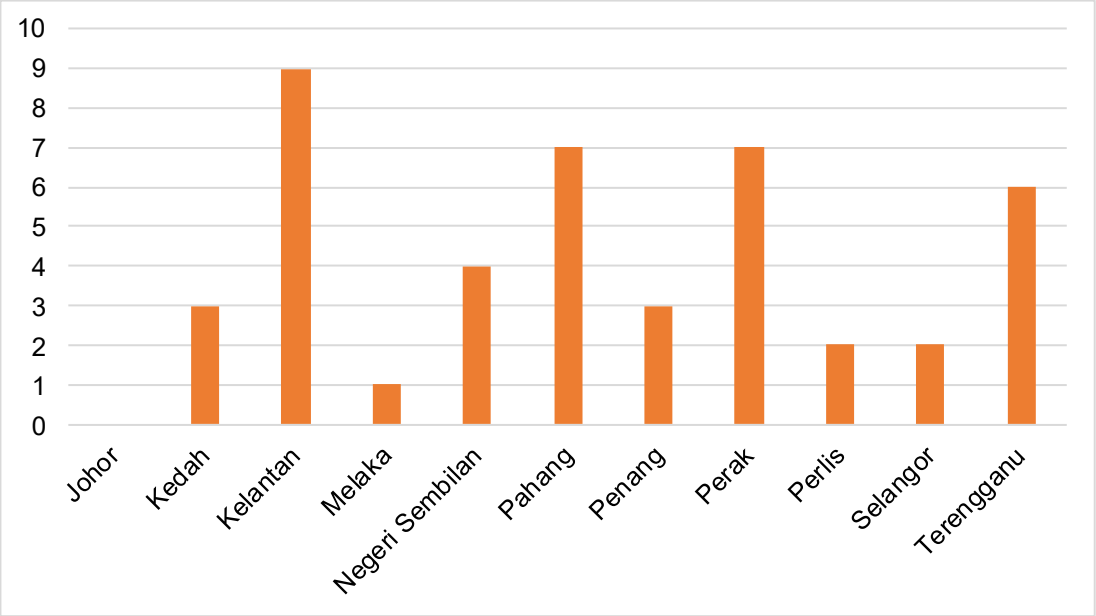

Figure 1.9 : Incidence of Poverty (%) by States in Peninsular Malaysia, 2014
(Source : Economic Planning Unit (EPU) Prime Minister's Department, 2017) Official website: ww.epu.gov.my

With regards to rise in gross monthly income, there is a virtually significant increase in all states of Peninsular Malaysia, with Selangor having the highest monthly income of RM8,252 in 2014 as reported by EPU and Kelantan become the state with lowest gross monthly income of about RM3,715, as shown in the Figure 1.10 below.

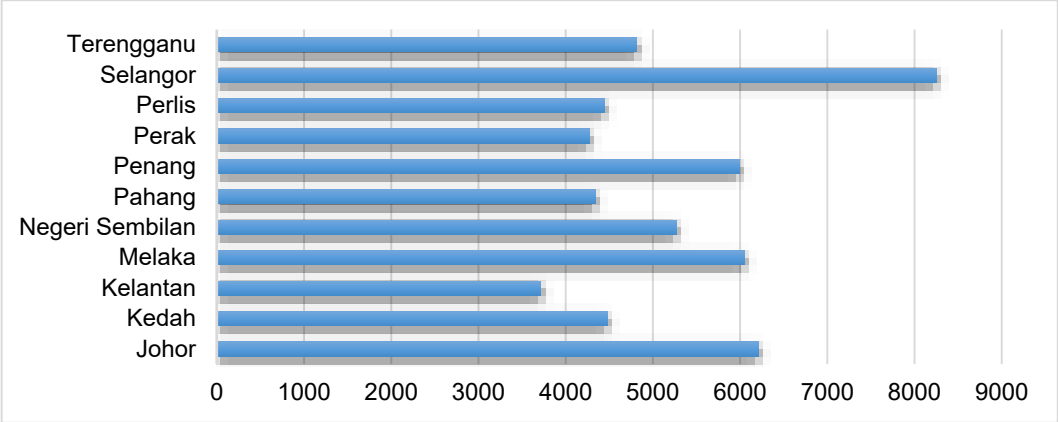

Figure 1.10 : Mean Monthly Gross Household Income by States in Peninsular Malaysia, 2014
(Source : Economic Planning Unit (EPU) Prime Minister's Department, 2017) Official website www.epu.gov.my

This study argues that, despite all these onerous achievements in eradicating poverty among the rural populace, it is necessary to assess the flood disaster effect on smallholder farmers agriculture and livelihood, and the policy responses against disaster, since various empirical studies had opined that food security and income of rural households in disaster prone areas are not only threatened by the unavailability of food or inadequate government policies and programmes but the prevailing natural disasters in the area that caused substantial asset losses and damages, large income fluctuations and thus, leads to food insecurity (Abdelhak, 2013; Fothergill and Peek, 2004; Morduch, 1994; Masozera et al., 2006; Siwar et al., 2013). Rural households around the world both in developing and developed nations like United States of America (USA), suffer the greatest disaster losses and have the most limited access to public and private recovery assets (Blaikie et al. 2003; Fothergill and Peek, 2004) lack of formal mechanisms such as credits and insurance hinder the ability of smallholder farmers to cope with natural disaster impacts (Abdelhak, 2013). For the case of Malaysia, it has been reported that over 3.5 million people who are mostly living along flood prone areas in the coastal region are vulnerable to flood disaster, which occasionally destroys their agricultural produce, farm infrastructures, households properties and affects their general welfare (Ngai Weng Chan, 2012b).

1.14 Problem Statement

The 2014/2015 flood disaster due to its frequency and magnitude stands out to be the most devastating natural disaster in Kelantan state, disrupting various sectors of the economy and caused substantial economic losses by destroying and damaging agricultural land and products, houses, infrastructures and other public buildings costing millions of ringgit. It has been reported that at least 70% of the villages in Kelantan or nearly half of the State population were affected (Baharuddin et al.,

2015). It has caused a considerable economic damage to farmers and their livelihood (Tahir et al., 2015). According to Agriculture and Agro-Based Industry Minister Datuk Seri Ismail Sabri Yaakob, RM194mil was lost due to damage to agriculture produce and Kelantan recorded the highest number of livestock breeders, fishermen, and farmers who were affected by the floods. Being an agrarian State (Kelantan), the resulting losses, in the agricultural production sector would have negative effects on the livelihood outcomes of the victims, especially in rural communities, where a majority of households still depend on smallholder agriculture for survival. However, on the policy response to flood disaster, most studies have claimed that governments and other stakeholders put more efforts on reactive approaches such as response and recovery measures rather than mitigation that are proactive measures (Mojtahedi, 2015).

Although there are numerous studies on flood disaster effect in Kelantan (Wan Ahmad et al., 2015; Weng et al., 2016; Hussain et al., 2014). Few were carried out to assess its effect on agriculture and livelihood outcomes of smallholder farmers, and policy efforts used in reducing the effects. Several models such as IO Model, SAM, and CGE that were used to assess the impact of natural disasters hardly estimate individual livelihood disruptions. In addition, many of these studies have investigated the direct and indirect effect of natural disasters on socio-economic and livelihood conditions separately and few integrated frameworks were found to evaluate the natural disasters effects on both economic and livelihood conditions concurrently in the literature. There is the need for an integrated conceptual framework that would estimate flood disaster effect on agriculture and livelihood outcomes of the affected smallholder farmers, incorporated with policy responses as moderating factors to the flood disaster effect, so as to bridge the gap on the limitations of previous studies.

1.15 Research Questions

The research questions that are proposed and addressed in this study are as follows:

1) What is the extent of the 2014/2015 flood disaster effect on smallholder farmers' agricultural production activities?
2) What is the level of policy responses and smallholder farmers' adaptation strategies against flood disaster?
3) Does flood disaster affect the livelihood outcomes of the smallholder farmers?
4) Does livelihood outcomes of the smallholder farmers depend on the flood disaster effect and some socioeconomic variables?
5) Could direct and indirect effect on agriculture, mediates the relationship between flood disaster characteristics and smallholder farmers' livelihood outcomes?
6) Has mitigation strategies moderates the relationship between flood disaster characteristics and its effect on agriculture?
7) Has provision of recovery needs resources moderates the relationship between flood disaster effect on agriculture and its effect on livelihood outcomes?

1.16 Objectives of the Study

1.16.1 General Objective

The general objective of this study is to assess the economic effects of flood disaster among smallholder farmers in Kelantan state of Peninsular Malaysia. The specific objectives are:

1.16.2 Specific Objectives

The specific objectives are:

1) To evaluate the extent of 2014/2015 flood disaster effect on smallholder farmers' agricultural production activities.
2) Determine the level of government policy responses and smallholder farmers' adaptation to floods.
3) To examine the effect of a flood disaster on respondents' livelihood outcomes.
4) To develop a framework on how flood disaster affects agriculture and livelihood outcomes of smallholder farmers.
5) To determine the mediating role of direct and indirect effect on agriculture, on the relationship between flood disaster characteristics and smallholder farmers' livelihood outcomes.
6) To test the moderating role of mitigation strategies and recovery need resources within the integrated model.

1.17 Significance of the Study

This research contributes to the knowledge by assessing the economic effect of flood disaster on agricultural production and livelihood outcomes of smallholder farmers in Kelantan and identifying the role of policy measures such as flood mitigation strategies and recovery resources in preventing and/or alleviating the effects, while its importance is realised by the practical and theoretical significance discussed below.

1.17.1 Practical Significance

In Kelantan flood disaster has become an important research topic for various studies, however, there are limited empirical studies on the economic effect of flood disaster among smallholder farmers, therefore, assessing and understanding the economic effect of a flood disaster on agriculture and farmers' livelihood is important and necessary for the enhancement and holistic implementation of flood management policies in the best interest of all.

Therefore this study quite important as it will serve as a blueprint for local, state, national government and non-governmental organizations to in designing policies and action plans to address the flood disaster effect in the study area, so as to also reduce vulnerabilities and to unearth prioritizing requirement for future agriculture and farmers livelihoods.

1.17.2 Theoretical Significance

In terms of theoretical and academic contribution, this study therefore develops and operationalizes an integrated conceptual framework on flood disaster economic effect on smallholder among smallholder farmers, by depicting simultaneous relationship between flood disaster characteristics, direct and indirect effects of flood disaster on agriculture in explaining their effect on livelihood outcomes of smallholder farmers, at the same time determining the major role of policy responses in moderating flood disaster effect. The study also demonstrates that disaster impact model, the major theory of this study, is useful in investigating the economic effect of a flood disaster on the livelihood of smallholder farmers. Although, the findings of this study are limited to the study area and their generalizability to other states, countries and/or regions is limited, however, the theoretical framework of this study could be used and/or improved while assessing the effect of flood and other natural disasters in future researches. In addition, the outcome of this study provides an avenue for researchers to build on the limitations of this study and as relevant material for students.

1.18 Scope of the Research

This study is limited to cover only the Kelantan state of peninsular Malaysia. It focuses on the effect of 2014/2015 flood disaster on smallholder agriculture and their consequences to the farmers' livelihood outcomes (food security and income). Therefore the findings of this research may only be generalized on the population of Kelantan state due to the fact that, the flood disaster effect and the characteristics of the sampled respondents may differ from the populations of other states in Malaysia. Similarly, the study only covered smallholder farmers that are affected by 2014/2015 flood disaster on their agricultural production and livelihoods in Kelantan state, thus the study findings may not generalized on the population who are not smallholder

1.19 Conceptual Definition of Terms/Key Constructs

This section covers the definition and/or description of key terms consistently used in the body of this research work, which include natural disaster, flood, flood disaster characteristics, direct and indirect flood disaster effect on agriculture, livelihood outcomes i.e. food security and income, mitigation strategies and response/recovery needs to be used in lessening the effect of disaster.

