

# **UNIVERSITI PUTRA MALAYSIA**

INFLUENCE OF ICTs USE ON LIVELIHOOD RESILIENCE MEDIATED BY FLOOD RISK PERCEPTION AMONG FISHERMEN IN THE EAST COAST OF MALAYSIA

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FP 2018 76



# INFLUENCE OF ICTs USE ON LIVELIHOOD RESILIENCE MEDIATED BY FLOOD RISK PERCEPTION AMONG FISHERMEN IN THE EAST COAST OF MALAYSIA



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

February 2018

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# **DEDICATION**

This thesis is dedicated to:

My inspiration and beacon of hope......My mother!!! A matchless motivator for his unique ways....My Father My strength and comfort.....My Wife and Children



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

#### INFLUENCE OF ICTs USE ON LIVELIHOOD RESILIENCE MEDIATED BY FLOOD RISK PERCEPTION AMONG FISHERMEN IN THE EAST COAST OF MALAYSIA

By

#### **BASHIR MUKTAR GARBA**

February 2018

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Small-scale fisheries are important socio-ecological systems contributing towards the attainment of food security, economic wealth and social well-being in Malaysia. They provide about 65% protein requirements of the population while extending a lot of employments opportunities across the fish value chain. However, climate change and extreme events are threatening the sustainability of fishing activities. Climate extreme events like flood disrupts and destroys assets thereby undermining fishing community's developmental gains and livelihoods. Malaysian governments' effort to reduce fishermen's vulnerability towards sustainable productivity, has promoted the use of Information Communication Technologies (ICTs) in the fishing sector. Hence, ICTs are utilized in all stages of fish value chain, from sourcing climate information, advisory services, navigation, down to e-declaration of catches and linkages to markets. Such information as key input to adaptation for Livelihood Resilience (LR) are disseminated through various ICTs.

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Yet, an unresponsiveness and unprepared attitude by fishermen towards flood risks communication is reported. Generally, the reactive rather than proactive flood management in the country suggests an unsustainable top-down approach. Furthermore, a paucity of empirical evidences on influences of use of ICTs on LR limits informed planning by authorities. This research, utilized Sustainable Livelihood Framework and Protective Motivation Theory to contribute to literature. It highlights access, utilization of ICTs and preferences (bottom-up input) for flood risks communication. It identified underlying structures for measuring LR and how flood risk perception mediates the relationship between use of ICTs and LR.

Through a stratified random sampling and proportionate distribution in three states of east-coast Malaysia (Terengganu, Pahang and Kelantan states), data were collected using self-administered questionnaire to a randomly drawn sample size of 380 fishermen. Descriptive statistics facilitates the categorization of socio-economics characteristics, levels of LR and perceived importance-performance of risks communications. Results reveals 52.2 % fishermen have low and another 40.9% have moderate LR. 65.5% perceived flood risk communication is important and 64.4% rated the flood risk communication as satisfactorily. Factor analysis reveals five factors with total explained variance of 72.893%, KMO of .878 indicating sufficient inter-correlations and adequacy of sample studied while the Bartlett's test of sphericity was significant (Chi square= 4836.384, P<0.00). The Structural Equation Modelling analysis reveals insignificant relationship between use of ICTs and LR, indicative of full mediation of flood risk perception.

The results suggest that fishermen's specific need of information should be provided through the discovered preferred ICTs. The interaction among variables and the identified influence of the mediator extends an insight into the influence of 'cognitive processes' towards flood preparedness action for LR enhancement. This is a valuable input in flood risk management and other policy formulation on communication for behavioural change in agricultural communities. Detailed assessments within this research provide valuable input in all the five steps of developing National Adaptation Communication Strategy as recommended by United Nations. The integrated model has also presented a framework for understanding influences of ICTs mediated communication on cognitive appraisal of 'risk perception' towards sustainable behaviour change. The academics and practitioners can use this findings and frameworks for further research and also as a baseline for a longitudinal form of studies.

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

# PENGARUH PENGGUNAAN ICT KE ATAS KERINTANGAN KEHIDUPAN NELAYAN TERHADAP RISIKO BANJIR DI PANTAI TIMUR MALAYSIA

Oleh

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Perikanan berskala kecil adalah sistem sosial-ekologi penting yang menyumbang ke arah pencapaian keselamatan makanan, kekayaan ekonomi dan kesejahteraan sosial di Malaysia. Ia membekalkan lebih kurang 65% keperluan protein kepada populasi penduduk di samping menyediakan peluang pekerjaan merentasi rantaian nilai perikanan. Namun, perubahan iklim dan kejadian cuaca ekstrim mengancam kemampanan aktiviti perikanan. Kejadian cuaca ekstrim seperti banjir mengganggu dan memusnahkan aset sekali gus menjejaskan keuntungan pembangunan dan penghidupan komuniti nelayan. Usaha kerajaan Malaysia untuk mengurangkan kerentanan nelayan melalui produktiviti mampan telah menggalakkan penggunaan Teknologi Komunikasi Maklumat (ICT) dalam aktiviti penangkapan ikan. Oleh itu, ICT digunakan di semua peringkat rantaian nilai perikanan, daripada mendapatkan maklumat iklim dan khidmat nasihat, navigasi di laut, pengesanan kepadatan ikan yang tinggi di laut, sehinggalah e-pengisytiharan tangkapan dan hubungan dengan maklumat pasaran. Maklumat sedemikian sebagai input utama untuk adaptasi bagi Kerintangan Kehidupan (Livelihood Resilience = LR) disebarkan menerusi kepelbagaian ICT.

Namun begitu, terdapat sikap tidak responsif dan tidak bersedia nelayan terhadap komunikasi risiko banjir telah dilaporkan. Secara umumnya, pengurusan banjir reaktif yang dikenal pasti berbanding proaktif dalam negara menunjukkan pendekatan atas-bawah yang tidak mampan. Tambahan pula, terdapat kekurangan bukti empirikal tentang pengaruh penggunaan ICT pada LR mengehadkan keputusan yang dimaklumkan oleh pihak berkuasa. Kajian ini telah menggunakan Rangka Kehidupan Mampan (SLF) dan Teori Motivasi Perlindungan (PMT) untuk menyumbang kepada sorotan karya. Ia menonjolkan akses, penggunaan ICT dan kecenderungan (input bawah-atas) untuk komunikasi risiko banjir. Ia mengenal pasti

struktur asas untuk mengukur LR dan bagaimana persepsi risiko banjir mengantara hubungan antara penggunaan ICT dan LR.

Melalui persampelan rawak berstrata dan pengagihan berkadar antara tiga strata di pantai timur Malaysia (negeri Terengganu, Pahang dan Kelantan), data telah dikumpul menggunakan soalan kaji selidik yang dijawab sendiri oleh 380 orang nelayan yang dipilih secara rawak. Statistik deskriptif memudahkan pengkategorian dan menggambarkan ciri sosioekonomi, tahap LR dan kepentingan prestasi komunikasi risiko yang dipercayai. Keputusan menunjukkan bahawa 52.2% responden mengalami penurunan dan 40.9% lagi mempunyai LR yang sederhana. 65.5% menganggap komunikasi risiko banjir penting dan 64.4% menilai komunikasi risiko banjir sebagai memuaskan. Keputusan analisis faktor menunjukkan lima faktor dengan jumlah varians yang dijelaskan sebanyak 72.893%, KMO .878 menunjukkan interelelasi yang mencukupi dan kecukupan sampel yang dikaji manakala ujian sphericity Bartlett adalah signifikan (khi kuasa dua = 4836.384, P <0.00). Analisis Pemodelan Persamaan Struktur menunjukkan kaitan yang tidak signifikan antara penggunaan ICT dan LR, menandakan pengantaraan penuh persepsi risiko banjir.

Keputusan menunjukkan bahawa keperluan maklumat tertentu nelayan perlu diberikan melalui ICT pilihan yang dikenalpasti. Interaksi diantara pembolehubah dan pengaruh pengantara yang dikenal pasti memanjangkan suatu pandangan ke dalam pengaruh 'proses kognitif' terhadap tindakan persediaan banjir untuk peningkatan LR. Ini adalah input penting dalam pengurusan risiko banjir dan penggubalan dasar lain mengenai komunikasi untuk perubahan tingkah laku dalam komuniti pertanian. Penilaian terperinci dalam penyelidikan ini akan memberikan input yang berharga dalam kesemua lima langkah pembangunan Strategi Komunikasi Penyesuaian Nasional seperti yang disarankan oleh Pertubuhan Bangsabangsa Bersatu. Model bersepadu juga telah membentangkan satu rangka kerja untuk memahami pengaruh ICT sebagai pengantara komunikasi ke atas penilaian kognitif 'persepsi risiko' terhadap perubahan tingkah laku yang mampan. Para ahli akademik dan pengamal boleh menggunakan penemuan dan rangka kerja ini untuk penilaian lanjut dan juga sebagai garis dasar bagi kajian berbentuk jangka masa panjang.

#### ACKNOWLEDGEMENTS

The greatest attribution, glorification, supplication and praises goes to the most exalted, omnipotent and the most merciful King, ALMIGHTY ALLAH for gift of life, health and endless mercies in my life. His endowed strength and inspiration steered by my faith in him gives me strength, perseverance and patience in my pursuit of academic and general life goals. My gratitude goes to the platform that extends me access to a world class of facilities and consortium of experts in my chosen field, the Universiti Putra Malaysia. My profound gratitude goes to my supervisory committee, comprising of academics of immense intellectual acumen and global prominence under the chairmanship of Associate Professor Dr. Norsida Man with membership of Associate Professor Dr. Nitty Hirawaty Kamarulzaman and Associate Professor Dr. Asnarulkhadi Abu Samah for their constructive criticisms, engaging discussions, valuable suggestions and well-articulated guidance throughout the research journey.

I also, wish to extend my appreciation to the entire staff and post graduate students of the department of Agricultural Technology and Agribusiness and Bio-resource economics for their support and intellectual contributions. I also deeply appreciate the many constructive chats with members of Faculty of Educational Studies UPM, Dr. Zohra and Prof. Dr Bahaman Abu Samah etc. My gratitude goes to Professor Richard Heeks and Professor Mahmud Ibrahim Daneji, Professor Shehu Musa of the University of Manchester United Kingdom and Bayero University Kano for their patience and engaging discussions and validation of my research instruments. I appreciate the friendship and academic compatriots Umar Mukhtar, Abdulsalam Jega, Sulaiman Umar, Umar Ghazali, Muhammad Salisu Khalil, Ahmed Hamdan, Jasim Muhammad Saleh, Wisam Yako, Nasar Mansir and numerous others for their engaging academic companionship.

My father Alhaji Mukhtar Garba, the Dan Ruwata of Gumel Emirate, whom I took so much from- his resources, his thoughts and attention, I even took his name. My mother who has been my guiding post in life, your words, counselling and constant prayers see me sailing in life. My grandparents, the entire Dan Ruwatan Gumel Family and my extended larger families, the Limawas, Idrissawas and Wazirawas of Gumel. I thank you all for your direct and indirect positive influences and prayers.