1.19.1 Natural Disaster

A natural disaster is defined as a "serious disruption of the functioning of a community or a society involving widespread economic, human, material, and environmental losses and impacts which exceeds the ability of the affected community or society to cope using its own resources" (Jongman, Ward and Aerts, 2012).

Disaster is a sudden event which a society or its subdivisions undergoes physical harm or social disruption (Lindell, 2011) resulting in the death of ten or more people, one hundred or more people reportedly affected, necessitating a call for an international assistance or declaration of a state of emergency (Guha-sapir, Hoyois, & Below, 2011).

1.19.2 Flood

A flood is defined as a temporary condition of surface water (river, lake, sea), in which the water level and/or discharge exceed a certain value, thereby escaping from their normal confines (Mirza, 2003)**.** Flood is also generally defined as "a natural phenomenon, event or occurrence, which involves rising and over flowing of a body of water beyond its normal limit resulting in its spilling over onto that, is normally dry". Or as "an overflow of water where an area of land that is usually dry gets submerged under water".

1.19.3 Economic Effect

According to Birkmann et al. (2014), it is an effect related with potential losses in an economic activity (like agriculture), which is considered through losses in production, income and/or jobs.

1.19.4 Flood Characteristics

These are triggering factors that define the nature of the flood event and they include occurrence, duration, inundation/depth, high and persistent rain, overflowing of river (Beksin, 2011a) and man-made factor which is deforestation/logging (Adnan, 2010), they are flood damage influencing characteristics, of which some may be more significant than others (Hammond et al. 2014). Berkman et al. (2015) opined that flood characteristics typically include flood extent, depth, duration and sometimes include flow rate and rise rate, which are linked to economic damages of structures more especially land.

1.19.5 Flood Effect on Agriculture

1) Direct Effect

This implies a physical effect on agriculture through loss of crops, Livestock, farm structures and damage to farmland area and soil (FAO, 2015b; Israel and Briones, 2013a; Lindell and Prater, 2003).

2) Indirect Effect

This is the loss of economic activity resulting from direct damages and includes disruption of business, a decrease in employment, the decline in wages and high food prices (FAO, 2015b; Israel and Briones, 2013a).

1.19.6 Flood Effect on Livelihood Outcomes

This is an effect on household capacity (food security and income) that are used to meet their survival threshold.

1) Flood Effect on Food Security

Food security exists "when all people, at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 2006; Wardell-Johnson et al., 2013)**.**
Flood disaster affects all the dimensions of food security, food availability, accessibility, stability and utilization, where agriculturally-based farmers' livelihoods living on the coasts and floodplains faced the immediate risk of crop failures, loss of livestock and farm structures (Alam et al., 2016; Wulf, 2008).

2) Flood Effect on Income

Income loss/reduced from agricultural production activities, as a result of damage to crops, loss of livestock, replacement of damaged assets, farm labor and disruption in agricultural trade flows (FAO, 2015b; Izevbuwa and Adeolu, 2015; Wulf, 2008).

1.19.7 Mitigation Strategies

These are proactive measures which include structural (physical construction measures such as dams, embankments, levees, reservoirs, etc.) and non-structural (land use planning, forecasting, and warning, insurance, etc.) measures undertaken to

reduce or limit the impact of a disaster (Moe and Pathranarakul, 2006; Weichselgartner, 2001).

1.19.8 Recovery Needs Resources

Refers to a provision of immediate assistance from a variety of governments, individuals and organizations to the affected communities and decisions taken after a disaster with a view to restoring pre-disaster living conditions (Moe and Pathranarakul, 2006; Mojtahedi and Lan, 2011).

1.20 Organization of the Thesis

This study is divided into five independent but related chapters. Chapter one discusses the general background of the study in which flood disaster effects on agriculture and livelihood outcomes of smallholder farmers were elaborated. It further introduces the problem statement and objectives of the study, significance, and scope of the research at hand and conceptual definitions of terms. Chapter two reviewed previous studies on the concept of flood disaster, theoretical and empirical literature related to the study, models, and techniques of analysis used in the previous literature. Chapter three discusses the general research methodology that covered research design, conceptual framework, the operationalization of the proposed theoretical framework on the flood disaster effect on smallholder farmers agriculture and livelihood outcomes. Data analysis consisting of analytical techniques was also discussed. Chapter four of this study present and discusses the findings of this study. Chapter five summarized the entire study, discussed the research policy implications and limitations, and make recommendations for future research were put forward and finally concluded based on the aim and findings of this research work

REFERENCES

Abd. Rashid, S. K., W. Ibrahim, W. zainuddin, & Mohd, W. (2007). *Flood Hazard Mapping in Malaysia: Department of Drainage and Irrigation (DID) Malaysia. sitikhadijah@water.gov.my*.

Abdelhak, S. (2013). *Vulnerability to Poverty: A Study of Rural Population in Kelantan and Terengganu, Malaysia. Unpublished Ph.D. Thesis Submitted to Universiti Sains Malaysia*.

Abiodun, O. E. (2012). Households â€TM food security status and its determinants in North-Central Nigeria. *Food Economics*, *9*(4), 241–256. http://doi.org/10.1080/2164828X.2013.845559.

Adedeji, O. S., Gieck-bricco, J., & Kehayova, V. (2016). Natural Disasters and Food Crises in Low- Income Countries: Macroeconomic Dimensions. *IMF Working Paper*, (65). http://doi.org/10.13140/RG.2.1.5123.2400.

Adnan, N. A. (2010). *Quantifying the impacts of climate and land use changes on the hydrological response of a monsoonal catchment. An Unpublished Ph.D. Thesis Submitted to Faculty of Social and Human Sciences, University of Southampton.* Retrieved from http://eprints.soton.ac.uk/197225/.

Afroz, R., & Akhtar, R. (2017). Determinants of Malaysian Farmers â€TM Choice of Adaptation Strategies for Adapting to Climate Change in Kedah Malaysia. *Asian Journal of Agricultural Research*, (November). http://doi.org/10.3923/ajar.2017.Research.

Afshin, A. (2015). *The Impact of Climate Change on Canadian Agriculture: A Ricardian Approach. Thesis submitted to the Department of Bioresource Policy, Business and Economics University of Saskatchewan.*

Akasah, Z. A., & Doraisamy, S. V. (2015). 2014 Malaysia flood : impacts & factors contributing towards the restoration of damages. *Journal of Scientific Research and Development*, *2*(14), 53–59.

Al-Amin, A. Q., Leal, W., Trinxeria, J. M., Jaafar, A. H., & Ghani, Z. A. (2011). Assessing the Impacts of Climate Change in the Malaysian Agriculture Sector and its Influences in Investment Decision Faculty of Life Sciences, Hamburg University of Applied Sciences, Hamburg, Faculty of Business and Economics, Universiti Kebangsaan M. *Middle-East Journal of Scientific Research*, *7*(2), 225–234.

Alam, G. M. M., Alam, K., & Mushtaq, S. (2017). Climate Risk Management Climate change perceptions and local adaptation strategies of hazard-prone rural households in Bangladesh. *Climate Risk Management*, *17*, 52–63. http://doi.org/10.1016/j.crm.2017.06.006.

Alam, M. M., & Siwar, C. (2010). An Empirical Study of Farm Level Impacts Assessment of Climatic Change on Agricultural Productivity, Crop Choice, and Food Security in North-West Selangor, Malaysia. In *International Conference on Food Safety and Security under climate change*.

Alam, M. M., Siwar, C., Talib, B., Mokhtar, M., & Toriman, M. E. (2012). Climate change adaptation policy in Malaysia: Issues for the agricultural sector. *African Journal of Agricultural Reseearch*, *7*(9), 1368–1373. http://doi.org/10.5897/AJARX11.030.

Alam, M. M., Talib, B. A., Siwar, C., & Abu N. M. Wahid. (2016). Climate Change and Food Security of the Malayan East Coast Poor: A Path Modeling Approach. *Journal of Economic Studies*, *43*(3).

Alexander, D. (2000). *Confronting Catastrophe: New Perspective on Natural Disasters. Confronting Catastrophe: New Perspectives on Natural Disasters. [Book]. Terra and Oxford University Press: Harpenden, UK and New York.*

Ali, S., Liu, Y., Ishaq, M., Shah, T., Abdullah, Ilyas, A., & Din, I. (2017). Climate Change and Its Impact on the Yield of Major Food Crops: Evidence from Pakistan. *Foods*, *6*(6), 39. http://doi.org/10.3390/foods6060039.

Alinovi, L., Marco, D., & Erdgin, M. (2010). *LiveLihoods strategies and household resiLience to Food insecurity : an empiricaL anaLysis to Kenya. Paper prepared for the Conference on "Promoting Resilience through Social Protection in Sub-Saharan Africa", organised by the European Report of Developme*.

Alwis, D. De. (2018). *Distributional impacts of disaster recovery : Sri Lankan households a decade after the 2004 Indian Ocean tsunami*. Working Papers in Economics and Finance, School of Economics and Finance Victoria Business School www.victoria.ac.nz/sef

Amin, M. E. (2005). *Social Science Research: Conception, Methodology and Analysis* (First edition copy right 2005). Kampala: Makerere University Printery P.O Box 7062 Kampala Uganda.

Amugune, B. . (2014). *Sample Size Determination and Sampling Techniques. Mental Health Workshop Maanzoni, 15th October 2014.*

Arbuckle, J. G., Morton, L. W., & Hobbs, J. (2015). Understanding Farmer Perspectives on Climate Change Adaptation and Mitigation: The Roles of Trust in Sources of Climate Information, Climate Change Beliefs, and Perceived Risk. *Environment and Behavior*, *47*(2), 205–234. http://doi.org/10.1177/0013916513503832.

Arshad, F. M. (2010). Food Security and Climate Change : Some Evidence on their Dynamics. In *International Conference on Food Safety and Security under Changing Climate (FCC2010)* (pp. 1–16).

Arshad, R. R. (2010). *Preliminary Rapid Damage Assessment in the Agriculture Sector for Flood-Affected Areas of Pakistan. Conducted by the Agriculture Cluster: August 2010 Analysis and Report Compiled: September 2010.*

ASEAN. (2015). *SITUATION UPDATE NO. 5 FLOOD/ MALAYSIA Monday, 12 January 2015*.

Ashikin, N. O. R., & Shaari, B. (2016). *Flood causes due to some geological aspects: a case study in kota bharu, kelantan, malaysia. Unpublished MSc. Thesis Submitted to the Faculty of Earth Science, Universiti Malaysia Kelantan.*

Ashley, S. T., & Ashley, W. S. (2008). Flood fatalities in the United States. *Journal of Applied Meteorology and Climatology*, *47*(3), 805–818. http://doi.org/10.1175/2007JAMC1611.1.

Ashraf, S., Iftikhar, M., Shahbaz, B., & Khan, G. A. (2013). Impacts of Flood on Livelihoods and Food Security of Rural Communities : a Case Study of Southern Punjab, Pakistan. *Pak. J. Agri. Sci.*, *50*(4), 751–758.

Asrat, P., & Simane, B. (2018). Farmers ' perception of climate change and adaptation strategies in the Dabus watershed, North-West Ethiopia. *Ecological Processes*, *7*(7), 1–13.

Atreya, A., Ferreira, S., & Kriesel, W. (2013). Forgetting the Flood ? An Analysis of the Flood Risk Discount over Time. ISSN 0023-7639; E-ISSN 1543-8325 ; 2013 by the Board of Regents of the University of Wisconsin System. *Land Economics*, *89*(4), 577–596.

Azimi, M., Bagherpourhamedani, A., Mohamed, S. F. Bin, Md. Tahir, M., Majid, M. Z. A., Ma, C.-K., & Vahed, Y. K. (2016). "Structural Post-Disaster Damage Classification with Consideration of Liquefaction Due To Flood: Manek Urai, Kelantan, Malaysia." *International Journal of Sustainable Energy and Environmental Research*, *5*(1), 1–7. http://doi.org/10.18488/journal.13/2016.5.1/13.1.1.7.

Bahaman, A. S. (2016). *Enhancing Extension Education Research using Structural Equation Modelling. Enriching Evidence Based Extension Work Practices. Universiti Putra Malaysia Press, Serdang. http://www.penerbit.upm.edu.mu y*.

Baharuddin, K., Wahab, S. F. A., Rahman, N. H. N., Mohamad, N. A. N., Kamauzaman, T. H. T., Yazid Md Noh, A., & Majid, 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 Journal of Medical Sciences*, *22*(2), 1–7.

Baharuddin, M. K. (2007). *Climate Change-its Effects on the Agricultural Sector in Malaysia*. Soil Resource Management and Conservation Division, Department of Agriculture, Malaysia.

Balgah, R. A., Buchenrieder, G., & Mbue, I. N. (2015). When nature frowns: A comprehensive impact assessment of the 2012 Babessi floods on people's livelihoods in rural Cameroon. *Jàmbá: Journal of Disaster Risk Studies, 7*(1), 1–8. http://doi.org/10.4102/jamba.v7i1.197.

Bandara, J. S., & Cai, Y. (2014). The impact of climate change on food crop productivity, food prices and food security in South Asia. *Economic Analysis and Policy, 44*(4), 451–465. http://doi.org/10.1016/j.eap.2014.09.005.

Banerjee, L. (2010). Effects of flood on agricultural productivity in Bangladesh. *Oxford Development Studies, 38*(3), 339–356. http://doi.org/10.1080/13600818.2010.505681.

Banerjee, R., Kamanda, J., Bantilan, C., & Singh, N. P. (2013). Exploring the relationship between local institutions in SAT India and adaptation to climate variability. *Natural Hazards, 65*(3), 1443–1464. http://doi.org/10.1007/s11069-012-0417-9.

Baron, R. M., & Kenny D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173–1182.

Bauer, K. (2013). Are preventive and coping measures enough to avoid loss and damage from flooding in Udayapur district, Nepal? *International Journal of Global Warming, 5*(4), 433–451. http://doi.org/10.1504/ijgw.2013.057292.

Beksin, A. M. (2011). *The Effects of Flooding on House Prices : Two Case Studies in Malaysia*. Retrieved from http://studentsrepo.um.edu.my/3702/

Benjamin, M. A. (2008). *Analysing Urban Flood Risk in Low_Cost Settlements of George, Western Cape, South Africa: Investigating Physical and Social Dimensions*. University of Cape Town (UCT).

Berkman, M. P., & Brown, T. (2015). *Estimating Flood Impacts : A Status Report*. *Australasian Coasts & Ports Conference 2015 15 - 18 September 2015, Auckland, New Zealand*.

Bhandari, R. K. (2014). *Disaster Terminology. Disaster Education and Management A Joyride for Students, Teachers and Disaster Managers.* Springer India. http://doi.org/10.1007/978-81-322-1566-0.

Bhattacherjee, A. (2012). *Social Science Research: Principles, Methods, and Practices*. USF Tampa Bay Open Access Textbooks Collection. Book 3. http://scholarcommons.usf.edu/oa_textbooks/3. Retrieved from http://scholarcommons.usf.edu/oa_textbooks/3.

Birkmann, J., Kienberger, S., & Alexander, D. E. (2014). *Assessment of Vulnerability to Natural Hazards*. *Assessment of Vulnerability to Natural Hazards*. http://doi.org/10.1016/B978-0-12-410528-7.00007-2.

Blaikie, P., Wisner, B., Cannon, T., & Davis, I. (2003). *At Risk : natural hazards , people ' s vulnerability and disasters*. *Framework*. http://doi.org/10.4324/9780203428764.

Brémond, P., Grelot, F., & Agenais, A.-L. (2013). Review Article: Economic evaluation of flood damage to agriculture – review and analysis of existing methods. *Nat. Hazards Earth Syst. Sci.*, *13*(10), 2493–2512. http://doi.org/10.5194/nhess-13-2493-2013.

Brody, S. D., & Brody, S. D. (2007). The Rising Costs of Floods. *Journal of the American Planning Association*, *73*(3), 330–345. Retrieved from http://ezproxy.library.uvic.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=27063626&loginpage=Login.asp&scope=site.

Bruce, S. W., & John, R. F. (2000). Psychosocial resource loss as a mediator of the effects of flood exposure on psychological distress and physical symptoms. *Journal of Traumatic Stress*, *13*(2), 349–357. http://doi.org/10.1023/A:1007745920466.

Buang, T. S. Bin A.. (2009). *Auditor General ' S Report for the Year 2009 Synopsis Auditor General ' S Report 2009 on the Activities of the Kelantan State Government Departments and Agencies and the Management of State Government Companies*.

Bui, A. T., Dungey, M., Nguyen, C. V., & Pham, T. P. (2014). The impact of natural disasters on household income, expenditure, poverty and inequality: Evidence from Vietnam. *Applied Economics*, *46*(15), 1751–1766. http://doi.org/10.1080/00036846.2014.884706.

Byrne, B. M. (2001). Structural Equation Modeling With AMOS, EQS, and LISREL: Comparative Approaches to Testing for the Factorial Validity of a Measuring Instrument. *International Journal of Testing*, *1*(1), 55–86. http://doi.org/10.1207/S15327574IJT0101_4.

Byrne, B. M. (2009). *Structural Equation Modelling with AMOS: Basic Concepts, Applications, and Programming, Second Edition (Multivariate Applications Series) 2nd Edition.* Routledge/Taylor & Francis.

Campbell, R., Knowles, T. (2011). *The economic impacts of losing livestock in a disaster. Final report Prepared for the World Society for the Protection of Animals. prepared by Economists at Large, Melbourne, Australia. www.ecolarge.com research@ecolarge.com.*

Carrera, L., Gabriele Standardi, Bosello, F., & Mysiak, J. (2013). Assessing direct and indirect economic impacts of a flood event through the integration of spatial and computable general equilibrium modelling. *Centro Euro-Mediterraneo Sui Cambiamenti Climatici*, (December).

Carrera, L., Koks, E., Mysiak, J., Aerts, J., & Standardi, G. (2014). *Economics of flood risk in Italy under current and future climate. Euro-Mediterranean Centre on Climate Change - Italy. lorenzo.carrera@feem.it*

Carrera, L., Standardi, G., Bosello, F., & Mysiak, J. (2015). Assessing direct and indirect economic impacts of a flood event through the integration of spatial and computable general equilibrium modelling. *Environmental Modelling and Software*, *63*, 109–122. http://doi.org/10.1016/j.envsoft.2014.09.016.

Cavallo, E., Galiani, S., Noy, I., & Pantano, J. (2013). Catastrophic Natural Disasters and Economic Growth. *Review of Economics and Statistics*, *95*(5), 1549–1561. http://doi.org/10.1162/REST_a_00413.

CFE-DM. (2016). *Malaysia: Disaster Managment Reference Handbook 2016*. Retrieved from http://reliefweb.int/report/malaysia/malaysia-disaster-management-reference-handbook-2016.

Chan, N. W. (1997). Institutional arrangements for flood hazard management in Malaysia: an evaluation using the criteria approach. *Disasters*, *21*(3), 206–222. http://doi.org/10.1111/1467-7717.00057.

Chan, N. W. (2000). Reducing Flood Hazard Exposure and Vulnerability in Peninsular Malaysia. In *Floods (Hazards & Disasters) 1st Edition by Dennis J. Parker (Editor)*. Routledge/Taylor & Francis.

Chan, N. W. (2012). Impacts of disasters and disasters risk management in Malaysia: The case of floods. *Economic and Welfare Impacts of Disasters in East Asia and Policy Responses.*, (December), 503–551. http://doi.org/10.1007/978-4-431-55022-8.

Chan, N. W. (2015). *Challenges in Flood Disasters Management in Malaysia. A Contextual Analysis of Flood Hazard Management in Peninsular Malaysia. Tesis Ph.D., Middlesex University (UK).*

Chapagain, T., & Raizada, M. N. (2017). Impacts of natural disasters on smallholder farmers: gaps and recommendations. *Agriculture & Food Security*, *6*(1), 39. http://doi.org/10.1186/s40066-017-0116-6.

Charveriat, C. (2000). Natural Disasters in Latin America and the Caribbean : An Overview of Risk. Inter-American Development Bank Banco Interamericano de Desarrollo (BID) Research department Departamento de investigación Working Paper #434.

Châu, V. N. (2014). *Assessing the Impacts of Extreme Floods on Agriculture in Vietnam : Quang Nam Case Study. Ph.D. Thesis in Environmental Management submitted at Massey University, Manawatu, New Zealand*.

Chen, A. S., Hammond, M. J., Djordjevi??, S., Butler, D., Khan, D. M., & Veerbeek, W. (2016). *From hazard to impact: flood damage assessment tools for mega cities*. *Natural Hazards* (Vol. 82). http://doi.org/10.1007/s11069-016-2223-2.

Coelli, F., & Manasse, P. (2014). *The impact of floods on firms ' performance. University of Bologna, Italy. Email: federica.coelli@gmail.com.*

Cooley, H. (2007). *Floods and Droughts. The World's Water Volume 7: The Biennial Report on Freshwater Resources. Island Press Washington USA.* Island Press Washingto USA.

Cooper, D. R., & Schindler, P. S. (2014). *Business research methods. Twelfth edition. Published by McGraw-Hill/Irwin, a business unit of The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY, 10020. Copyright © 2014.*

Correljé, A., & Broekhans, B. (2015). Flood risk management in the Netherlands after the 1953 flood: A competition between the public value(s) of water. *Journal of Flood Risk Management*, *8*(2), 99–115. http://doi.org/10.1111/jfr3.12087.

CPPS. (2015). *CPPS Policy Fact Sheet : Malaysia's Flood Management*. Retrieved from www.cpps.org.my/.../Factsheet on Malaysia's Flood Management .

Dai, W., Chen, L., Tan, H., Wang, J., Lai, Z., Kaminga, A. C., & Li, Y. (2016). Association between social support and recovery from post-traumatic stress disorder after flood : a 13 – 14 year follow-up study in Hunan , China. *BMC Public Health*, *16*, 1–9. http://doi.org/10.1186/s12889-016-2871-x.

Damiani, L., & Donati, D. (2010). *Executive Brief of Pakistan Flooding. Pakistan Floods Response 2010. http://www.fao.org/emergencies/country_information/list/asia/pakistanfloods/en/.*

Daniela Molinari, Scira Menoni, F. B. (2017). *Flood Damage Survey and Assessment: New Insights from Research and Practice*. *American Geophysical Union*. first published 2017 by John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA and the American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009 John Wiley & Sons. ISBN:9781119217930 |DOI:10.1002/9781119217930

Dassanayake, D. R., Burzel, A., & Oumeraci, H. (2015). Methodologies For Their Evaluation of Intangible Flood Losses and Integration in Flood Risk Analysis. *Word Scientific*, *57*(1), 585–590. http://doi.org/10.1142/S0578563415400070.