C

I owe special gratitude to my mentor, big brother and my teacher both in academics and professional practice Professor Babagana Abba Gambo of Department of Crop Science University of Maiduguri, 'an erudite scholar and a true Kanem Prince' you have been wonderfully gracious in all respect sir. A special gratitude to my brother who has been very supportive and concerned in my academics Bello Abubakar (Abba). Also, to Alhaji Ibrahim Ismail Sarkin Shanun Gumel Alhaji Abubakar Ibrahim and Sarkin Dawaki Gumel Alhaji Muhammad Sani Alhassan, Alh Muhammad Sagagi who were equally supportive. My wife, for her refreshing companionship and encouragements that whips away my fears in my despairs and tribulations, with you it's always blissfully peaceful. My son Mukhtar (Sayyeed) for his innocence, pure love and the hope he provokes in me of an extended 'me' in him. Muhammad (Al-amin), my Ph.D. graduation gift from Almighty. I hope and pray for Almighty Allah's blessings on you. I understand your frustrations, reluctant sacrifices and patience while I endlessly glance to my computer screen despite your attention seeking acts.



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

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# LIST OF ABBREVIATIONS

ΔΚΡ	
	Adaptation Knowledge Platform
AIS	Agricultural innovation system
ARDL	Autoregressive Distributed Lag
DfID	Department for International Development
DRR	Disaster Risk Reduction
DEWN	Disaster Early Warning
FAO	Food and Agricultural Organization
FRR	Flood Risk Reduction
FRAS	Flood Risk Advisory Services
FRR	Flood Risk Reduction
ICT4D	Information Communication Technologies for Development
ICTs	Information Communication Technologies
IPCC	Intergovernemntal Panel on Climate Change
IPA	Importance Performance Analysis
IFAD	Institute for Agricultural Development
LR	Livelihood Resilience
MDGs	Millennium Development Goals
NGOs	Non- governmental Organizations
NRI	Network Readiness Index
NSC	National Security Council
PMT	Protective Motivation Theory
RABIT	Resilience Assessment Benchmarking and Impact Assessment Tool
RIC	Rural Internet Centre

SEM	Structural Equation Model
SLF	Sustainable Livelihood Framework
SLA	Sustainable Livelihood Approach
SDGs	Sustainable Development Goals
UNISDR	United Nations Office for Disaster Risk Reduction
UN	United Nations



#### **CHAPTER 1**

#### **INTRODUCTION**

This chapter is the introductory part of this research and it describes the background of the study, problem statement, objectives, significance, and scope of the study. The chapter also contains some definition of terms.

#### **1.1 Background of the Study**

Climate change is warming the atmosphere and oceans, causing changes in patterns and frequencies of rainfall. This brings devastating effect of climate related extreme events like drought and or flood which are known to disrupt livelihood activities. Flood and other extreme events like heat waves are known to affect the fishing livelihoods by affecting the biophysical distribution and availability of fishes among others, therefore fish catches and by extension the incomes of fishermen (Daw, Adger, & Brown, 2009; FAO, 2013c; Shaffril, Abu Samah, & D'Silva, 2017). The overall effect of climate change on agriculture is reported as capable of affecting global food security, as was mentioned in the fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC). It is clear such effect are of direct consequences to food production system of crops, livestock and fisheries (FAO, 2017; IPCC, 2007, 2014). This devastating consequences of flood on livelihoods, food production and developmental goals, have sparked a renewed global interest on building livelihood resilience through social approach of adaptation practices in most developmental and food security efforts (FAO, 2016b; Tanner et al., 2014). Resilience, which is regarded as a trajectory to sustainable development is defined as the capacity of livelihoods to absorb shocks or disturbances and continue with its main functions (Chinwe Ifejika, Wiesmann, & Rist, 2014; FAO, 2016; Heeks & Ospina, 2015). As such the enhancement of livelihood resilience is subject to reducing vulnerability to extreme events which is directly linked to adaptation practices like preparedness, a practice that is reported as capable of saving up to 80 percent of extreme events' effect (Fox-Rogers, Devitt, O'Neill, Brereton, & Clinch, 2016).

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Normally, adaptation practices are based on access, use of climate information and livelihood assets (human, physical, social, financial and natural). Accordingly, the generation, dissemination and utilization of this information is necessary and key to adaptation for livelihood resilience. The services of providing these information are ably facilitated by the Information Communication Technologies (ICTs), which are regarded as pivotal, unrivalled and requisite in communication for adaptive actions (Heeks & Ospina, 2012;Ospina & Heeks, 2010; Pitrėnaitė-Žilenienė et al., 2014; Wang & Li, 2016). ICTs are known to play significant and unique role in data generation, weather monitoring and climate information dissemination. Conversely, in any efforts towards development in the 21<sup>st</sup> century the ICTs are very essential for

the unlimited number of services they provide (Imam, Hossain, & Saha, 2017; Maiye & McGrath, 2010; Raiti, 2007). These services involve; the provision of information, establishing and maintaining social network, mobilization and creation of awareness towards acceptance and adoption of programs. Major global developmental efforts like the Sustainable Development Goals (SDGs), Sendai framework, United Nation Framework Convention on Climate Change (UNFCC), Non- governmental Organizations (NGOs), governments and agencies have already underscored the role ICTs can play in resilience building and are rapidly adopting its integration in projects and programs as means of accountability and sustainability (Bahadur, Lovell, Wilkinson, & Tanner, 2015; Baudoin, Henly-shepard, Fernando, Sitati, & Zommers, 2014; Béné et al., 2011; DFID, 2011; Ludin & Arbon, 2017; Malaysia Economic Planning Unit, 2016; Pitrenaite-Žileniene, Carosi, & Vallesi, 2014). It is therefore evident that the place of ICTs in developmental goals achievement and the dissemination of vital and lifesaving information from extreme events like flood tsunamis, and earthquakes is non-negotiable and absolutely essential.

Globally, the most frequent climate related extreme event is flood and its effect is profound on human settlements and livelihoods. Flood has within the period (2000-2012) damaged an estimated whopping \$1.5 trillion worth of economic damages in the world. In Malaysia flood is incessant and is said to be affecting about 22 percent of the population (Chan, 2015), this is about the total population of the rural dwellers of the country which is put at about 25 percent by the World Bank (2016). The 2014 flood event in Malaysia is reported to have made the country incur a lot of monetary and material costs and even life loss (Hua, 2015; Karim, Noon, Diah, Tajuddin, & Mustari, 2016; Seri et al., 2014; Wan Ahmad & Abdurahman, 2015). Among the most affected and vulnerable population worldwide to weather extreme events like flood are the fishermen whose dwellings are usually coastal zones. Equally, their communities are always on the line from flash floods and coastal floods, this is of detrimental effect to their overall well-being and the global effort on food security. The fishing communities in Malaysia were also reported to be under such risks, as it is reported that their livelihood, wellbeing, productive and unproductive assets and overall social circumstance are being constantly being threatened by flood (Azril, Shaffril, Hamzah, & Silva, 2016; Shaffril et al., 2017). The fact that when flood occurs it also acts as a vector and help in spreading zoonotic diseases which causes sickness like dengue fever etc. put their health also at risks as well.

Efforts to reduce such risks and achieve overall development has made the Malaysian government to explicitly mention its desire to enhance livelihoods resilience as reflected in the Tenth and Eleventh developmental plans (Shaffril et al., 2012; Malaysia Economic Planning Unit, 2016; Yusof, et al., 2014). Malaysia has also adopted the ICTs as a tool for achieving its socio-economics development and has invested billions of ringgits to develop its ICTs strength over the years (Alias, 2013; Meng, Samah, & Omar, 2013). Furthermore, the country has also subscribed to regional and global declarations for adaptation, resilience building among other developmental goals. It therefore has extended its commitment to efforts like the

Adaptation Knowledge platform (AKP) of the south east Asia nations, which promise to provide a platform for sharing information for collaboration on issues of adaptation, the Hygo framework of 2005 and its successor Sendai Framework for disaster risk reduction, Millennium Development Goals (MDGs) and it successor SDGs, it is also a member in the scientific organization of Intergovernmental Panel on Climate change (IPCC). These points to the unwavering commitments and efforts by the authorities towards the building of a resilient population in the country.

Both mitigation and adaptation measures are adopted in the country, among the mitigation measures taken include limiting the green gases emission, which the country has made a self-declared commitment to stem down the emission of greenhouse gases to 40 percent by the year 2020 and has already achieved 33 percent so far (Zurinah Tahir, AbdulMalek, & Ibrahim, 2016). However, the social dimension of adaptation practices such as preparedness and participation are seen to be poorly done as reported in the Malaysia Economic Planning Unit, (2016), where it is stated that the early warning to flood event are ineffective. This means all climate and weather related information being relayed to the populace did little in pushing them in to taking proactive measures towards flood. Hence, several early warnings and climate information are not responded to by majority of the population who were found unprepared (Khalid & Shafiai, 2015; Nazli, Sipon, & Radzi, 2014; Noorhashirin, Faiza, Mohammad, & Juni, 2016). This shows a clear need for realignment and re-strategizing in the subsequent program design and implementations of adaptation measures. Further analysis revealed an expert centric approach in design and implementation and a reactive rather proactive flood management approach, where aids and rescue services are focussed upon and are almost efficiently provided to victims of such events.

Integration of social dimension to risk reduction emphasizes participatory approach to designs and implementation of such efforts. This is fully ingrained in all global development frameworks and accepted as an avenue of achieving sustainable and equitable development. Hence the top-down approaches and prescriptive design to such flood programs is deemed a recipe for failure at inception or at least unsustainable. The resilience perspective to development therefore addresses this issue and emphasizes the identification of dynamics and complementarities within systems and how they integrate to build resilience through raising the awareness of extreme events risks and their respective risks reduction pathways. This is promoted by providing information, necessary to elicit taking adaptive measures by all, including the socially vulnerable population in their livelihood pursuit within precarious climatic contexts. The graphs in figure 1.2 and 1.3 depict the frequency of flood and its effect on lives and economy respectively. It shows the frequency of flood events in the world and how it is the most frequent event in relation to others like storms, earthquakes etc.