Demirtepe-Saygili, D., & Bozo, Ö. (2011). Perceived social support as a moderator of the relationship between caregiver well-being indicators and psychological symptoms. *Journal of Health Psychology*, *16*(7), 1091–1100. http://doi.org/10.1177/1359105311399486.

Devendra, C. (2012). *Climate change threats and effects: challenges for agriculture and food Security*. *Academy of Science Malaysia*. Retrieved from http://agrilinks.org/sites/default/files/resource/files/climate_change_threats_effects_strategies.pdf.

Devereux, S. (2006). The Impact of Droughts and Floods on Food Security and Policy Options to Alleviate Negative Effects. In *Economics of Natural Disasters" International Association of Agricultural Economists (IAAE) conference Gold Coast Convention and Exhibition Center, Queensland, Australia*.

Dewan, T. H. (2015). Societal impacts and vulnerability to floods in Bangladesh and Nepal. *Weather and Climate Extremes*, *7*, 36–42. http://doi.org/10.1016/j.wace.2014.11.001.

DID. (2003). *Department of Irrigation and Drainage Malaysia: National Register of River Basins. Volume 2 Updating of Condition of Flooding in Malaysia.* (Vol. 2).

Doocy, S., Leidman, E., Aung, T., & Kirsch, T. (2013). Household economic and food security after the 2010 Pakistan floods. *Food and Nutrition Bulletin*, *34*(1), 95–103. http://doi.org/10.1177/156482651303400110.

Doswell, C. A. (2003). *Flooding. University of Oklahoma, Norman, OK, USA Copyright. Copyright 2003 Elsevier Science Ltd. All Rights Reserved.*

Downton, M. W., & Miller, J. Z. B. (2002). *Flood Damage in the United States , 1926 – 2000 A Reanalysis of National Weather Service Estimates*.

Drost, E. A. (2011). Validity and Reliability in Social Science Research. *Education Research and Perspectives*, *38*(1), 105–123.

Dunja, P. (2016). *Agricultural flood losses in Austria : empirical evidence and estimates based on grid data*. University of Natural Resources and Life Sciences, Vienna.

Dutta, D., & Herath, S. (2004). Trend of floods in Asia and flood risk management with integrated river basin approach. *... of the 2Nd International Conference of ...*, 1–8.

Dutta, D., Herath, S., & Musiake, K. (2003). A mathematical model for flood loss estimation. *Journal of Hydrology*, *277*(1–2), 24–49. http://doi.org/10.1016/S0022-1694(03)00084-2.

ECCM. (2011). *Economics of Climate Change for Malaysia Inception Workshop*. *Economic Planning Unit (EPU) Prime Minister's Department*.

EM-DAT. (2018). The Emergency Events Database (EM-DAT) Universite catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium.

Engler, S., Koster, J., & Siebert, A. (2014). *Farmers Food Insecurity Monitoring: Identifying Situations of Food Insecurity and Famine*. IFHV Working Paper Volume 4, No. 3, May 2014

Ernawati Hamdan, M., Man, N., Md Yassin, S., Lawrence D'Silva, J., & Mohamed Shaffril, H. (2013). Farmers' Adaptive Capacity towards the Impacts of Global Warming: A Review. *Asian Social Science*, *9*(13), 177–184. http://doi.org/10.5539/ass.v9n13p177.

ETP. (2015). *Economic Transformation Programme: Annual Report 2014*. Retrieved from www.pemandu.gov.my.

Eves, C., & Wilkinson, S. (2014). Assessing the immediate and short-term impact of flooding on residential property participant behaviour. *Natural Hazards*, *71*(3), 1519–1536. http://doi.org/10.1007/s11069-013-0961-y.

Fan, Y., Chen, J., Shirkey, G., John, R., Wu, S. R., Park, H., & Shao, C. (2016). Applications of structural equation modeling (SEM) in ecological studies: an updated review. *Ecological Processes*, *5*(1). http://doi.org/10.1186/s13717-016-0063-3.

FAO. (2006). *Food Security*. Policy Breif, June 2006, Issue 2. www.fao.org/fileadmin/templates/faoitaly/.../pdf_Food_Security_Cocept_Note.pdf

FAO. (2008). An Introduction to the Basic Concepts of Food Security Food Security Information for Action. *Food Security Information for Action: Practical Guides*, 1–3. Retrieved from http://www.fao.org/docrep/013/al936e/al936e00.pdf.

FAO. (2015a). *The Impact of Natural Hazards and Disasters on Agriculture Food Security*. *Food and Agriculture Organization of the United Nations Rome, 2015*.

FAO. (2016). *Damage and losses from climate-related disasters in agricultural sectors*. Retrieved from http://www.fao.org/3/a-i6486e.pdf

FAO, 2015. (2015b). *Impact of Natural Hazards and Disasters on Agriculture and Food Security and Nutrition*.

Felbermayr, G., Groeschl, J., Gr??schl, J., & Groeschl, J. (2014). Naturally negative: The growth effects of natural disasters. *Journal of Development Economics*, *111*, 92–106. http://doi.org/10.1016/j.jdeveco.2014.07.004,

Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics 4th Editon*. SAGE Publications Ltd.

Fothergill, A., & Peek, L. A. (2004). Poverty and Disasters in the United States : A Review of Recent Sociological Findings. *Nat. Hazards*, *32*, 89–110.

G.Ramakrishna, Solomon, R. G., & I. Daisy. (2014). Impact of Floods on Food Security and Livelihoods of Idp Tribal. *International Journal of Development and Economics Sustainability*, *2*(1), 11–24.

George, D., & Mallery, P. (2016). *IBM SPSS Statistics 23 Step by Step: A Simple Guide and Reference. Fourteenth edition*. Routledge 711 Third Avenue, New York, NY 10017.

Gichere, S. K., Olado, G., Anyona, D. N., Matano, A., Dida, G. O., Abuom, P. O., … Ofulla, A. V. O. (2013). Effects of Drought and Floods on Crop and Animal Losses and Socio-economic Status of Households in the Lake Victoria Basin of. *Journal of Emerging Trends in Economics and Management Sciences (JETEMS)*, *4*(1), 31–41.

GlobalEconomy. (2017). *Malaysia: Agriculture productivity (measure: U.S. dollars; source: The World Bank). www.TheGlobalEconomy.com*.

Gornall, J., Betts, R., Burke, E., Clark, R., Camp, J., Willett, K., & Wiltshire, A. (2010). Implications of climate change for agricultural productivity in the early twenty-first century. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, *365*(1554), 2973–2989. http://doi.org/10.1098/rstb.2010.0158

Gotham, K. F., Campanella, R., Lauve-moon, K., & Powers, B. (2017). Hazard Experience, Geophysical Vulnerability, and Flood Risk Perceptions in a Postdisaster City, the Case of New Orleans. *Risk Analysis*, *0*(0), 1–12. http://doi.org/10.1111/risa.12830

Grahn, T., & Nyberg, R. (2014). Damage assessment of lake floods: Insured damage to private property during two lake floods in Sweden 2000/2001. *International Journal of Disaster Risk Reduction*, *10*, 305–314. http://doi.org/10.1016/j.ijdrr.2014.10.003.

Guha-sapir, D., Hoyois, P., & Below, R. (2011). Annual Disaster Statistical Review 2010: The numbers and trends. *Review Literature And Arts Of The Americas*, 1–50. http://doi.org/10.1093/rof/rfs003.

Gundersen, C. (2008). Measuring the extent, depth, and severity of food insecurity: an application to American Indians in the USA. *Journal of Population Economics*, *21*(1), 191–215. http://doi.org/10.1007/s00148-007-0152-9.

Guo, X., & Kapucu, N. (2018). Examining the impacts of disaster resettlement from a livelihood perspective : a case study of Qinling. *Disasters*, *42*(2), 251–274.

Hair, J. F., Anderson, R. ., Tatham, R. ., & Black, W. . (2010). *Multivariate data analysis: A global Perspective (7th Edition). Upper Saddle River, New Jersey: Pearson Prentice Hall.*

Hair, J. F., Sarstedt, M., & Ringle, C. M. (2014). *Partial Least Squares Structural Equation Modeling*. *Handbook of Market Research* (Vol. 26). http://doi.org/10.1007/978-3-319-05542-8_15-1.

Hallegatte, S., Przyluski, V. (2010). *The Economics of Natural Disasters Concepts and Methods. Policy Research Working Paper: The World Bank Sustainable Development Network Office of the Chief Economist December*.

Hallegatte, S., & Przyluski, V. (2010). The economics of natural disasters. *CESifo Forum*, *11*(2), 14–24. http://doi.org/10.1146/annurev-resource-073009-104211.

Hamdan, R., Kari, F., Othman, A., & Samsi, S. M. (2012). Climate Change, Socio-economic and Production Linkages in East Malaysia Aquaculture Sector. In *2012 International Conference on Future Environment and Energy IPCBEE vol.28(2012) © (2012)IACSIT Press, Singapoore* (Vol. 28, pp. 201–207).

Hammond, M., Djordjevic, S., Butler, D., & Chen, A. (2014). *Flood Impact Assessment Literature Review*. Retrieved from http://corfu7.eu/media/universityofexeter/research/microsites/corfu/1publicdocs/publicresults/D3.1.pdf

Harvey, C. A., Rakotobe, Z. L., Rao, N. S., Dave, R., Razafimahatratra, H., Rabarijohn, R. H., … Harvey, C. A. (2014). *Extreme Vulnerability of Smallholder Farmers to Agricultural Risks and Climate Change*.

Hasegawa, R., Tamura, M., Kuwahara, Y., Yokoki, H., & Mimura, N. (2009). An Input-output Analysis for Economic Losses of Flood Caused by Global Warming - A Case Study of Japan at the River Basin ' s Level. *17th International Input-Output Conference*, 1–10.

Hayrol, Azril Mohamed Shaffril Bahaman, A. S., & Jeffrey, Lawrence D'Silva Sulaiman, M. Y. (2013). The process of social adaptation towards climate change among Malaysian fishermen. *International Journal of Climate Change Strategies and Management*, *5*(1), 38–53. http://doi.org/10.1108/17568691311299354

Hensher, D. A., Rose, J. M., & Greene, W. H. (2005). *Applied Choice Analysis: A Primer*. New York: Cambridge University Press, New York.

Hertel, B. R. (1976). Minimizing Error Variance Introduced by Missing Data Routines in Survey Analysis. *Sociological Method and Research*, *4*, 169–184.

Hertel, T. W., & Rosch, S. D. (2010). Climate Change, Agriculture and Poverty. The World Bank Development Research Group Agriculture and Rural Development Team November 2010. Policy Research Working Paper WPS5468.

Hochrainer, S. (2000). *Assessing the Macroeconomic Impact of Natural Disasters: Are there any? The World Bank Sustainable Development Network Vice Presidency Global Facility for Disaster Reduction and Recovery Unit June 2009. Policy Research Working Paper 4968*

Hua, A. K. (2015). An Adaptation of Kota Bharu Community towards Monsoon Flood. *International Journal of Academic Research in Environment and Geography*, *2*(1), 27–33. http://doi.org/10.6007/IJAREG/v2-i1/1873.

Huang, H., Wan Mohamed Radzi, C. W. J. bt, & Jenatabadi, H. S. (2017). Family environment and childhood obesity: A new framework with structural equation modeling. *International Journal of Environmental Research and Public Health*, *14*(2). http://doi.org/10.3390/ijerph14020181.

Huffman, S. K., & Jensen, H. H. (2003). *Do Food Assistance Programs Improve Household Food Security ? Recent Evidence from the United States* (No. 03 WP335). The USA.

Hussain, T. P. R. S., Nor, A. R. M., & Ismail, H. (2014). The level of satisfaction towards flood management system in Kelantan, Malaysia. *Pertanika Journal of Social Science and Humanities*, *22*(1), 257–269.