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

#### Figure 1.1 : Global Extreme Events Occurrences 2000-2017

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



# Figure 1.2 : Global flood Damage and Total Number of People Affected 2006-2016

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

# **1.2** Issues in the Fishing Industries and Livelihood Resilience of Fishermen in Malaysia

Despite the concerted and conscious efforts in Malaysia towards building resilient population in general and particularly of the fishing industries, there are issues that are threatening the fishermen and their livelihood in the country. These involves the impact of climate change like rising temperature which is known to affect the fish population, although this is global problem, Malaysia has taken measures to reduce the global warming by limiting greenhouse gasses emissions. The pressing effect of extreme events like flood which are seen to be outright disruptive on the fishing livelihood (Muhammad et al., 2016; Shaffril et al., 2017; Vaghefi, Shamsudin, Radam, & Rahim, 2016) are incessant and widespread among the coastal regions. Such disruptive events are known to exert a lot of pressure on their well-being, income, the nation's food security and by extension the overall agricultural sector's contribution to the economy. The welfare of the fishermen and sustainability of the fishing livelihood is of great relevance to global food security as they are an important source of protein supply to a lot of people. In Malaysia great percentage of the population are known to rely on this form of protein, where the per capita fisheries intake is estimated at 50kg per annum (Department of Fisheries Malaysia, 2015b). The fishing industry is also one of the most utilized sectors for poverty alleviation in countries all over the world. Conversely, the food and agriculture organization (FAO) has emphasized the need to build resilient agricultural livelihoods and particularly that of the fishing industry which is among the most vulnerable to climate change extreme events to ensure that the food demand of the world is attained (FAO, 2013b, 2015b, 2016a).

The government has provided number of interventions to reduce the Fishermen' vulnerability in the country, for example the provision of subsidies to diesel, guaranteed monthly stipends and the provision of up to date climate information like early warning and weather forecasts. However, the provided climate information in all its form of weather information, early warnings and even preparedness tips were reported as not having the desired effect. It is for instance concluded by a finding of a research that there is low level of preparedness to extreme events like the incessant flood (Khalid et al., 2015; Nazli et al., 2014; Noorhashirin et al., 2016) among populations. Also a reported exclusion or non-participation in adaptation activities by the vulnerable population (H. Ernawati, Man, Md Yassin, Lawrence D'Silva, & Mohamed Shaffril, 2013; M. Ernawati et al., 2017). The sustainability campaign of projects has been stressing buy-ins of the benefitting population, this is regarded as a sure way of sustainability of the projects. It is believed that people normally owned up to projects that they were involved in designing implementing and even evaluating. As such the need for their involvement at the initial stage through the provision of their specific input is of high importance. As such, in fishing community the fisher's specific input to projects and programs is deemed crucial and desirable for a resilient livelihood.

Furthermore, the fishing livelihood is characterized by an aging population, although that has been tackled by the government through provision of incentives like monthly stipends, the extreme events are seen to further push away the fisher's due to migratory action as a form of individual mitigation measure to reduce risks (Malaysia Economic Planning Unit, 2016). Such individualized decision of vulnerable agricultural communities' dwellers to relocate in order to reduce risks or evade it, usually leaves a vacuum in the production line of the livelihood they are leaving. These salient issues in the fishing sector if not addressed effectively are capable of compounding the vulnerability of the fishermen and thereby eroding their livelihood resilience.

#### **1.3 Problem Statement**

Fisheries sector remain a vital source of food, nutrition, income and livelihoods for a great number of Malaysian coastal dwellers. Thus, the attainment of food security is largely dependent on the sector. As one of the global most traded commodity, fisheries products also form part of the foreign earnings of the country. It is a great means to poverty reduction efforts, as it extends livelihood to many families across the fish value chain. However, the sector is vulnerable to climate extreme events like rising temperature, storms and flood. Apart from affecting the biophysical presence of fishing stocks, such extreme events are of immediate disruptive consequence to the fisherman's' income and wellbeing.

The implication is both national and global, as the food security, foreign earnings of the nation and the fish supply to global market are affected among other things. At least more than 125,000 individuals are livelihoods and many more depend on the sector for income, as well as Small and Medium Enterprises (SMEs) that source their raw materials from the sector. Fisheries is a major source of affordable protein to most of the people of the country, where an estimated 55 kg per capita consumption per individual was reported (Department of Fisheries Malaysia, 2015b).

The Malaysian government in its quest to make the fishing livelihood resilient for continued and sustainable fishing activity has developed and has been promoting the use of the robust ICTs by the fishermen. This is at various stages of their activities, from the sourcing of information and advisory services, to the use for direction to fishing density on sea, down to the marketing of the fishing catches. Climate information is an important input in the adaptation to climate change and its extreme events, and with the appropriate action is capable of reducing vulnerabilities and enhancing resilience. Conversely, social dimensions to climate change adaptation like preparedness and participation in adaptive actions has been prescribed as best routes to reducing vulnerabilities to such risks, especially flood related (FAO, 2013a; IPCC, 2007, 2014; United Nations, 2011).



Climate information brings awareness of an impending risks and ways of tackling them while the livelihood assets are necessary to facilitate and supports adaptive action. This is because the assets are organized and deployed for such actions in a systematic way by individuals and governments alike. Evidently, such effects were not observed from the fishermen as they were reported to have been taking little or no adaptive measures. They are unresponsive to such information and advisory services with regards to flood events, as indicated by their being reported as having low level of preparedness to flood event. Since information access and utility are important in adaptation and risks reduction communication, and it is seen to be abundantly provided in the country. The fishermen's unresponsiveness presents a gap worthy of attention by researchers, to unravel the unresponsive behaviour.

Furthermore, researchers have identified the process of risk communications program design and implementation to be loaded with expert centric prescriptive approach. In any social intervention were behaviour is targeted and sustainability is desired the need to integrate the local knowledge and perceived important aspects of the beneficiaries is stressed. Besides, the risk reduction efforts are also accused as being reactive rather than proactive adaptive approaches.

Globally, the social approach to adaptation and flood risk advisory services research are at their infancy stage, as such the need for studies to provide relevant data is obvious. Also, there is none or little empirical evidence exists at best on the influence of ICTs use on Livelihood resilience towards adaptation for environmental sustainability. Available researches are usually focussed on adoption of ICTs or their utilization by fishermen. Besides, such researches are described as non-theoretical in paradigm and un-analytical in approach.

The SLF which gaining popularity in adaptation and effect of ICTs is also accused of being too idealistic and assumes that information automatically spur adaptive action. It neglect the cognitive process triggered by such information before action, such phases like the cognitive stage of 'risk perception 'are described as very relevant in any behavioural change communication (Adelekan & Asiyanbi, 2016; Bočkarjova, Veen, & Geurts, 2011; Fuchs et al., 2017; Kellens, Terpstra, Schelfaut, & De Maeyer, 2013; Lieske, Wade, & Roness, 2014). In view of the foregoing this research therefore seeks to answer the following questions:

#### 1.4 Research Questions

- 1) What are the types of ICTs accessed and used by the fishermen in east coast Malaysia?
- 2) What are the preferred ICTs for flood risks communication and livelihood activities of the fishermen in east coast Malaysia?
- 3) What are the perceived fishermen' level of importance and performance ratings of flood risks communication received?

- 4) What are the underlying factors of measuring livelihood resilience and its level among fishermen in east coast Malaysia?
- 5) Do the cognitive factors of flood risk perception mediate the relationship between ICTs use and livelihood resilience?

### 1.4.1 General Objective

The general objective of this study is to assess the influence of ICTs use on livelihood resilience of fishermen in east coast Malaysia.

#### 1.4.2 Specific Objectives

The specific objectives of this study are:

- 1) To describe access and use of ICTs by fishermen in east coast Malaysia
- 2) To identify the preferred ICTs for flood risks communication and livelihood activities by the fishermen in east coast Malaysia?
- 3) To evaluate fisher's perceived importance and performance ratings of flood risks communication and their levels in east coast Malaysia.
- 4) To determine underlying factors and level of fishermen' livelihood resilience in east coast Malaysia.
- 5) To examine the mediation effect of flood risk perception (cognitive process) between ICTs use and livelihood resilience.

#### 1.5 Significance of the Study

The study would inform valuable input in the development of the recommended National adaptation Communication Strategy, as it extends input in all five steps of developing effective communication strategy as recommended by FAO and United Nations Development Programme (FAO, 2011; UNDP, 2011). These are the identification and analysing of the target population-the fishermen, defining of the communication goals which is to reduce risks, the identification of best channels as identified through the preferred channels as revealed by the fishermen and plan and evaluate the program which was achieved through the IPA. It will also inform policy on livelihood resilience enhancement in context of shock, flood risks communication and reduction programs. It has provided a grassroots input thereby informing an inclusive designing of programs that seek to enhance the livelihood and reduce risks. Detailing the area for improvement, where an acceptable and effective communication that both identify the need of the people while involving them in all the process through a double feedback system.



There is also a modest attempt to integrate theories that could be used to measure the effect of ICTs on cognitive process and subsequent action for resilience building. This will also help in explaining the effect and the psychosomatic process a message takes an individual through before the action is contemplated. The integrated framework will be handy for researcher in communication that is interested in understanding the psychological process of communication effect. A tool of analysis the IPA was used in an attempt to evaluate the perceived importance and performance of fishermen to services of flood risk communication through ICTs, which came across as a useful utility tool for extension agents for planning, resource allocation and prioritization of efforts in a cost-effective way.

#### **1.5.1** Theoretical Significance

The theoretical Significance of the study is that it has presented a proposed framework where the Sustainable Livelihood Framework (SLF) theory was extended using the variable of cognitive appraisal from the Protective Motivation. This was applied to assess not only the effect of ICTs on livelihood resilience but the cognitive process that is passed through by an individual when information is received and how that explained the adaptation action and resilience of an individual. The resultant framework will be useful for researchers in behaviour changing communication field. This is an attempt to respond to suggestion to researchers that recommend the integration of cognitive perspective in the assessment of effect of flood risks communication to risk and vulnerability reduction (Kellens et al., 2013; Kellens, Zaalberg, Neutens, Vanneuville, & De Maeyer, 2011; Terpstra, 2011).

#### 1.5.2 Practical Significance

The research output would prescribe solutions to the problem of the unresponsiveness by the fishermen to flood risk advisory services and their refusal to take adaptation practices like preparedness. It highlights factors that may have possibly influenced such inaction which are non-inclusive planning of risk reduction efforts. It has also presented vital information for the formulation of flood risk advisory service that promises to be more effective and acceptable.

#### **1.6** Scope of the Study

The research focuses on the fishermen of the east coast Malaysia who are in the coastal region, this is because of their being located around the coastal region and also the incessant flood that has been affecting them. It does not involve other agricultural livelihood like farming and or plantation management due to resource constraints. Also, the research adopt a cross sectional approach to investigation, however, it is viewed a longitudinal approach would give a more conclusive research findings. Although, this work can be used as a benchmark for further researchers that would want to see the impact of ICTs on livelihood resilience over a period of time.

#### **1.7 Organization of the Thesis**

The thesis is organized in five chapters and the summary of each chapter is presented graphically in the figure below and followed by the brief detailing of the each chapter's content. The first chapter discusses the background and highlight the problem of flood on fishing activities, chapter two presents a thorough literature review and chapter three describes methodology while chapter four presented the finding and chapter concludes and recommend based on findings.



Figure 1.3 : Outline of the Thesis Organization

## 1.8 Summary

This chapter provide a clear concise understanding of the problems, the identification of the gap has been comprehensively highlighted in the problem statement as it affects the Malaysian rural and fisheries development efforts with particular respect to the flood risk reduction. The significance, scope, significance of the study has been highlighted and the questions and objectives of the research have been all presented in the chapter.

#### REFERENCES

- Abu Samah, B. (2016). Inaugural Lecture Enhancing Extension Education Research Using Structural Equation Modelling (First). Universiti Putra Malaysis Press.
- Adelekan, I. O., & Asiyanbi, A. P. (2016). Flood risk perception in flood-affected communities in Lagos, Nigeria. *Natural Hazards*, 80(1), 445–469. http://doi.org/10.1007/s11069-015-1977-2
- Adger, W. N. (2000). Social and ecological resilience: are they related? Progress in<br/>Human Geography, 24(3), 347–364.<br/>http://doi.org/10.1191/030913200701540465
- Adger, W. N. (2010). Social Capital, Collective Action, and Adaptation to Climate Change. In M. Voss (Ed.), *Der Klimawandel: Sozialwissenschaftliche Perspektiven* (pp. 327–345). Wiesbaden: VS Verlag f{ü}r Sozialwissenschaften. http://doi.org/10.1007/978-3-531-92258-4\_19
- Adriana Keating, Karen Campbell, Reinhard Mechler, Erwann Michel-Kerjan, J., Mochizuki, Howard Kunreuther, JoAnne Bayer, Susanne Hanger, Ian McCallum, L. S. K., Williges, Ajita Atreya, Wouter Botzen, Ben Collier, Jeff Czajkowski, Stefan Hochrainer, C., & Egan. (2014). *Operationalizing Resilience Against Natural Disaster Risk: Opportunities , Barriers and A Way Forward. Zurich Insurance , IIASA and Wharton*. Retrieved from http://www.iiasa.ac.at/web/home/research/researchPrograms/RiskPolicyandV ulnerability/whitepaper.pdf
- Alderete, M. V. (2017). Examining<br/>development: the moderating<br/>*Technology* forthe ICT access effect on socioeconomic<br/>role of ICT use and skills. Information<br/>Development, 23(1), 1–17.<br/>http://doi.org/10.1080/02681102.2016.1238807
- Alias, N. A. (2013). ICT Development for Social and Rural Connectedness. In *CT Development for Social and Rural Connectedness* (p. 46). Springer. http://doi.org/10.1007/978-1-4614-6901-8
- Allison, E. H., & Ellis, F. (2001). The livelihoods approach and management of small scale fisheries. *Mar. Policy*, 25(July), 377–388. Retrieved from http://ac.els-cdn.com/S0308597X01000239/1-s2.0-S0308597X01000239main.pdf?\_tid=7215ca24-e0c3-11e3-9ef1-00000aacb35d&acdnat=1400661759 6aa76f0b62ed9948b523761fa268b027
- Areni, C. S., & Miller, R. (2012). Sales effects of in-store radio advertising. *Journal* of Marketing Communications, 18:4(August), 37–41. http://doi.org/10.1080/13527266.2010.528208

- Ary, D., Jacobs, L. C., & Sorenson, C. (2005). Introduction to Research in Education. Measurement (Vol. 8). http://doi.org/10.1017/CBO9781107415324.004
- Asante, F. a., Boakye, A. a., Egyir, I. S., & Jatoe, J. B. D. (2012). Climate change and farmers' adaptive capacity to strategic innovations: The case of northern Ghana. *International Journal of Development and Sustainability*, 1(3), 766– 784. Retrieved from http://isdsnet.com/ijds-v1n3-11.pdf
- Asif, M., & Kamran, a. (2012). Crop Stress and Its Management: Perspectives and Strategies. Crop Science, 52(4), 1968. http://doi.org/10.2135/cropsci2012.12.0002br
- Avory, B., Cameron, E., Rickson, C., & Fresia, P. (2015). *Climate Resilience and the Role of the Private Sector in Thailand.*
- Awang, Z. (2015). SEM Made Simple. A gentle approach to learning structural Equation Modelling (First). MPWS Rich Publication Sdn.Bhd.
- Awang, Z., Wan Afthanorhan, W. M. A., & Asri, M. A. M. (2015). Parametric and Non Parametric Approach in Structural Equation Modeling (SEM): The Application of Bootstrapping. *Modern Applied Science*, 9(9), 58–67. http://doi.org/10.5539/mas.v9n9p58
- Ayobami, A. S. (2012). SMS as a Rural Disaster notification system in Malaysia : A feasibility study. In International Conference on Communication and Media, 1st to 3rd November 2012 Penang, Malaysia.
- Azril, H., Shaffril, M., Hamzah, A., & Silva, J. L. D. (2016). Individual adaptive capacity of small-scale fishermen living in vulnerable areas towards the climate change in Malaysia. *Climate and Development*, 5529(April), 1–12. http://doi.org/10.1080/17565529.2016.1145100
- Bahadur, A., Lovell, E., Wilkinson, E., & Tanner, T. (2015). *Resilience in the SDGs: Developing an indicator for Target 1.5 that is fit for purpose*. Retrieved from http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinionfiles/9780.pdf
- Bahadur, A. V., Ibrahim, M., & Tanner, T. (2010). *The resilience renaissance? Unpacking of resilience for tackling climate change and disasters. SCR Discussion Paper.* Retrieved from http://r4d.dfid.gov.uk/Output/189793/Default.aspx
- Baudoin, M., Henly-shepard, S., Fernando, N., Sitati, A., & Zommers, Z. (2014). Early warning systems and livelihood resilience : Exploring opportunities for community participation: UNU-EHS Working Paper Series, No.1. Bonn: United Nations University Institute of Environment and Human Security (UNU-EHS).

- Béné, C., Evans, L., Mills, D., Ovie, S., Raji, A., Tafida, A., ... Andrew, N. (2011). Testing resilience thinking in a poverty context: Experience from the Niger River basin. *Global Environmental Change*, 21(4), 1173–1184. http://doi.org/10.1016/j.gloenvcha.2011.07.002
- Berardi, G., Green, R., & Hammond, B. (2011). Stability, sustainability, and catastrophe: Applying resilience thinking to U. S. agriculture. *Human Ecology Review*, 18(2), 115–125.
- Bočkarjova, M. A., Veen, van der, & Geurts, P. A. T. M. (2011). *A PMT-TTM* model of protective motivation for flood danger in the Netherlands (ITC Working Papers Series Paper 3 – November 2009 A) (Vol. 31).
- Boto, I., Pandya, R., Filippo, R. B., Cruz, D., Pandya-lorch, R., Biasca, R., ... Cruz, D. (2013). Agricultural resilience in the face of crisis and shocks. BRUSSELS RURAL DEVELOPMENT BRIEFINGS A SERIES OF MEETINGS ON ACP-EU DEVELOPMENT ISSUES. Retrieved from http://brusselsbriefings.net
- Bradford, R. A., O'Sullivan, J. J., Van Der Craats, I. M., Krywkow, J., Rotko, P., Aaltonen, J., ... Schelfaut, K. (2012). Risk perception - Issues for flood management in Europe. *Natural Hazards and Earth System Science*, 12(7), 2299–2309. http://doi.org/10.5194/nhess-12-2299-2012
- Brooks, N., & Adger, W. N. (2004). Assessing and Enhancing Adaptive Capacity.
- Brooks, N., Adger, W. N., & Kelly, P. M. (2005). The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation. *Global Environmental Change*, 15(2), 151–163. http://doi.org/10.1016/j.gloenvcha.2004.12.006
- Byrne, B. (2010). *Structural equation modeling with AMOS Basic Concepts, Applications, and Programming* (Second). New York: Routledge Taylor & Francis Group. http://doi.org/10.4324/9781410600219
- Chambers, R. (1994). The Origins and Practice of Participatory Rural Appraisal. World Development, 22(7), 953–969. http://doi.org/10.1016/0305-750X(94)90141-4
- Chan, N. W. (2015). Impacts of Disasters and Disaster Risk Management in Malaysia: The Case of Floods (pp. 239–265). Springer Berlin Heidelberg. http://doi.org/10.1007/978-4-431-55022-8
- Chaudhary, A. K., & Warner, L. A. (2016). Identifying Gaps between Importance and Satisfaction to Identify Extension Clients 'Needs 1 (Department of Agricultural Education and Communication, UF/IFAS Extension. No. AEC590). Florida.

- Cheng, J. W., Mitomo, H., Otsuka, T., & Jeon, S. Y. (2015). The effects of ICT and mass media in post-disaster recovery - A two model case study of the Great East Japan Earthquake. *Telecommunications Policy*. http://doi.org/10.1016/j.telpol.2015.03.006
- Cheng, J. W., Mitomo, H., Otsuka, T., & Jeon, S. Y. (2016). The effectiveness of flood risk communication strategies and the influence of social networks-Insights from an agent-based model. *Environmental Science and Policy*, 60, 44–52. http://doi.org/10.1016/j.envsci.2016.03.006
- Chinwe Ifejika, S., Wiesmann, U., & Rist, S. (2014). An indicator framework for assessing livelihood resilience in the context of social – ecological dynamics. *Global Environmental Change*, 28(August 2014), 109–119. http://doi.org/10.1016/j.gloenvcha.2014.06.005
- Cismaru, M., Cismaru, R., Ono, T., & Nelson, K. (2011). "Act on climate change:" An application of Protection Motivation Theory. *Social Marketing Quarterly*, *17*(3), 62–84. http://doi.org/10.1080/15245004.2011.595539
- Clubb, A. C., & Hinkle, J. C. (2015). Protection motivation theory as a theoretical framework for understanding the use of protective measures. *Criminal Justice Studies: A Critical Journal of Crime, Law & Society*, 28(3), 336–355. http://doi.org/10.1080/1478601X.2015.1050590
- Cox, D. N., Koster, A., & Russell, C. G. (2004). Predicting intentions to consume functional foods and supplements to offset memory loss using an adaptation of protection motivation theory. *Appetite*, 43(1), 55–64. http://doi.org/10.1016/j.appet.2004.02.003
- Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change*, 18(4), 598–606. http://doi.org/10.1016/j.gloenvcha.2008.07.013
- D'Silva, J. L., Shaffril, H. M., Abu Samah, B., & Uli, J. (2012). Assessment of social adptation to climate change by fishermen.pdf. *Journal of Applied Sciences*, 12(9), 7.
- Dasgupta, P., Dreèze, J., Putnam, H., Putnam, R. A., Nussbaum, M., Parfit, D., ... Scanlon, T. (2010). Capability and Well - Being Amartya Sen 1 Introduction 2 Functionings, Capability, and Values 3 Value-Objects and Evaluative Spaces, (November), 2003–2010. http://doi.org/10.1093/0198287976.001.0001
- Daud, L., Utaberta, N., & Othuman Mydin, M. A. (2016). The Culture Changes Among Kelantan Community Before And After Flood Disaster. *Research Journal of Fisheries and Hydrobiology*, 11(3), 111–115.