Hutcheson, G. D., & Sofroniou, N. (1999). *The Multivariate Social Scientist: Introductory Statistics Using Generalized Linear Models*. SAGE Publications.

Huttenlau, M., Stötter, J., & Stiefelmeyer, H. (2010). Risk-based damage potential and loss estimation of extreme flooding scenarios in the Austrian Federal Province of Tyrol. *Natural Hazards and Earth System Science*, *10*(12), 2451–2473. http://doi.org/10.5194/nhess-10-2451-2010.

IFRC. (2016). *World Disasters Report. Resilience: saving lives today, investing in tomorrow*. International Federation of Red Cross and Red Crescent Societies. www.ifrc.org

Inquirer. (2015). Damage due to Malaysia flood close to $284M. *Read More: http://newsinfo.inquirer.net/662008/damage-Due-to-Malaysia-Flood-Close-to-284m#ixzz4yMvPAEQE Follow Us: @inquirerdotnet on Twitter | Inquirerdotnet on Facebook.*

IPCC. (2001). *Climate Change 2001: Impacts, Adaptation, and Vulnerability*. Published for the Intergovernmental Panel on Climate Change, by Cambridge University Press. The Edinburgh Building, Cambridge CB2 2RU, UK 40 West 20th Street, New York, NY 10011-4211, USA

Islam, K. M. N., Munir, M. Q., Roddick, S., Roberts, E., Hasemann, A., & CDKN, in the "Loss and D. A. vulnerable country initiative." (2013). *Assessing the Risk of Loss and Damage Associated with the Adverse Effects of Climate Change in Bangladesh*. *International Centre for Climate Change and Development (ICCCAD)*. Retrieved from www.lossanddamage.net/4899.

Islam, R., Kamaruddin, R., Ahmad, S. A., Jan, S. J., & Anuar, A. R. (2016). A Review of Mechanism of Flood Disaster Management in Asia. *International Review of Management and Marketing*, *6*(1), 29–52.

Islam, S., & Wong, A. T. (2017). Climate Change and Food In / Security : A Critical Nexus. *Environments 2017, 4, 38; doi:10.3390/environments4020038 www.mdpi.com/journal/environments*.

Ismail, W. I. F. W. (1996). Urban Growth Determinants for the State of Kelantan Opinions of the State â€™ s Policy Makers. *Buletin Ukur*, *7*(3), 176–189.

Israel, D. C., & Briones, R. M. (2013a). Impacts of Natural Disasters on Agriculture, Food Security, and Natural Resources and Environment in the Philippines. *ERIA Discussion Paper Series*, (October), 1–53. Retrieved from http://www.eria.org/ERIA-DP-2013-15.pdf

Israel, D. C., & Briones, R. R. (2013b). *The impact of natural disasters on income and poverty: framework and some evidence from Philippine households*. Philippine Institute for Development Studies Surian sa mga Pag-aaral Pangkaunlaran ng Pilipinas. No. 2013-14 (November 2013) ISSN 1656-5266

Ivers, L. C. (2015). *Food Insecurity and Public Health*. Taylor & Francis Group, LLC CRC Press is an imprint of Taylor & Francis Group. CRC Press Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487-2742 International Standard Book Number-13: 978-1-4665-9906-2 (eBook - PDF).

Iya, S., Gasim, M., Toriman, M., & Abdullahi, M. (2014). Floods in Malaysia: Historical Reviews, Causes, Effects and Mitigation Approach. *International Journal of Interdisciplinary Research and Innovations*, *9*(3), 1–187. http://doi.org/10.5897/AJBx10.009.

Izevbuwa, O. D., & Adeolu, A. R. (2015). Economic Analysis of Effect of Flood on Income Distribution among Farmers in Edo State, Nigeria. *International Journal of Research in Agriculture and Forestry*, *2*(3), 7–13.

Jaafar, A. S., Sidek, L. M., Basri, H., Zahari, N. M., Jajarmizadeh, M., Noor, H. M., … Azad, W. H. (2016). An Overview : Flood Catastrophe of Kelantan Watershed in 2014 An Overview : Flood Catastrophe of Kelantan Watershed in 2014. In *ISFRAM 2015*. http://doi.org/10.1007/978-981-10-0500-8.

Jabareen, Y. (2009). Building a conceptual framework: philosophy, definitions, and procedure. *International Journal of Qualitative Methods*, *8*, 49–62. http://doi.org/10.2522/ptj.20100192.

Jabin, N., Al-Amin, A. Q., Kari, F., & Alam, G. M. (2015). Climate change adaptation provisions for the agricultural sector in Malaysia. *International Journal of Global Warming*, *7*(3), 336–348. http://doi.org/10.1504/IJGW.2015.069366.

Javari, M. (2015). A Study of Impacts of Temperature Components on Precipitation in Iran. *Earth Science & Climatic Change*, *S3*(4). http://doi.org/10.4172/2157-7617.S3-004.

Jiang, W., Deng, L., Chen, L., Wu, J., & Li, J. (2009). Risk assessment and validation of flood disaster based on fuzzy mathematics. *Progress in Natural Science*, *19*(10), 1419–1425. http://doi.org/10.1016/j.pnsc.2008.12.010.

Jonathan, M. (1994). Poverty and Vulnerability. *The American Economic Review*, *84*(2), 221–225.

Jongman, B., Ward, P. J., & Aerts, J. C. J. H. (2012). Global exposure to the river and coastal flooding: Long term trends and changes. *Global Environmental Change*, *22*(4), 823–835. http://doi.org/10.1016/j.gloenvcha.2012.07.004.

Jonkman, S. N., Bočkarjova, M., Kok, M., & Bernardini, P. (2008). Integrated hydrodynamic and economic modelling of flood damage in the Netherlands. *Ecological Economics*, *66*(1), 77–90. http://doi.org/10.1016/j.ecolecon.2007.12.022.

Jonkman, S. N., & Vrijling, J. K. (2008). Loss of life due to floods. *Journal of Flood Risk Management (JFRM)*, *1*(6), 43–56. http://doi.org/10.1111/j.1753-318X.2008.00006.x.

Joreskog, K., & Sorbom, D. (1993). *Lisrel 8: User's Reference Guide, Hillsdale, NJ: SSI Scientific Software International.*

Joseph F. Hair, J., Hult, G. T. M., Ringle, C. M., & Rstedt, M. S. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM)*. SAGE Publications, Inc.

Karim, A. H. M. Z., Hazizan, M. N., Diah, N. M., Tajuddin, N. A., & Mustari, S. (2016). Torrential Floods in Malaysia: Assessing the Loss and Vulnerabilities in Three Kelantan Villages. *Mediterranean Journal of Social Sciences*, *7*(5), 192–201. http://doi.org/10.5901/mjss.2016.v7n5p192.

Kator, P. E. (2015). Farmers Perception Of The Effect Of Floods On Crop Production In Some Rural Communities Of Delta State : The 2012 Flood Experience. *Researchjournali's Journal of Agriculture*, *2*(10), 1–11.

Kellens, W., Terpstra, T., & Philippe De Maeyer. (2013). Perception and Communication of Flood Risks: A Systematic Review of Empirical Research. *Risk Analysis.*, *33*.

Kelly, F. A., & Laura, A. M. (2016). Disaster Devastation in Poor Nations: The Direct and Indirect Effects of Gender Equality, Ecological Losses, and Development. *Social Forces*, *95*(1), 355–380. http://doi.org/10.1093/sf/sow056.

Kenny, D. A., Korchmaros, J. D., & Bolger, N. (2003). Lower level mediation in multilevel models. *Psychological Methods*, *8*(2), 115–128. http://doi.org/10.1037/1082-989X.8.2.115

Kerlinger, F. N., & Lee, H. B. (2000). *Foundation of Behavioral Research (4th Ed.) Fort Worth, TX : Harcourt College Publishers*.

Khalid, M. S. Bin, & Shafiai, S. B. (2015). Flood Disaster Management in Malaysia: An Evaluation of the Effectiveness Flood Delivery System. *International Journal of Social Science and Humanity*, *5*(4), 398–402. http://doi.org/10.7763/IJSSH.2015.V5.488.

Khan, M. M. A., Shaari, N. A. B., Achmad, A. M., Baten, A., & Nazaruddin, D. A. Bin. (2014). Flood Impact Assessment in Kota Bharu, Malaysia: A Statistical Analysis. *World Applied Sciences Journa*, *32*(4), 626–634. http://doi.org/10.5829/idosi.wasj.2014.32.04.422.

Kiel, L. D. (1995). Chaos Theory And Disaster Response Management: Lessons For Managing Periods Of Exterme Instablity. In *Disaster Management Response* (pp. 1–20).

Kreibich, H., & Thieken, A. H. (2008). Assessment of damage caused by high groundwater inundation, *44*(September), 1–14. http://doi.org/10.1029/2007WR006621.

Kron, W. (2005). Flood risk = hazard • values • vulnerability. *Water International*, *30*(1), 58–68. http://doi.org/10.1080/02508060508691837.

Kwari, J. W., Paul, M. K., & Shekarau, L. B. (2015). The Impacts of Flooding on Socio-Economic Development and Agriculture in Northern Nigeria: A Case Study of 2012 Flooding in Yola and Numan Areas of Adamawa State Nigeria. *International Journal of Scientific & Engineering Research*, *6*(7).

Lee, W. K., & Mohamad, I. N. (2014). Flood Economy Appraisal: An Overview of the Malaysian Scenario. *Proceedings of the International Civil and Infrastructure Engineering Conference 2013*, (September), 263–274. http://doi.org/10.1007/978-981-4585-02-6.

Levy, D. (2007). Chaos theory and strategy: Theory, application, and managerial implications. *Strategic Management Journal*. http://doi.org/10.1002/smj.4250151011.

Lindell, M. K. (2011). Disaster studies. *Sociopedia.isa*, *61*(5–6), 797–825. http://doi.org/10.1177/0011392113484456.

Lindell, M. K., & Prater, C. S. (2003). Assessing Community Impacts of Natural Disasters. *Natural Hazards Review*, *4*(4), 176–185. http://doi.org/10.1061/(ASCE)1527-6988(2003)4:4(176).

Liu, X. (2009). Ordinal regression analysis: Fitting the proportional odds model using Stata, SAS and SPSS. *Journal of Modern Applied Statistical Methods*, *8*(2), 632–645.

Long, F. (2007). The Impact of Natural Disasters on Third World Agriculture : An Exploratory Survey of the Need for Some. *American Journal of Economics and Sociology*, *37*(2), 149–163.

Looney, R. (2012). Economic impacts of the floods in Pakistan. *Contemporary South Asia*, *20*(2), 225–241. http://doi.org/10.1080/09584935.2012.670203

Lucini, B. (2014). *Disaster Resilience from a Sociological Perspective*. Exploring Three Italian Earthquakes as Models for Disaster Resilience Planning. Humanitarian Solutions in the 21st Century. Humanitarian Solutions in the 21st Century. © Springer International Publishing Switzerland 2014, ISBN 978-3-319-04737-9 ISBN 978-3-319-04738-6 (eBook) http://www.springer.com/series/11580.

Lwin Maung Maung Swe, Shrestha, R. P., Ebbers, T., & Jourdain, D. (2015). Farmers' perception of and adaptation to climate-change impacts in the Dry Zone of Myanmar. *Climate and Development*, *7*(5), 437–453. http://doi.org/10.1080/17565529.2014.989188.

Mahendra Dev, S. (2011). *Climate Change, Rural Livelihoods and Agriculture (focus on Food Security) in the Asia-Pacific Region*. Indira Gandhi Institute of Development Research, Mumbai August 2011http://www.igidr.ac.in/pdf/publication/WP-2011-014.pdf

Malaymailonline. (2015). 2014-2015 Malaysia Floods. *Malaymail Online Newspaper 2015*.

Manan, A. A., & Geleta, B. (2007). *Malaysia : Floods*. *Disaster Relief Emergency Fund Bulletin no.MDRMY001, International Federation of Red Cross and Red Crescent Societies*.

Marumo, Y. (2011). *An analysis of disaster prevention capability from a standpoint of social capital in Shinjuku- Shinjuku - ku*. GRIPS Discussion Paper 10-37. National Graduate Institute for Policy Studies 7-22-1 Roppongi, Minato-ku, Tokyo, Japan 106-8677

Masozera, M., Bailey, M., & Kerchner, C. (2006). Distribution of impacts of natural disasters across income groups : A case study of New Orleans. *Ecological Economics*, *63*, 299–306. http://doi.org/10.1016/j.ecolecon.2006.06.013.

Mauguen, A., & Begg, C. B. (2016). Using the Lorenz Curve to Characterize Risk Predictiveness and Etiologic Heterogeneity. *Epidemiology*, *27*(4), 531–537. http://doi.org/10.1097/EDE.0000000000000499.

Mcdowell, J. Z., & Hess, J. J. (2012). Accessing adaptation : Multiple stressors on livelihoods in the Bolivian highlands under a changing climate, *22*, 342–352. http://doi.org/10.1016/j.gloenvcha.2011.11.002.

McEntire, D. A. (2004). The Status of Emergency Management Theory: Issues, Barriers, and Recommendations for Improved Scholarship. In *FEMA Higher Education Conference*.

Md. Mahmudul, A., Siwar, C., Wahid, A. N. M., & Talib, B. A. (2016). Food Security and Low-Income Households in the Malaysian East Coast Economic Region : An Empirical Analysis (Vol. 28). http://doi.org/10.1111/rurd.12042.

Mei, S. L., Weng, C. N., & Masazumi, A. (2016). Political and Institutional Responses to Flooding in Pahang River Basin, Malaysia: Learning from Flooding in the ELbe River Germany. *Journal of Education and Social Sciences*, *3*(2008), 128–136.

Merz, B., Kreibich, H., Schwarze, R., & Thieken, A. (2010). Review article "assessment of economic flood damage." *Natural Hazards and Earth System Science*, *10*(8), 1697–1724. http://doi.org/10.5194/nhess-10-1697-2010.

Messner, F., & Meyer, V. (2006). Flood Damage, Vulnerability and Risk Perception – Challenges for Flood Damage Research. *Springer*, 149–167. http://doi.org/10.1007/978-1-4020-4598-1.

Messner, F., Penning-rowsell, E., Green, C., Tunstall, S., Veen, A. Van Der, Tapsell, S., … Haase, D. (2007a). *Evaluating flood damages : guidance and recommendations on principles and methods principles and methods*.

Messner, F., Penning-rowsell, E., Green, C., Tunstall, S., Veen, A. Van Der, Tapsell, S., … Haase, D. (2007b). Evaluating flood damages : guidance and recommendations on principles and methods principles and methods. *Flood Risk Management: Hazards, Vulnerability and Mitigation Measures*, 189.

Meyer, V., Becker, N., Markantonis, V., Schwarze, R., Van Den Bergh, J. C. J. M., Bouwer, L. M., … Viavattene, C. (2013). Review article: Assessing the costs of natural hazards-state of the art and knowledge gaps. *Natural Hazards and Earth System Science*, *13*(5), 1351–1373. http://doi.org/10.5194/nhess-13-1351-2013.

Mileti, D. S. (1999). *Disasters by design: a reassessment of natural hazards in the United States. Washington, DC*. Joseph Henry Press.

Mirza, M. (2003). Climate change and extreme weather events: can developing countries adapt? *Climate Policy*, *3*(3), 233–248. http://doi.org/10.1016/S1469-3062(03)00052-4

MOAI, MOLFRD, FAO, & WFP. (2015). *Agriculture and Livelihood Flood Impact Assessment in Myanmar*. *FAO and WFP under the framework of the Food Security Sector in partnership with UN Women, World Vision, CESVI, CARE, JICA and LIFT*.

Moe, T. L., & Pathranarakul, P. (2006). An integrated approach to natural disaster management. *Disaster Prevention and Management: An International Journal*, *15*(3), 396–413. http://doi.org/10.1108/09653560610669882.

Mohamed, A. H., Othman, J., Suid, M., & Zaim, M. S. M. (2015). Assessing Economic Losses Of 2104 Flood Disaster : A Case Study on Dabong, Kelantan, Malaysia. *International Journal of Humanities and Social Sciences*, *2*(10).

Mohd Yusoff, M. (2007). *Plans, People and Floods : The problems of urbanisation in the Klang Valley, Malaysia*. An Unpublished Thesis Submitted to the University of Leeds School of Geography.

Mojtahedi, S. M. (2015). *Stakeholder Attributes and Approaches in Natural Disaster Risk Management in the Built Environment : the Case of Flood Risk Management in Transport Infrastructure*. The University of Sydney.

Mojtahedi, S. M., & Lan Oo, B. (2011). Stakeholders ' approaches to disaster risk reduction in the built environment. *Disaster Prevention and Management*, *17*(4), 176–185. http://doi.org/10.1061/(ASCE)1527-6988(2003)4:4(176).

Moore, W., & Phillips, W. (2015). *Review of ECLAC damage and loss assessments Review of ECLAC damage and loss assessments in the Caribbean*.

Morton, J. F. (2007a). *The impact of climate change on smallholder and subsistence agriculture*. *PNAS* (Vol. 104).

Morton, J. F. (2007b). The impact of climate change on smallholder and subsistence agriculture. *Proceedings of the National Academy of Sciences of the United States of America*, *104*(50), 19680–5. http://doi.org/10.1073/pnas.0701855104.

Mueller, R., Ralph, O., Hancock, G. R. (2008). Best practices in structural equation modeling. In *Best practices in quantitative methods* (pp. 488–510). http://doi.org/10.4135/9781412995627.

Muhammad, M. S. (2015). *Income Diversification in Enhancing Food Security among Rural Households in Nigeria. Unpublished PhD theisis Universiti Putra Malaysia.* Universiti Putra Malaysia.

Munich Re. (2015). *Natural catastrophes 2014 Analyses, assessments, positions 2015 issue*. Munich Re Group. Topics Geo 2014. www.ceres.org/resources/reports.

Musah, B. a. N., E., M., O., A., & B., J. M. (2013). Effects of Floods on the Livelihoods and Food Security of Households in the Tolon / Kumbumgu District of the Northern Region of Ghana. *American Journal of Research Communication*, *1*(8), 160–171.

Mustapha, S., Tanko, M., & Alidu, A. F. (2016). Determinants of Household Food Insecurity in Northern Ghana: An Ordered Probit Approach. *Journal of Economics and Sustainable Development*, *7*(16), 2222–1700. Retrieved from www.iiste.org

Muthén, L., & Muthén, B. (2012). Confirmatory Factor Analysis and Structural Equation. *MPlus Statical Analysis with Latent Variables (User's Guide)*, 55–110.

Mwape, Y. P. (2009a). *an Impact of Floods on the Socio-Economic Livelihoods of People: a Case Study of Sikaunzwe Community in Kazungula District of Zambia*. *Disaster Risk Management Training and Education Centre for Africa (DiMTEC)*.

Mwape, Y. P. (2009b). *An Impact of Floods on the Socio-Economic Livelihoods of People: a Case Study of Sikaunzwe Community in Kazungula District of Zambia*. *Disaster Risk Management Training and Education Centre for Africa (DiMTEC)*.

Nafari, R. H. (2013). *Flood Damage Assessment with the Help of HEC-FIA Model. Thesis submitted at the Faculty of Civil and Environmental Engineering. POLITECNICO DI MILANO Faculty*.

Nastis, S., Michailidis, A., & Chatzitheodoridis, F. (2012). Climate change and agricultural productivity. *African Journal of Agricultural Reseearch*, *7*(35), 4885–4893. http://doi.org/10.5897/AJAR11.2395.

National, R. C. (2008). *Severe Space Weather Events: Understanding Societal and Economic Impacts*. The National Academies Press, 500 Fifth Street, Washington, DC 20001

Nations, U. (2013). *The Global Assessment Report on Disaster Risk Reduction (GAR) From Shared Risk to Shared Value : The Business Case for Disaster Risk Reduction*. ISBN 978-92-1-132038-1 © United Nations 2013. All rights reserved

Ngai, W. C. (1997). Increasing flood risk in Malaysia: causes and solutions. *Researchgate: Disaster Prevention and Management Journal*, *6*(2), 72–86. http://doi.org/10.1108/09653569710164035.

Nor, N. M., Sibly, S., Fizri, F. F. A., Rahim, A. A., Ridzuan, M. R., & Kadir, S. M. A. (2011). *Increasing knowledge and awareness of floods in flood affected communities in Padang Terap, Kedah.*

Noratiqah Mohd Ariff. (2010). *Flooding in Malaysia. Regional frequency analysis of maximum daily rainfalls Using tl-moment approach*.

Nord, M., & Prell, M. (2006). *Struggling to Feed the Family: What Does It Mean to Be Food Insecure? United States Department of Agriculture Economic Research Service*. *USDA* (Vol. 5).

Nordin, D. H. et al., (2015). *Seasonal Floods 2014. Information bulletin Malaysia: The International Federation of Red Cross and Red Crescent Societies (IFRC)*.

Nunnaly, J. (1978). *Psychometric theory. New York: McGraw-Hill.*

Nur, W., Wan, T., Nor, H., Zakaria, H., & Nazir, M. (2015). Knowledge Sharing and Lesson Learned From Flood Disaster : A Case In Kelantan. *Journal of Information Systems Research and Innovation*, *9*(August), 1–10.

Ocholla, D. N., & Roux, J. Le. (2011). Conceptions and Misconceptions of a theoretical framework in Library and Information Science Research. In the *6th Biennial Prolissa Conference, Pretoria 9-11 March*.

Ogechukwu Divine-favour, E. (2015). Evaluating the Effects of Flooding in Six Communities in the Awka Anambra State of Nigeria. *Journal of Environment and Earth Science*, *5*(4), 26–39. Retrieved from www.iiste.org.

Okeleye, S. O., Olorunfemi, F. B., Sogbedji, J. M., & Aziadekey, M. (2016). Impact Assessment of flood disaster on the livelihoods of farmers in selected farming communities in Oke-Ogun region of Oyo State, Nigeria. *International Journal of Scientific & Engineering Research*, *7*(8), 2067–2083.

Okuyama, Y. (2011). *A critical review of methodologies on disaster impact estimation*. *UN Assessment on the Economics of Disaster Risk Reduction*. Retrieved from papers://ef64220a-a077-48ec-ae81-be13b32d2073/Paper/p733.

Okuyama, Y., & Santos, J. R. (2014). DISASTER IMPACT AND INPUT – OUTPUT. *Economic Systems Research*, *26*(1), 1–12. http://doi.org/10.1080/09535314.2013.871505.

Oluwatayo, I. B. (2009). Explaining Inequality and Welfare Status of Households in Rural Nigeria : Evidence from Ekiti State. *Academic Journal of Plant Sciences*, *2*(1), 29–38.

Osseini, H., Oosta, S. M. R., Amanipour, K. Z., & Eymouri, A. T. (2018). Using Structural Equation Modeling Approach to Investigate Farmers â€TM Perception Consequences of Drought (Case Study: Birjand Township, Iran). *Applied Ecology and Environmental Research*, *16*(1), 521–534.