- Davis, K., Babu, S. C., & Blom, S. (2014). The role of extension and advisory services in building resilience of smallholder farmers. In *Builiding Resilience For Food and Nutrition Security* (p. 4). Addis Ababa, Ethiopia. Retrieved from http://www.ifpri.org/publication/role-extension-and-advisory-servicesbuilding-resilience-smallholder-farmers
- Davoudi, S. (2012). Resilience: A Bridging Concept or a Dead End? *Planning Theory* & *Practice*, *13*(2), 299–307. http://doi.org/10.1080/14649357.2012.677124
- Daw, T., Adger, W. N., & Brown, K. (2009). Climate change and capture fisheries: potential impacts, adaptation and mitigation. In *FAO Fisheries and Aquaculture Technical Paper NO 530. Rome,* (pp. 107–153). Rome: FAO. http://doi.org/FAO Fisheries and Aquaculture Technical paper No. 530
- De Goede, D. M., Gremmen, B., & Blom-Zandstra, M. (2013). Robust agriculture: Balancing between vulnerability and stability. *NJAS - Wageningen Journal of Life Sciences*, 64–65, 1–7. http://doi.org/10.1016/j.njas.2012.03.001
- Department for International Development. (2011). *Defining Disaster Resilience* (Dfid approach papers). *A DFID Approach Paper*. Retrieved from https://reliefweb.int/report/world/defining-disaster-resilience-dfid-approachpaper
- Department of Fisheries Malaysia. (2015a). Distribution of Fishermen Working on Licensed Fishing Vessels by Fisheries Districts, 2015. Retrieved from http://www.dof.gov.my/dof2/resources/user\_29/Documents/Perangkaan Perikanan/2015/1.Nelayan\_Vessel\_.pdf
- Department of Fisheries Malaysia. (2015b). National Plan of Action for the Management of Fishing Capacity in Malaysia (Plan 2) (2nd ed.). Retrieved from http://www.dof.gov.my/dof2/resources/user\_1/UploadFile/Penerbitan/Senarai Penerbitan/NPOA.pdf
- DfID. (1999). Sustainable livelihoods guidance sheets comparing development approches overview. *Ids Discussion Paper*, *Section 6*, 1996–2001. http://doi.org/10.1002/smj
- Duncombe, R. (2007). Using the Livelihoods Framework to Analyze ICT Applications for Poverty Reduction through Microenterprise. Information Technologies and International Development (Vol. 3). http://doi.org/10.1162/itid.2007.3.3.81
- Ernawati, H., 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

- Ernawati, M., Universiti, H., Abu, A., Universiti, S., Idris, K., Putra, U., ... View, P. (2017). Measuring the Small Scale Fishermen â€<sup>TM</sup> s Adaptation Ability based on their Practices : The Case of Peninsular Malaysia Measuring the Small Scale Fishermen 's Adaptation Ability based on their Practices : The Case of Peninsular Malaysia. *International Journal of Academic Research in Business and Social Sciences*, (July). http://doi.org/10.6007/IJARBSS/v7-i6/3004
- Fang, Jane Teng Yan, Q. Y. (2015). NEW Model on Disaster Preparedness Jane, 4916. Retrieved from file:///C:/Users/Bashir Muktar/Desktop/ICT AND RISK MGT/Capacity Building/NEW MODEL ON DISASTER PREPAREDNESS.pdf
- FAO. (2009). *World Fisheries and Aquaculture. Aquaculture* (Vol. 35). http://doi.org/issn 10
- FAO. (2011). The Role of Information and Communication Technologies for Community-Based Adaptation to Climate Change.
- FAO. (2013a). Climate-Smart Agriculture Sourcebook. Sourcebook on Climate-Smart Agriculture, Forestry and Fisheries. http://doi.org/10.1080/03068374.2014.874687
- FAO. (2013b). Resilient Livelihoods Disaster- Risk Reduction For Food And Nutrition Security Framework Programme (2013th ed.). Retrieved from http://www.pacificdisaster.net/m/show article.jsp?id=11378
- FAO. (2013c). *The vulnerability of fishing-dependent economies to disasters* (Vol. 1081). Retrieved from http://www.fao.org/docrep/018/i3328e/i3328e.pdf
- FAO. (2014). The state of world fisheries and aquaculture. Food and Agriculture Oraganization of the United Nations (Vol. 2014). http://doi.org/92-5-105177-1
- FAO. (2015a). Planning Communication for Agricultural Disaster Risk Management a field guide. Retrieved from http://www.fao.org/publications/card/en/c/ae800dea-60ca-4640-a3c1f457fb5538c3/
- FAO. (2015b). The impact of disasters on agriculture and food security, 76. http://doi.org/F0134/EN
- FAO. (2016a). *Climate change and food security: Risks and responses*. (V. Gitz, A. Meybeck, L. Lipper, C. De Young, & S. Braatz, Eds.). FAO.
- FAO. (2016b). *Increasing the Resilience of Agricultural Livelihoods*. Retrieved from http://www.fao.org/3/a-i5615e.pdf

- FAO. (2017). Addressing agriculture, forestry and fisheries in national adaptation plans. Foodand Agriculture Organization. Retrieved from http://www.fao.org/3/a-i6714e.pdf
- Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S., & Walker, B. (2002). Resilience and sustainable development: building adaptive capacity in a world of transformations. *Ambio*, 31(5), 437–440. http://doi.org/citeulike-article-id:1524120
- Food and Agriculture Organization and the World Food Programme. (2013). Resilience Measurement Principles TOWARDS AN AGENDA FOR MEASUREMENT DESIGN.
- Fox-Rogers, L., Devitt, C., O'Neill, E., Brereton, F., & Clinch, J. P. (2016). Is there really "nothing you can do"? Pathways to enhanced flood-risk preparedness. *Journal of Hydrology*, 543, 330–343. http://doi.org/10.1016/j.jhydrol.2016.10.009
- Fuchs, S., Karagiorgos, K., Kitikidou, K., Maris, F., Paparrizos, S., & Thaler, T. (2017). Flood risk perception and adaptation capacity: a contribution to the socio-hydrology debate. *Earth Syst. Sci*, 215194, 3183–3198. http://doi.org/10.5194/hess-21-3183-2017
- Gallopín, G. C. (2006). Linkages between vulnerability, resilience, and adaptive capacity. *Global Environmental Change*, 16(3), 293–303. http://doi.org/10.1016/j.gloenvcha.2006.02.004
- Garson, G. D. (2012). *Testing Statistical Assumptions. Blue Book Series* (2012th ed.). Associate publishing. Retrieved from http://www.statisticalassociates.com/assumptions.pdf
- Gaskin, C. J., & Happell, B. (2014). On exploratory factor analysis: A review of recent evidence, an assessment of current practice, and recommendations for future use. *International Journal of Nursing Studies*, 51(3), 511–521. http://doi.org/10.1016/j.ijnurstu.2013.10.005
- Hair, J. F., Babin, B. J., & Krey, N. (2017). Covariance-Based Structural Equation Modeling in the Journal of Advertising: Review and Recommendations. *Journal of Advertising*, 46(1), 163–177. http://doi.org/10.1080/00913367.2017.1281777
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). *MULTIVARIATE* DATA ANALYSIS A Global Perspective (Seventh). Pearson.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis. Vectors* (Seventh). Pearson Prentice Hall. http://doi.org/10.1016/j.ijpharm.2011.02.019

- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2012). Partial least squares: the better approach to structural equation modeling? *Long Range Planning*, 45(5–6), 312–319. http://doi.org/10.1016/j.lrp.2012.09.011
- Hamzah, A., Krauss, S. E., Shaffril, H. A. M., Suandi, T., Ismail, I. A., & Abu Samah, B. (2014). Toward understanding Malaysian fishermen's decision making on the use of fishing technology: A mental model approach. *International Journal of Psychology*, 49(5), 397–403. http://doi.org/10.1002/ijop.12010
- Han, Z. (2014). FROM VULNERABILITY TO RESILIENCE: LONG-TERM LIVELIHOOD RECOVERY IN RURAL CHINA AFTER THE 2008 WENCHUAN EARTHQUAKE by Ziqiang Han A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degr.
- Harvey, B. (2011). Negotiating Openness Across Science, ICTs and Participatory Development: Lessons from the AfricaAdapt Network. *Information Technologies & International Development*, 7(1), 19–31. Retrieved from http://itidjournal.org/index.php/itid/article/view/694%5Cnhttp://itidjournal.org jindex.php/itid/article/download/694/292%5Cnhttp://itidjournal.org/index.php/itid/article/view/694/292
- Hashim, F., Razak, N. A., & Amir, Z. (2011). Empowering rural women entrepreneurs with ict skills: An impact study of 1 nita project in Malaysia. *Procedia Social and Behavioral Sciences*, 15, 3779–3783. http://doi.org/10.1016/j.sbspro.2011.04.373
- Hassan, M. A., Md. Salleh, H., Shaffril, H. a M., & D'Silva, J. L. (2009). Problems and obstacles in using Information and Communication Technology (ICT) among Malaysian agro-based entrepreneurs. *European Journal of Scientific Research*, 36(1), 93–101. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-70349826866&partnerID=40&md5=28f897baa8609ef7bcd577e574dd55ac
- Hassan, M. A., Samah, B. A., Shaffril, H. M., & D'Silva, J. L. (2011). Perceived usefulness of ICT usage among JKKK members in Peninsular Malaysia. *Asian Social Science*, 7(10), 255–266. http://doi.org/10.5539/ass.v7n10p255
- Hassan, M. A., Shaffril, H. A., D'Silva, J. L., Omar, S. Z., & Bolong, J. (2011). Fishermen and ICT: Towards creating knowledgeable fishermen in Malaysia. *Australian Journal of Basic and Applied Sciences*, 5(9), 457–469. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-81755172407&partnerID=40&md5=9c467e39f3ec8ef5b68680bbbba14745
- Hautala, K. R. (2013). A Sustainable Livelihood Analysis of Small-Scale Farmers in *M* 'muock, Cameroon Local Realities and Structural Constraints.

- Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. *Communication Monographs*, 76(4), 408–420. http://doi.org/10.1080/03637750903310360
- Hayrol Azril Mohammad Shaffril; Mohd Salleh Hassan. (2012). Agro-Based Entrepreneur.Pdf. International Business Management.
- Heeks, R. (2014). Future Priorities for Development Informatics Research from the Post-2015 Development Agenda (Development Informatics No. 54). Development (Vol. 32). Retrieved from http://www.digitalechancen.de/transfer/downloads/MD280.pdf
- Heeks, R., & Ospina, A. V. (2012a). ICTs, Climate Change and Development: Case Evidence. (A. V. O. Heeks, R., Ed.). Manchester: Centre for Development Informatics. Retrieved from http://www.manchester.ac.uk/escholar/uk-acman-scw:176883
- Heeks, R., & Ospina, A. V. (2012b). *ICTs*, *Climate Change and Development: Themes* and *Strategic* Actions. Retrieved from http://www.niccd.org/sites/default/files/Book ICCD Themes Actions.pdf
- Heeks, R., & Ospina, V. A. (2013). Understanding Urban Climate Change and Digital Infrastructure Interventions from a Resilience Perspective (Development Informatics Working No. Paper No 54). Development Informatics (Vol. 54). Manchester. Retrieved from http://www.digitalechancen.de/transfer/downloads/MD280.pdf
- Heeks, R., Ospina V. Angelica, Ishida, L., Ssenkima, S., Mabirizi, G., Mugabi, N., & Namarome, T. (2015). *Benchmarking Resilience of Agricultural Livelihoods* (Resilience Assessment Benchmarking and Imapct Toolkit (RABIT)). Retrieved from http://www.niccd.org/wpcontent/uploads/2017/03/RABITUgandaFullCaseStudy.pdf
- Heeks, R., & Ospina, A. V. (2015). Analysing urban community informatics from a resilience perspective. *Journal of Community Informatics*, 11(1), 1–14. Retrieved from http://ci-journal.net/index.php/ciej/article/view/1108/1135
- Holling, C. S. (1973). JSTOR: Annual Review of Ecology and Systematics, Vol. 4 (1973), pp. 1-23. *Annual Review of Ecology and Systematics*. Retrieved from http://www.jstor.org/stable/10.2307/2096802%5Cnpapers2://publication/uuid /44C6D432-0F37-4813-958F-6DF2D50982EC
- Holt, K. (2014). analysis A Comparison Between Factor Analysis and Item Response Theory Modeling in Scale Analysis.
- Hua, A. K. (2015). Monsoon Flood Disaster in Kota Bharu , Kelantan Case Study: A Comprehensive Review, *3*(9), 2014–2016.

- Hunt, W. D. (2014). The Role of Extension in Building Capacity and Resilience in Australian Rural Industries PhD Thesis, (December).
- Ibrahim, K., Shabudin, A. F. A., Chacko Koshy, K., & Asrar, G. R. (2016). A new framework for integrated climate finance and inclusive responses to sustainable development in Malaysia. *Geomatics, Natural Hazards and Risk*, 7(6), 1754–1768. http://doi.org/10.1080/19475705.2016.1155503
- Imam, N., Hossain, M. K., & Saha, T. R. (2017). Potentials and Challenges of Using ICT for Climate Change Adaptation: A Study of Vulnerable Community in Riverine Islands of Bangladesh. In H. Kaur, E. Lechman, & A. Marszk (Eds.), *Catalyzing Development through ICT Adoption: The Developing World Experience* (pp. 89–110). Cham: Springer International Publishing. http://doi.org/10.1007/978-3-319-56523-1
- Inquirer. (2015, January 3). Damage due to Malaysia flood close to \$ 284M, pp. 1–4. Retrieved from http://newsinfo.inquirer.net/662008/damage-due-to-malaysiaflood-close-to-284m
- IPCC. (2007). *IPCC Fourth Assessment Report (AR4)*. *IPCC* (Vol. 1). Retrieved from http://www.ipcc.ch/publications\_and\_data/publications\_ipcc\_fourth\_assessm ent\_report\_wg2\_report\_impacts\_adaptation\_and\_vulnerability.htm%5Cnhttp ://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf
- IPCC. (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Core Writing Team, R.K. Pachauri and L.A. Meyer. http://doi.org/10.1017/CBO9781107415324.004
- Islam, M. M., Sallu, S., Hubacek, K., & Paavola, J. (2014). Vulnerability of fisherybased livelihoods to the impacts of climate variability and change: Insights from coastal Bangladesh. *Regional Environmental Change*, 14(1), 281–294. http://doi.org/10.1007/s10113-013-0487-6
- Ismail, N. H., Karim, M. Z. A., & Basri, B. H. (2016). Flood and land property values. *Asian Social Science*, 12(5), 84–93. http://doi.org/10.5539/ass.v12n5p84
- ITU. (2014). Measuring the Information Society Report 2014. International Telecommunication Union (Vol. 8). http://doi.org/10.3359/oz0303157
- Jackson, T. (2005). Motivating Sustainable Consumption. A Review of Evidence on Consumer Behaviour and Behavioural Change In A Report to the Sustainable Development Research Network as Part of the ESRC Sustainable Technologies Programme Centre for Environmental Strategy University of Surrey Guildford, 15(January), 1027–1051. http://doi.org/10.1260/0958305043026573

- Joerin, J., & Luo, Y. (2015). Experiences of Private Sector Involvement in DRR in Europe: Focus on Insurance. In *Disaster Management and Private Sectors: Challenges and Potentials* (pp. 69–82). http://doi.org/10.1007/978-4-431-55414-1
- Jones, L., & Tanner, T. (2015). Measuring "subjective resilience" using people's perceptions to quantify household resilience Cover photo: CGIAR Research Programme on Dryland Systems: Indigenous knowledge for resilience in marginal drylands -Tunisia. Retrieved from www.odi.org%5Cnwww.odi.org/facebook%5Cnwww.odi.org/twitter
- Karen MacDonell, Xinguang Chen, Y. Y. and al. (2013). A Protection Motivation Theory-Based Scale for Tobacco Research among Chinese Youth. *Addoctionn Research and Therapy*, 4(3), 154. http://doi.org/10.4172/2155-6105.1000154
- Karim, A. H. M. Z., Noon, H. M., 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*, (September). http://doi.org/10.5901/mjss.2016.v7n5p192
- Kassenga, G. R., Mbegha, A. R., Guido, U., Malele, B., & Rugai, D. (2012). INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT) AND DISASTER RISK MANAGEMENT (DRM) IN TANZANIA -- A CASE STUDY. Saudi Med J, 33, 3–8. http://doi.org/10.1073/pnas.0703993104
- Kellens, W., Terpstra, T., Schelfaut, K., & De Maeyer, P. (2013). Perception and Communication of Flood Risks: A Systematic Review of Empirical Research. *Risk Analysis*, 33(1), 24–49. http://doi.org/10.1111/j.1539-6924.2012.01844.x
- Kellens, W., Zaalberg, R., Neutens, T., Vanneuville, W., & De Maeyer, P. (2011).
  An Analysis of the Public Perception of Flood Risk on the Belgian Coast. *Risk Analysis*, 31(7), 1055–1068. http://doi.org/10.1111/j.1539-6924.2010.01571.x
- Keshavarz, M., & Karami, E. (2016). Farmers' pro-environmental behavior under drought: Application of protection motivation theory. *Journal of Arid Environments*, *127*(December 2015), 128–136. http://doi.org/10.1016/j.jaridenv.2015.11.010
- Khalid, M. S., Mustaffa, C. S., Marzuki, M. N., Fo, M., Sipon, S., Taib, M., & Shafiai, S. (2015). Failure to React Positively to Flood Early Warning Systems: Lessons Learned by Flood Victims from Flash Flood Disasters: The Malaysia Experience. *International Journal of Social, Behavioral, Educational, Economic and Management Engineering*, 9(5), 1331–1335.

- 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
- Khayyati, M., & Aazami, M. (2016). Drought impact assessment on rural livelihood systems in Iran. *Ecological Indicators*, 69, 850–858. http://doi.org/10.1016/j.ecolind.2016.05.039
- King, C. A. (2008). Community Resilience and Contemporary Agri-Ecological Systems: Reconnecting People and Food, and People with People. *Systems Research and Behavioral Science*, 8(3), 27–42. http://doi.org/10.1002/sres
- Koerth, J., Vafeidis, A. T., Hinkel, J., & Sterr, H. (2013). What motivates coastal households to adapt pro-actively to sea-level rise and increasing flood risk? *Regional Environmental Change*, *13*(4), 897–909. http://doi.org/10.1007/s10113-012-0399-x
- Koirala, S. (2015). Livelihood Vulnerability Assessment to the Impacts of Socio-Environmental Stressors in Raksirang VDC of Makwanpur District Nepal.
- Koutsouris, A. (2012). Facilitating Agricultural Innovation Systems: A critical realist approach. *Studies in Agricultural Economics*, 114(2), 64–70. http://doi.org/10.7896/j.1210
- Krejcie, R. V, & Morgan, D. W. (1970). Determining Sample Size for Research Activities Robert. *Educational and Psychological Measurement*, 38(1), 607–610. http://doi.org/10.1177/001316447003000308
- Kumar, R. (2014). *RESEARCH METHODOLOGY: A STEP BY STEP GUIDE FOR BEGINNERS* (Fourth Edi). Sage Publications. http://doi.org/10.1017/CBO9781107415324.004
- Li, L., Fei, X., Xu, J., & Slater, H. (2012). Scoping assessment of knowledge needs in climate change adaptation in China. Retrieved from http://www.ied.cn/sites/default/files/Scoping assessment of knowledge needs in climate change adaptation in China.pdf
- Lieske, D. J., Wade, T., & Roness, L. A. (2014). Climate change awareness and strategies for communicating the risk of coastal flooding: A Canadian Maritime case example. *Estuarine, Coastal and Shelf Science, 140*, 83–94. http://doi.org/10.1016/j.ecss.2013.04.017
- Lim, J. (2018). This Major Tunnel In Malaysia Has Been Listed As One Of The World 's Greatest. Says.com, pp. 1–10. Kula Lumpur. Retrieved from http://says.com/my/news/smart-tunnel

- Loh, Y. A. (2015). Approaches to ICT for development (ICT4D): vulnerabilities vs. capabilities. *Information Development*, 31(3), 229–238. http://doi.org/10.1177/0266666913513198
- Ludin, S. M., & Arbon, P. A. (2017). Improving community disaster resilience through scorecard self-testing. *Disaster Prevention and Management: An International Journal*, 26(1), 13–27. http://doi.org/10.1108/DPM-08-2016-0177
- Mackinnon, D. (2008). Introduction to Statistical Mediation Analysis. In *APA Handbook of Research Methods in Psychology*. Routledge. http://doi.org/10.4324/9780203809556
- Maiye, a, & McGrath, K. (2010). ICTs and sustainable development: A capability perspective. *16th Americas Conference on Information Systems 2010, AMCIS 2010, 4, 3049–3064.* Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-84870364942&partnerID=40&md5=1dcbad1f736610c2aeb0f5a3f89d7100
- Makoza, F., & Wallace, C. (2012). Application of Sustainable Livelihood Approach in assessing the impact of ICT use in microenterprises in developing countries. Abstract: Microenterprises in the South African context. *The Electronic Journal of Information Systems in Developing Countries*, 53(1), 1–16. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/j.1681-4835.2012.tb00374.x/pdf
- Malaysia Economic Planning Unit, P. M. D. (2016). Chapter 6 Thrust IV : Pursuing Green Growth for Sustainability and Resilience. *Eleventh Malaysia Plan*, 1– 21.
- Malaysian Economic Planning Unit. (2001). Eighth Malaysian Plan, 2001-2005. In *Poverty, Eradication and Restructuring of Society* (pp. 1995–2005).
- Martilla, J. A., & James, J. C. (1977). Importance-Performance Analysis. *Journal of Marketing*, 41(1), 77–79.
- Masinde, M. (2014). An Effective Drought Early Warning System for Sub- Saharan Africa : Integrating Modern and Indigenous Approaches, 60–69.
- Mazuki, R., & Man, N. (2014). Acceptance of Technology among Malaysian Fishermen. Asian Social Science, 10(16), 1–5. http://doi.org/10.5539/ass.v10n16p1
- Mazuki, R., Omar, S. Z., Bolong, J., D'Silva, J. L., Hassan, M. A., & Shaffril, H. A. M. (2013). Social influence in using ICT among fishermen in Malaysia. *Asian Social Science*, 9(2), 135–138. http://doi.org/10.5539/ass.v9n2p135