Palas, M. J. U. (2016). A Structural Equations Model on Mobile Banking Factors Influencing Socio-economic Development in Bangladesh. *Journal of Business Studies*, *37*(1).

Pandey, S., Surya, G., Tefera, D. D., & Guha-Sapir, D. (2016). Impact of disasters on child stunting in Nepal. *Dove Press Journal*, 113–127. http://doi.org/10.2147/RMHP.S101124.

Parvin, G., Shimi, A., Shaw, R., & Biswas, C. (2016). Flood in a Changing Climate: The Impact on Livelihood and How the Rural Poor Cope in Bangladesh. *Climate*, *4*(4), 60. http://doi.org/10.3390/cli4040060.

Paul, B. K. (2011). *Environmental Hazards and Disasters: Contexts, Perspectives and Management*. John Wiley&Sons, Ltd. Wiley-Blackwell.

Paul, B. K., & Mahmood, S. (2016). Selected physical parameters as determinants of flood fatalities in Bangladesh, 1972–2013. *Natural Hazards*, *83*(3), 1703–1715. http://doi.org/10.1007/s11069-016-2384-z.

Paul, S., Stephen, H., William, A., & Jackie, H. (2008). *Flood Risk Management: Research and Practice*. *Proceedings of the European Conference on Flood Risk Management Research Into Practice (Floodrisk 2008), Oxford, Uk, 30 September–2 October 2008*.

Pawley, M. D. (2006). *Systematic Sampling in Ecology. Unpublished thesis, Departments of Statistics and Biology, University of Auckland.*

Penning-rowsell, E., Johnson, C., Tunstall, S., Morris, J., Chatterton, J., Green, C., … Fernandez-bilbao, A. (2005). *The Benefits of Flood and Coastal Risk Management : A Handbook of Assessment Techniques*.

Pfurtscheller, C., & Vetter, M. (2015). Assessing entrepreneurial and regional-economic flood impacts on a globalized production facility. *Journal of Flood Risk Management*, *8*(4), 329–342. http://doi.org/10.1111/jfr3.12102.

Poaponsakorn, N., Meethom, P., & Pantakua, K. (2015). The impact of the 2011 floods, and flood management on thai households. *Resilience and Recovery in Asian Disasters: Community Ties, Market Mechanisms, and Governance*, 75–104. http://doi.org/10.1007/9784431550228_5.

Posthumus, H., Morris, J., Hess, T. M., Neville, D., Phillips, E., & Baylis, A. (2009). Impacts of the summer 2007 floods on agriculture in England. *Journal of Flood Risk Management*, *2*(3), 182–189. http://doi.org/10.1111/j.1753-318X.2009.01031.x.

Poussin, J. K., Wouter Botzen, W. J., & Aerts, J. C. J. H. (2015). The effectiveness of flood damage mitigation measures: Empirical evidence from French flood disasters. *Global Environmental Change*, *31*, 74–84. http://doi.org/10.1016/j.gloenvcha.2014.12.007.

Pugesek, B. H., Tomer, A., & Eye, A. Von. (2003). *Structural Equation Modeling: Applications in Ecological and Evolutionary Biology (eds)*. Cambridge University Press.

Quiroga, S., & Suárez, C. (2016). Climate change and drought effects on rural income distribution in the Mediterranean: A case study for Spain. *Natural Hazards and Earth System Sciences*, *16*(6), 1369–1385. http://doi.org/10.5194/nhess-16-1369-2016.

Rahim, H., Hamid, M. T., Wahab, M. A. M. A., & Amin, M. Z. M. (2016). *Security Interests of Crops Against Environmental Uncertainty in Malaysia*. Retrieved from http://ap.fftc.agnet.org/ap_db.php?id=648&print=1.

Rana, S., & Islam, R. (2015). Impact of Flood Hazards on the Agricultural Production and Livelihood Shifting in Rural Bangladesh : A Comparative Study. In *5th International Conference on Water & Flood Management (ICWFM-2015)* (pp. 71–80).

Reeve, L. (2013). *Systematic Sampling from Finite Populations. Unpublished thesis School of Mathematics, Statistics and Computer Science, University of KwaZulu-Natal, Durban.*

Rezai, G., Kit Teng, P., Mohamed, Z., & Nasir Shamsudin M. (2013). Going Green: Survey of Perceptions and Intentions Among Malaysian Consumers. *International Business and Management*, *6*(61), 104–112. http://doi.org/10.3968/j.ibm.1923842820130601.1125.

Robert, W. S. (2011). *Scoping Assessment on Climate Change Adaptation in Malaysia. Regional Climate Change Adaptation Knowledge Platform for Asia. Copyright © AIT-UNEP RRC.AP 2011 Bangkok, Thailand October 2011. www.asiapacificadapt.net.*

Robert Ho. (2006). *Handbook of Univariate and Multivariate Data Analysis and Interpretation with SPSS*. Published in 2006 by Chapman & Hall/CRC Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300. www.copyright.com

Boca Raton, FL 33487-2742Rofyanto, K., & Suhaiza, Hanim Zailani Mohammad, Iranmanesh Premkumar, R. (2017). The effects of vulnerability mitigation strategies on supply chain effectiveness : risk culture as a moderator. *Supply Chain Management*, *22*(1), 1–15. http://doi.org/10.1108/SCM-12-2015-0482.

Romali, N. S., & Sulaiman, M. S. A. K. (2015). Flood Damage Assessment: A Review of Flood Stage–Damage Function Curve. *Springer Science+Business Media Singapore 2015*. http://doi.org/10.1007/978-981-287-365-1.

Rose, A. (2005). Modeling Regional Economic Resilience To Disasters : A Computable General Equilibrium Analysis Of Water Service Disruptions *. *Journal of Regional Science*, *45*(1), 75–112.

Rufat, S., Tate, E., Burton, C. G., & Maroof, A. S. (2015). Social vulnerability to floods: Review of case studies and implications for measurement. *International Journal of Disaster Risk Reduction*, *14*, 470–486. http://doi.org/10.1016/j.ijdrr.2015.09.013.

Saidu, M. B. (2014). *Particapation in Microfinance Scheme as a Medium for Empowerment Among Farmers Community in Kano State, Nigeria*. Unpublished thesis to the Faculty of Human Ecology, Universiti Putra Malaysia.

Samuel, D. B., Sammy Zahran, Praveen Maghelal, H. G., & Highfiel, W. E. (2007). The Rising Costs of Floods: Examining the Impact of Planning and Development Decisions on Property Damage in Florida. *Journal of American Association*, *73*(3). Retrieved from http://www.suncorpbank.com.au/sites/default/files/Media_Release_The rising_costs_of_kids_NATIONAL.pdf.

Santos, J. R., Yu, K. D. S., Pagsuyoin, S. A. T., & Tan, R. R. (2014). Time-varying disaster recovery model for interdependent economic systems using hybrid input – output and event tree analysis. *Economic Systems Research*, *26*(1), 60–80. http://doi.org/10.1080/09535314.2013.872602.

Sardar, A., Javed, S. A., & Amir-ud-din, R. (2016). *Natural Disasters and Economic Growth in Pakistan : An Enquiry into the Floods Related Hazards â€™ Triad. Pakistan Institute of Development Economics Islamabad*. Islamabad: Centre for Environmental Economics and Climate Change. Retrieved from http://www.pide.org.pk.

Sarkar, S. K., Begum, R. A., Pereira, J. J., Jaafar, A. H., & Saari, M. Y. (2014). Impacts of and Adaptations to Sea Level Rise in Malaysia Impacts of and Adaptations to Sea Level Rise in Malaysia. *Asian Journal of Water, Environment and Pollution*, *11*(2), 29–36.

Sauer, J. (2011). *Natural Disasters and Agriculture: Individual Risk Preferences towards Flooding Johannes Sauer*. Unpublished thesis, University of Manchester, Manchester, Oxford Road, M13 9PL, UK.

Sawada, Y., & Sothea, O. (2011). *Economic and welfare impacts of disasters in east asia and policy responses*. ERIA Research Project Report 2011, No.8

Scawthorn, C., Flores, P., Blais, N., Seligson, H., Tate, E., Chang, S., … Lawrence, M. (2006). HAZUS-MH Flood Loss Estimation Methodology. II. Damage and Loss Assessment. *Natural Hazards Review*, *7*(2), 72–81. http://doi.org/10.1061/(ASCE)1527-6988(2006)7:2(72).

Sekhampu, T. (2013). Determination Of The Factors Affecting The Food Security Status Of Households In Bophelong, South Africa. *International Business & Economics Research Journal*, *12*(5), 543. http://doi.org/10.19030/iber.v12i5.7829.

SHA, Z., XIE, Y., TAN, X., BAI, Y., LI, J., & LIU, X. (2017). Assessing the impacts of human activities and climate variations on grassland productivity by partial least squares structural equation modeling. *Journal of Arid Land*, *9*(4), 473–488. http://doi.org/10.1007/s40333-017-0022-6.

Shaar, M. S. M., Karim, M. Z. A., & Basri, B. H. (2011). The Effects of Flooding on House Prices : Two Case Studies in Malaysia. *Agriculture, Ecosystems and Environment*, *2*(4), 176–185. http://doi.org/10.1061/(ASCE)1527-6988(2003)4:4(176).

Shaari, M. S. M., Zaini, M., Karim, A., & Basri, B. H. (2016). Flood disaster and gdp growth in malaysia. *European Journal of Business and Social Sciences*, *4*(10), 27–40. Retrieved from http://www.ejbss.com/recent.aspx-/.

Shabnam, N. (2014). Natural Disasters and Economic Growth: A Review. *International Journal of Disaster Risk Science*, *5*(2), 157–163. http://doi.org/10.1007/s13753-014-0022-5.

Shafiai, S., & Khalid, M. S. (2016). Flood Disaster Management in Malaysia : A Review of Issues of Flood Disaster Relief during and Post-Disaster. *The European Proceedings of Social and Behavioural Sciences*. Future Academy.

Shah, S. M. H., Mustaffa, Z., & Yusof, K. W. (2017). Disasters Worldwide and Floods in the Malaysian Region: A Brief Review. *Indian Journal of Science and Technology*, *10*(2). http://doi.org/10.17485/ijst/2017/v10i2/110385.

Shamshuddin, J., Panhwar, Q. A., Othman, R., & Ismail, R. (2016). Effects of December 2014 Great Flood on the Physico-Chemical Properties of the Soils in the Kelantan Plains, Malaysia. *Journal of Water Resource and Protection*, *8*(February), 263–276. http://doi.org/10.4236/jwarp.2016.82023.

Shariff, Z. M., & Khor, G. L. (2005). Obesity and household food insecurity : evidence from a sample of rural households in Malaysia. *European Journal of Clinical Nutrition*, *59*, 1049–1058. http://doi.org/10.1038/sj.ejcn.1602210.

Shaughnessy, T. M., White, M. L., & Brendler, M. D. (2010). the Income Distribution Effect of Natural Disasters: an Analysis of Hurricane Katrina. *Regional Analysis and Policy*, *40*(1), 84–95. Retrieved from http://www.swdsi.org/swdsi07/2007_proceedings/papers/155.pdf.

Siddiquee, S. A. (2012). Climate Change and Farming Vulnerability in the Coast of Bangladesh. *ANGLISTICUM International Journal of Literature, Linguistics & Interdisciplinary Studies*, *I*(2), 126–134.

Singh, A. S., & Masuku, M. B. (2013). Fundamentals of Applied Research and Sampling Techniques. *International Journal of Medical and Applied Sciences*, *2*(4), 123–124.

Sivakumar, M. V. K., P.Motha, R., & Das, H. P. (2005). *Natural Disasters and Extreme Events in Agriculture: Impacts and Mitigation*. *Springer*. http://doi.org/10.1007/3-540-28307-2.

Siwar, C., Ahmed, F., & Begum, R. A. (2013). Climate change, agriculture and food security issues: Malaysian perspective. *Journal of Food Agriculture & Environment*, *11*(April), 1118–1123.

Siwar, C., Alam, M., Murad, W., & Al-Amin, A. Q. (2009). Impacts of Climate Change on Agricultural Sustainability and Poverty in Malaysia. *10th International Business Research Conference*, 1–15.

Smith, K., & Roy, W. (1998). *Floods : Physiacal Processes and Human Impacts*. John Wiley&Sons, Ltd. Wiley-Blackwell. ISBN: 978-0-471-95248-0 Jun 1998, 394 pages.

Smith, R. G., Davis, A. S., Jordan, N. R., Atwood, L. W., Daly, A. B., Grandy, A. S., … Yannarell, A. C. (2014). *Transdisciplinary Research on Agriculture and Climate Change*. Published in Crop Sci. 54:475–483 (2014). doi: 10.2135/cropsci2013.07.0474 © Crop Science Society of America | 5585 Guilford Rd., Madison, WI 53711 USA

Song, J. (2017). Measuring Recovery to Build up Metrics of Flood Resilience Based on Pollutant Discharge Data : A Case Study in East China. *Water (MPDI)*, *9*, 619. http://doi.org/10.3390/w9080619.

Stimpson, J. p. (2005). Flood and Psychological Well-Being : Direct, Mediating, and Moderating Effects. *International Journal of Mass Emergencies and Disasters*, *23*(1), 27–44.

Straub, D., Boudreau, M., & Gefen, D. (2004). Validation guidelines for IS positivist research Validation Guidelines for IS Positivist Research. *Communications of the Association for Information Systems*, *13*(January), 380–427. http://doi.org/Article.

Strobl, E. (2012). The economic growth impact of natural disasters in developing countries : Evidence from hurricane strikes in the Central American and Caribbean regions. *Journal of Development Economics*, *97*(1), 130–141. http://doi.org/10.1016/j.jdeveco.2010.12.002.

Suhaiza, Z., Ariffin, H. A. M., Iranmanesh, M., Moeinzadeh, S., & Iranmanesh, M. (2016). The moderating effect of project risk mitigation strategies on the relationship between delay factors and construction project performance. *Journal of Science and Technology Policy Management*, *7*(3), 346–368. http://doi.org/10.1108/JSTPM-12-2015-0041.

Suharyanto., J. H. M., Darwanto., D. H., & Widodo, S. (2014). Determinants of Food Security Among Rice Farming Households in the Province of Bali : An Ordered Logistic Model. *Journal of Economics and Sustainable Development*, *5*(8), 35–43.

Sukeri, M., Khalid, B., & Shafiai, S. B. (2015). Flood Disaster Management in Malaysia : An Evaluation of the Effectiveness Flood Delivery System. *International Journal of Social Science and Humanity*, *5*(4). http://doi.org/10.7763/IJSSH.2015.V5.488.

Swenson, D., Eathington, L., & O'Brien, M. (2008). *Economic Impacts of the 2008 Floods in Iowa*. Regional Capacity Analysis Program 17 East Hall, Iowa State University Ames, Iowa 50011. recap@iastate.edu

Syaheera, M., & Shaari, M. (2017). Does Flood Disaster Lessen GDP Growth ? Evidence from Malaysia ' s Manufacturing and Agricultural Sectors. *Malaysian Journal of Economic Studies*, *54*(1), 61–81.

Syed Hussain, T. P. R., & Ismail, H. (2013). Flood frequency analysis of Kelantan River Basin, Malaysia. *World Applied Sciences Journal*, *28*(12), 1989–1995. http://doi.org/10.5829/idosi.wasj.2013.28.12.1559,

Tabachnick, B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics (7th Ed.) Pearson Education. Inc.*

Tabassum, I., Haq, F., & Planning, R. (2013). Flood (2010) Effects on Agriculture, Livestock, Infrastructure and Human Health: A Case Study of Charsadda District. *Journal of Humanities & Social Sciences*, *2013*(1), 95–117.

Tahir, W., Hamid, S., Bakar, A., Ab, M., Siti, W., Mohd, R., … Symposium, I. (2015). International Symposium on Flood Research and Management 2015 (Isfram 2015). In *ISFRAM 2014 Proceedings of the International Symposium on Flood Research and Management*.

Tanza, E. (2008). *Estimating the economic impacts of Hurricane Damage on Coastal Fishing Infrastructure*. A Thesis submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College. Department of Agricultural Economics and Agribusiness

Tewari, M. H. R., Bhowmick, P. K., & Mccormick, M. (2015). Roles of Government and Community Support, Flood Experience, and Flood Education in Livelihood Resilience. *Journal of Sociology & Social Welfare*, *XLII*(4), 101–134.

Thieken, A. H., Kreibich, H., Muller, M., & Merz, B. (2007). Coping with floods: preparedness, response and recovery of flood-affected residents in Germany in 2002. *Hydrological Sciences Journal*, *52*(5), 1016–1037. http://doi.org/10.1623/hysj.52.5.1016

Tobin, G. A. (1999). Sustainability and community resilience : the holy grail of hazards planning. *Environmental Hazards*, 13–25.

Torrente, E. C. (2012). *Post Disaster Damage, Loss and Needs Assessment in Agriculture*. Food and Agriculture Organization of the United Nations Retrieved from http://www.fao.org/docrep/015/an544e/an544e00.pdf.

Toya, H., & Skidmore, M. (2005). *Economic Development and the Impacts of Natural Disasters*. *UW Whitewater University of Wisconsin Department of Economics* (Vol. 94). Retrieved from http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=11423950.

Twining, S. (2014). *Impact of 2014 Winter Floods on Agriculture in England*. *ADAS UK Ltd. on behalf of Defra*. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401235/RFI7086_Flood_Impacts_Report__2_.pdf.

Umar, S., Man, N., Nawi, N. M., Latif, I. A., & Samah, B. A. (2017). Core competency requirements among extension workers in peninsular Malaysia: Use of Borich's needs assessment model. *Evaluation and Program Planning*, *62*, 9–14. http://doi.org/10.1016/j.evalprogplan.2017.02.001.

UNWCDRR. (2015). *Third United Nations World Conference on Disaster Risk Reduction. Official Statement by: H.E Tan Sri Muhyiddin Mohd Yassin Deputy Prime Minister, Head of Delegation Malaysia.*

Vaghefi, N., Shamsudin, M. N., Radam, A., & Rahim, K. A. (2016). Impact of climate change on food security in Malaysia: economic and policy adjustments for the rice industry. *Journal of Integrative Environmental Sciences*, (February). http://doi.org/10.1080/1943815X.2015.1112292.

Vetere-Arellano, A. ., Nordvik, J.-P., & Ranguelov, B. (2003). *In search of a common methodology on damage estimation: from a European perspective*.

Vozinaki, A. E. K., Kourgialas, N. N., & Karatzas, G. P. (2012). Estimation of agricultural flood loss in the Koiliaris river basin in Crete,. *European Water*, *39*, 53–63.

Wan Ahmad, W. I., & Abdurahman, S. M. (2015). Kelantan Flood 2014: Reflections from Relief Aid Mission to Kampung Kemubu, Kelantan. *Mediterranean Journal of Social Sciences MCSER Publishing, Rome-Italy*, *6*(3), 340–344. http://doi.org/10.5901/mjss.2015.v6n3s2p340.

Wardell-Johnson, A., Uddin, N., Islam, N., Nath, T., Stockwell, B., & Slade, C. (2013). *Creating a climate for food security : Creating a climate for food security : The businesses, people and landscapes in food production, National Climate Change Adaptation Research Facility, Gold Coast, 142 pp.*

Webb, P., Coates, J., Frongillo, E. A., Rogers, L., Swindale, A., & Bilinsky, P. (2006). Advances in Developing Country Food Insecurity Measurement Measuring Household Food Insecurity : Why It ' s So Important and Yet So, (2), 1404–1408.

Weichselgartner, J. (2001). Disaster mitigation: the concept of vulnerability revisited. *Disaster Prevention and Management: An International Journal*, *10*(2), 85–95. http://doi.org/10.1108/09653560110388609.

Weng, N. C., Ruhana, K. K., & Karim, M. Z. A. (2016). *Assessing Different Types of Flood Losses in Kelantan State in Malaysia During the December 2014 Flood*. In: 1st International Conference on Society, Space & Environment 2016, 2-3 November 2016, Bali, Indonesia.

Whitfield, P. H. (2012). Floods in future climates: A review. *Journal of Flood Risk Management*, *5*(4), 336–365. http://doi.org/10.1111/j.1753-318X.2012.01150.x

WHO. (2002). *Floods: climate change and adaptation strategies for human health. London, UK*. report on a WHO meeting, London, United Kingdom 30 June-2 July 2002. Copenhagen WHO Regional Office for Europe. http://www.who.int/iris/handle/10665/107436.

Widiarto, L. A. (2013). *Agricultural Loss Caused By 2007 Flood And Its Household Impact*. *Thesis submitted to the Double Degree M.Sc. Programme, Gadjah Mada University and Faculty of Geo-Information Science and Earth Observation, University of Twente.*

WMO. (2013). *Conducting Flood Loss Assessments*. Integrated Flood Management Tools Series No.2 © World Meteorological Organization, 2007 (revised 2013).

Wulf, K. (2008). *Climate Change and Food Security : Food and Agriculture Organization of the United Nations Rome, 2008*. Retrieved from http://rstb.royalsocietypublishing.org/content/360/1463/2139.short.

Xiao, Y. (2002). *Local Labor Market Adjustment and Economic Impacts After a major Disaster: Evidence from the 1993 Midwest Flood*. Thesis submitted to University of Illinois at Urbana- Champaign.

Yong, A. G., & Pearce, S. (2013). A Beginner ' s Guide to Factor Analysis : Focusing on Exploratory Factor Analysis. *Tutorials in Quantitative Methods for Psychology*, *9*(2), 79–94. http://doi.org/10.20982/tqmp.09.2.p079

Younus, M. A. F. (2014). *Vulnerability and adaptation to climate change in Bangladesh*. Processes, Assessment and Effects. Springer Theses Recognizing Outstanding Ph.D. Research. Springer Theses Recognizing Outstanding Ph.D. Research. http://www.springer.com/series/8790

Zainudin, A. (2015). *SEM Made Simple: A Gentle Approach to Learning Structural Equation Modelling*. First eds. MPWS Rich Publication Sdn. Bhd. (1132290-K) Bandar Baru Bangi, Selangor, Malaysia.

Zeidler D. L. (2007). *What is Theoretical Framework? The University of South Florida. Available http://www.coedu.usf.edu/jwhite/secedseminar/theoryframe.pdf (Accessed 11 November 2010).*

Zenklusen, O. (2007). *Natural disasters and economic development :* Thesis submitted to the University of St. Gallen, Graduate School of Business Administration, Economics, Law and Social Sciences (HSG).

Zewdie, A. (2014). Impacts of Climate Change on Food Security : A Literature Review in Sub Saharan Africa. *Earth Science & Climatic Change*, *5*(8), 8–11. http://doi.org/10.4172/2157-7617.1000225.

Zhong, S., Okiyama, M., & Tokunaga, S. (2014). Impact of Natural Hazards on Agricultural Economy and Food Production in China: Based on a General Equilibrium Analysis. *Journal of Sustainable Development*, *7*(2), 45–69. http://doi.org/10.5539/jsd.v7n2p45.