- Meera, S. N., Balaji, V., Muthuraman, P., Sailaja, B., & Dixit, S. (2013). Changing Roles of Extension: Agricultural Harnessing Information and Communication Technology (ICT) for Adapting to Stresses Envisaged Under Climate Change. In Crop Stress and its Management: Perspectives and *Strategies* (Vol. 585-605). 53, pp p. http://doi.org/10.1017/CBO9781107415324.004
- Meng, C. C., Omar, S. Z., Kamaruddin, N., Bolong, J., D'Silva, J. L., & Shaffril, H. A. M. (2014). Media Usage among the Coastal Communities in Malaysia. *Asian Social Science*, 10(8), 30–34. http://doi.org/10.5539/ass.v10n8p30
- Meng, C. C., Samah, B. A., & Omar, S. Z. (2013). A review paper: Critical factors affecting the development of ICT projects in Malaysia. *Asian Social Science*, 9(4), 42–50. http://doi.org/10.5539/ass.v9n4p42
- Montaño, D., & Kasprzyk, D. (2008). *Theory of reasoned action, theory of planned behaviour, and the integrated behavioral model. Health Behaviour and Health Education. Theory, Research, and Practice.* http://doi.org/10.1016/S0033-3506(49)81524-1
- Morse, S., & McNamara, N. (2013). Sustainable livelihood approach: A critique of theory and practice. Sustainable Livelihood Approach: A Critique of Theory and Practice (Vol. 9789400762). Springer Berlin Heidelberg. http://doi.org/10.1007/978-94-007-6268-8
- Mudombi, S. (2014). Analysing the contribution of ICTS in addressing climate change amongst communal farmers from two districts of Zimbabwe.
- Muhammad, M., Idris, K., Ariffin, E. H., Shaffril, H. A. M., Samah, B. A., & Suandi, T. (2016). The impact of climate change on small-scale fishermen in Malaysia. *Social Sciences (Pakistan)*, 11(13), 3352–3356. http://doi.org/10.3923/sscience.2016.3352.3356
- Muktar, B. G., Mukhtar, U., & Ahungwa, G. T. (2015). Harvesting Youth for Agroentrepreneurship : Stimulus Role of Social Media in Nigeria. *International Journal of Applied Research and Technology*, 4(11), 94–100.
- Mustaffa, C. S., Marzuki, N. A., Ariffin, M. T., Salleh, N. 'Aaina, & Rahaman, N. H. (2014). Relationship between Social Support, Impression Management and Well-being among Flood Victims in Malaysia. *Procedia Social and Behavioral Sciences*, 155(October), 197–202. http://doi.org/10.1016/j.sbspro.2014.10.279
- Nasir, R., Zainah, A. Z., & Khairudin, R. (2012). Psychological effects on victims of the Johor Flood 2006/2007. Asian Social Science, 8(8), 126–133. http://doi.org/10.5539/ass.v8n8p126

- Nazli, N. N. N. N., Sipon, S., & Radzi, H. M. (2014). Analysis of Training Needs in Disaster Preparedness. *Proceedia - Social and Behavioral Sciences*, 140, 576– 580. http://doi.org/10.1016/j.sbspro.2014.04.473
- Nettle, R., Ayre, M., Beilin, R., Waller, S., Turner, L., Hall, A., ... Taylor, G. (2015). Empowering farmers for increased resilience in uncertain times. *Animal Production Science*. http://doi.org/10.1071/AN14882
- Noorhashirin, H., Faiza, N. T., Mohammad, F. R., & Juni, M. H. (2016). Assessing malaysian disaster preparedness for flood. *International Journal of Public Health and Clinical Sciences*, 3(2), 1–15.
- Norman, P., Boer, H., & Seydel, E. R. (2005). Protection motivation theory. Predicting Health Behaviour: Research and Practice with Social Cognition Models. Retrieved from http://psycnet.apa.org/psycinfo/1997-36396-006
- Obrist, B., Pfeiffer, C., & Henley, R. (2010). Multi-layered social resilience: a new approach in mitigation research. *Progress in Development Studies*, 10(4), 283–293. http://doi.org/10.1177/146499340901000402
- Omar, S. Z., Hassan, M. A., Azril, H., Shaffril, M., Bolong, J., & Silva, J. L. D. (2011). Information and communication technology for fisheries industry development in Malaysia. *African Journal of Agricultural Research*, 6(17), 4166–4176.
- Ospina, A. V., & Heeks, R. (2010). Linking ICTs and Climate Change Adaptation: A conceptual Framework for e-Resilience and e-Adaptation. Retrieved from niccd.org/sites/default/files/ConceptualPaper.pdf
- Ospina, V. A., Heeks, R., Camacho, K., Calvo, M., Zúñiga, V., Barrios, P., ... Rojas, I. (2015). Benchmarking Urban Community Resilience.
- Ospina, A. V, & Heeks, R. (2015). Benchmarking, Visualising and Strengthening ICTs ' Impact on Agricultural Livelihoods ' Resilience : A Ugandan Case Study.
- Paek, H.-J. (2016). Effective risk governance requires risk communication experts. *Epidemiology* and *Health*, 38, e2016055. http://doi.org/10.4178/epih.e2016055
- Pallant, J. (2011). For the SPSS Survival Manual website, go to www.allenandunwin.com/spss This is what readers from around the world say about the SPSS Survival Manual : (4th ed.). Allen & Unwin.
- Parkinson, S., & Ramirez, R. (2006). Using a sustainable livelihoods approach to assess the impact of ICTs in development. *The Journal of Community Informatics*, 2(3), 116–127. Retrieved from http://ci-journal.net/index.php/ciej/article/view/310

- Pertubuhan Akitek Malaysia. (2015). STRATEGIC INITIATIVES IN FLOOD DISASTER PREPAREDNESS & MITIGATION FOR MALAYSIA February 2015, 1–57.
- Petty, R. E., Barden, J., & Wheeler, S. C. (2009). The Elaboration Likelihood Model of persuasion: health promotions that yield sustained behavioral change. *Emerging Theories in Health Promotion Practive and Research*, 71–99.
- Pitrėnaitė-Žilenienė, B., Carosi, A., & Vallesi, P. (2014). Enhancing Societal Resilience Against Disasters: Engaging the Public Via Social Technologies. *Social Technologies*, 4(2), 318–332. http://doi.org/10.13165/ST-14-4-2-06
- Raiti, G. C. (2007). The Lost Sheep of ICT4D Literature. *Information Technologies* and *International Development*, 3(4), 1–8. http://doi.org/10.1162/itid.2007.3.4.1
- Ramli, S. A. B., Omar, S. Z., Bolong, J., D'Silva, J. L., & Shaffril, H. A. M. (2013). Behavioral intention towards ICT usage among fishermen in malaysia. *Research Journal of Applied Sciences*. http://doi.org/10.3923/rjasci.2013.221.224
- Reed, M. S., Podesta, G., Fazey, I., Geeson, N., Hessel, R., Hubacek, K., ... Thomas,
   A. D. (2013). Combining analytical frameworks to assess livelihood vulnerability to climate change and analyse adaptation options. *Ecological Economics*, 94, 66–77. http://doi.org/10.1016/j.ecolecon.2013.07.007
- Riaz, L., & Hunjra, A. I. (2015). Relationship between Psychological Factors and Investment Decision Making: The Mediating Role of Risk Perception. *Pakistan Journal of Commerce and Social Sciences*, 9(3), 968–981.
- Robinson, T. J., Borror, C. M., & Myers, R. H. (2004). Robust parameter design: A review. *Quality and Reliability Engineering International*, 20(1), 81–101. http://doi.org/Doi 10.1002/Qre.602
- Rogers, R. W. (1975). A Protection Motivation Theory of Fear Appeals and Attitude Change. *The Journal of Psychology*, *91*(1), 93–114. http://doi.org/10.1080/00223980.1975.9915803
- Rogers, R. W. (1985). Attitude Change and Information Integration. *Psychological Reports*, 56, 179–182. http://doi.org/10.2466/pr0.1985.56.1.179
- Rohn, E., & Erez, G. (2013). A framework for agro-terrorism intentions detection using overt data sources. *Technological Forecasting and Social Change*, 80(9), 1877–1884. http://doi.org/10.1016/j.techfore.2013.06.008
- Sagun, A. (2010). Efficient Deployment of ICT Tools in Disaster Management Process. In E. Asimakopoulou, N. Bessis, E. Asimakopoulou, & N. Bessis (Eds.), Advanced ICTs for Disaster Management and Threat Detection (pp. 95–107). IGI Global. http://doi.org/10.4018/978-1-61520-987-3.ch007

- Schipper, E. L. F., & Langston, L. (2015). A comparative overview of resilience measurement frameworks analysing indicators and approaches. Overseas Development Institute - Working Paper 422. Retrieved from www.odi.org%5Cnwww.odi.org/facebook%5Cnwww.odi.org/twitter
- Seng Wong, M., Hideki, N., & George, P. (2011). The Use of Importance-Performance Analysis (IPA) in Evaluating Japan's E-government Services. *Journal of Theoretical and Applied Electronic Commerce Research*, 6(2), 5– 6. http://doi.org/10.4067/S0718-18762011000200003
- Seri, D., Razak, N., Kebangsaan, S., Batang, K., Chepa, P., Mustapa, D. S., ... Kassim, S. (2014, December 27). Najib visits Flood-affected areas in Kelantan. *Malaymail on Line*. Kula Lumpur.
- Shaffril, H. A. M., Abu Samah, A., & D'Silva, J. L. (2017). Climate change: Social adaptation strategies for fishermen. *Marine Policy*, *81*(July), 256–261. http://doi.org/10.1016/j.marpol.2017.03.031
- Shaffril, H. A. M., Omar, S. Z., Hassan, M. A., Bolong, J., & Silva, J. L. (2012). Measuring ICT Usage among West Coast Fishermen : Pre-Test Results from Port Dickson, Negeri Sembilan. *American Journal of Agricultural and Biological Sciences*, 7(1), 21–27.
- Shafiq, F., & Ahsan, K. (2014). An ICT based Early Warning System for Flood Disasters in Pakistan. *Res.J.Recent Sci.*, 3(October 2005), 108–118.
- Shafrill, A. M., Abu Samah, B., D'Silva, J. L., & Yassin, S. M. (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
- Sharma, B. M. S. (2018). Affected fishermen and farmers get RM3mil federal funds, pp. 28–31.
- Silva, F., & Fernandes, P. (2011). Importance-performance analysis as a tool in evaluating higher education service quality: the empirical results of ESTiG (IPB). International Business Information Management Association Conference, 306–315. Retrieved from https://bibliotecadigital.ipb.pt/handle/10198/7120
- Siti Zobidah, O., & Chhachhar, A. (2012). A review on the roles of ICT tools towards the development of fishermen. *Journal of Basic and Applied Scientific* ..., 2(10), 9905–9911. Retrieved from http://www.researchgate.net/profile/Abdul\_Razaque\_Chhachhar3/publication /233741219\_A\_Review\_on\_the\_Roles\_of\_ICT\_Tools\_towards\_the\_Develop ment of Fishermen/links/54269ef50cf238c6ea7901b9.pdf
- Slovic, P. (1987). The perception of risk. *Science, New Series*. http://doi.org/10.1126/science.3563507

- Solar, R. W. (2011). Scoping Assessment on Climate Change Adaptation in Malaysia. (R. W., Ed.)2001 (First). AIT-UNEP RRC.AP 2011. Retrieved from http://www.rrcap.ait.asia/Publications/Malaysia.pdf
- Steer, A., & Wade-gery, W. (1992). Sustainable Development : Theory and Practice for a Sustainable Future. *Sustainable Development*, 1(3), 23–35.
- Stephen, M., & McNamara, N. (2013). Sustainable Livelihood Approach, A Critique of Theory and Practice (Vol. 53). Springer Berlin Heidelberg. http://doi.org/10.1017/CBO9781107415324.004
- Strong, R., Ganpat, W., Harder, A., Irby, T. L., & Lindner, J. R. (2014). Exploring the Use of Information Communication Technologies by Selected Caribbean Extension Officers. *The Journal of Agricultural Education and Extension*, 20(5), 485–495. http://doi.org/10.1080/1389224X.2014.927373
- Sussman, S., Omar, S. Z., Bolong, J., & Osman, M. (2011). Facebook Addiction Among Female University Students. *International Journal of Environmental Research and Public Health*, 2(7), 96–109. Retrieved from http://www.uvvg.ro/revad/files/nr7/10. sharifah.pdf
- Tabachnick, B. G. B. G., & Fidell, L. S. L. S. (2007). Using Multivariate Statistics. PsycCRITIQUESTabachnick, B. G., & Fidell, L. S. (2007). Using Multivariate Statistics. PsycCRITIQUES (Vol. 28). http://doi.org/10.1037/022267 (5th ed., Vol. 28). Boston: Pearson Education. http://doi.org/10.1037/022267
- Tang, Q., Bennett, S. J., Xu, Y., & Li, Y. (2013). Agricultural practices and sustainable livelihoods: Rural transformation within the Loess Plateau, China. *Applied Geography*, 41, 15–23. http://doi.org/10.1016/j.apgeog.2013.03.007
- Tanner, T., Lewis, D., Wrathall, D., Bronen, R., Cradock-Henry, N., Huq, S., ... Thomalla, F. (2014). Livelihood resilience in the face of climate change. *Nature Climate Change*, 5(1), 23–26. http://doi.org/10.1038/nclimate2431
- Tarhan, C., Aydin, C., & Tecim, V. (2016). How can be Disaster Resilience Built with Using Sustainable Development? *Procedia - Social and Behavioral Sciences*, 216, 452–459. http://doi.org/10.1016/j.sbspro.2015.12.059
- Taylor, A. L., Dessai, S., & Bruine de Bruin, W. (2014). Public perception of climate risk and adaptation in the UK: A review of the literature. *Climate Risk Management*, 4, 1–16. http://doi.org/10.1016/j.crm.2014.09.001
- Terjesen, S. (2004). Sen â€<sup>TM</sup> s " Development as Freedom ." *Graduate Journal of Social Science*, *1*(2), 1–9.

- Terpstra, T. (2011). Emotions, Trust, and Perceived Risk: Affective and Cognitive Routes to Flood Preparedness Behavior. *Risk Analysis*, 31(10), 1658–1675. http://doi.org/10.1111/j.1539-6924.2011.01616.x
- Terpstra, T., Gutteling, J. M., Geldof, G. D., & Kappe, L. J. (2006). The perception of flood risk and water nuisance. *Water Science and Technology*, 54(6–7), 431–439. http://doi.org/10.2166/wst.2006.573
- The Star Online. (2015). Agriculture sector suffers RM299mil loss due to floods. *The Star Online*, 2–3. Retrieved from http://www.thestar.com.my/news/nation/2015/02/18/agriculture-sector-suffers-rm299mil-loss-due-to-floods/
- Thulstrup, A. W. (2015). Livelihood Resilience and Adaptive Capacity: Tracing<br/>Changes in Household Access to Capital in Central Vietnam. WORLD<br/>DEVELOPMENT, 74, 352–362.<br/>http://doi.org/10.1016/j.worlddev.2015.05.019
- Tran, T. A. (2015). The role of social capital and community ties in rebuilding livelihoods of displaced households in peri-urban areas of Ho Chi Minh City.
- UNDP. (2011). Communciation for development: strenthening the effectiveness of the United Nations. New York.
- UNESCO. (2007). The UNESCO ICT in Education Programme. Bangkok.
- United Nations. (2011). *The Social Dimensions of Climate Change*. Retrieved from http://www.who.int/globalchange/mediacentre/events/2011/social-dimensions-of-climate-change.pdf
- United Nations Asian and Pacific Training Centre for Information and Communication, & (Un-Apcict/Escap), A. and P. T. C. for I. and C. T. for D. (2010). *ICT for Disaster Risk Reduction* (2nd ed.). United Nations Asian and Pacific Training Centre for Information and Communication Technology for Development.
- Unwin, A. (2013). Discovering Statistics Using R by Andy Field, Jeremy Miles, Zoë Field. (M. Carmichael & R. Lupon, Eds.)International Statistical Review (Fouth, Vol. 81). Sage Publications Ltd. http://doi.org/10.1111/insr.12011\_21
- 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 rice industry. *Journal of Integrative Environmental Sciences*, 13(1), 19–35. http://doi.org/10.1080/1943815X.2015.1112292
- Visschers, V. H. M., Wiedemann, P. M., Gutscher, H., Kurzenhauser, S., Seidl, R., Jardine, C. G., & Timmermans, D. R. M. (2012). Affect-inducing risk communication: Current knowledge and future directions. *Journal of Risk Research*, 15(3), 257–271. http://doi.org/10.1080/13669877.2011.634521

- Walsham, G. (2017). ICT4D research: reflections on history and future agenda. *Information Technology for Development*, 23(1), 18–41. http://doi.org/10.1080/02681102.2016.1246406
- 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*, 6(3), 340–344. http://doi.org/10.5901/mjss.2015.v6n3s2p340
- Wan Zin, W. Z., Jamaludin, S., Deni, S. M., & Jemain, A. A. (2010). Recent changes in extreme rainfall events in Peninsular Malaysia: 1971-2005. In *Theoretical* and Applied Climatology (Vol. 99, pp. 303–314). http://doi.org/10.1007/s00704-009-0141-x
- Wang, X., & Li, Y. (2016). Understanding collaborative resilience from continuous disruption: an actor-network perspective. *Behaviour & Information Technology*, 35(2), 151–162. http://doi.org/10.1080/0144929X.2015.1027875
- Warner, L. A., Chaudhary, A. K., & Alexa J. Lamm. (2016). Using Importance-Performance Analysis to Guide Extension Needs Assessment Applying IPA to Extension Messaging. *Journal of Extension*, 54(6).
- Wegscheidl, C., Coutts, J., & West, A. (n.d.). The role of agricultural extension in improving the health and resilience of the Great Barrier Reef. *Extension Farming Systems Journal*, 9(1), 196–203.
- Wickramasinghe, K. (2011). Role of ICTs in Early Warning of Climate Related Disasters : A Sri Lankan Case Study Author : Kanchana Wickramasinghe. In International Forestry and Environment Symposium (pp. 1–6).
- Williams, K. C. (2012). Fear appeal theory. *Research in Business and Economics Journal*, 1–21.
- Williams, L. (2011). Impact of climate change on fisheries and aquaculture in the developing world and opportunities for adaptation Key words. *Fisheries Thematic Paper*.
- Wong, T. S., Gaston, A., DeJesus, S., & Prapavessis, H. (2016). The utility of a protection motivation theory framework for understanding sedentary behavior. *Health Psychology and Behavioral Medicine*, 4(1), 29–48. http://doi.org/10.1080/21642850.2015.1128333
- World Bank. (2012). Agricultural Innovation Systems: An Investment Sourcebook. The World Bank. http://doi.org/10.1596/978-0-8213-8684-2
- World Bank. (2016). Malaysia Rural population Percentage of total population). Retrieved March 20, 2018, from http://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?end=2015&locations =IN&start=1960&view=chart

- World Economic Forum. (2015). *The global information technology report 2015*. *Organizacija znanja* (Vol. 8). http://doi.org/10.3359/oz0304203
- Xiao, H., Li, S., Chen, X., Yu, B., Gao, M., Yan, H., & Okafor, C. N. (2014). Protection Motivation Theory in Predicting Intention to Engage in Protective Behaviors against Schistosomiasis among Middle School Students in Rural China. *PLoS Neglected Tropical Diseases*, 8(10). http://doi.org/10.1371/journal.pntd.0003246
- Xiao, H., Peng, M., Yan, H., Gao, M., Li, J., Yu, B., ... Li, S. (2016). An instrument based on protection motivation theory to predict Chinese adolescents' intention to engage in protective behaviors against schistosomiasis. *Global Health Research and Policy*, 1(1), 15. http://doi.org/10.1186/s41256-016-0015-6
- Yusof, Z. F. M., Kamaruddin, N., Omar, S. Z., Bolong, J., & Shaffril, J. L. D. H. A. M. (2014). *Gratification towards weather information*. *The social Sciences* 9(3): 195-199,2014. Madwell Journals, 2014.
- Zaremohzzabieh, Zeinal, Bahaman Abu Samah, S. Z. O. (2014). Fishermen acceptance of ICTs moderating effect of age.pdf. *Journal of Applied Sciences* 14 (9), (14 (9)).
- Zurinah Tahir, AbdulMalek, J., & Ibrahim, M. A. (2016). DEVELOPING SMART ICT IN RURAL COMMUNITIES IN MALAYSIA THROUGH THE ESTABLISHMENT OF TELECENTERS Zurinah Tahir, Jalaluddin Abdul Malek & Mohd Asruladlyi Ibrahim. *E-Bangi Journal of Social Sciences and Humanities Faculty of Social Sciences and Humnaities Universiti Kebangsaan Malaysia*, 11(1), 227–242.