

## **Fishers ICTs Use for Early Warning Reception, It's Effect on Livelihood Resilience and Sustainability in East Coast Malaysia**

Bashir G. Muktar<sup>1&2\*</sup>, Norsida Man<sup>1</sup>, Nitty H. Kamaruzzaman<sup>1</sup>, Asnarulkhadi Abu Samah<sup>1</sup> and Sulaiman Umar<sup>1&3</sup>

<sup>1</sup> Universiti Putra Malaysia 43300

<sup>2</sup> Federal University Dutse PMB 7156

<sup>3</sup> Institute for Agricultural Research, Ahmadu Bello University, PMB 1044, Zaria, Nigeria;

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**Abstract:** Climate change is posing a serious threat to agriculture and hence food security of nations. Achieving sustainable development goals (SDGs) is thus contingent on adaptation measures that are aimed to reduce vulnerability and build resilience. The ICTs are recognized for strengthening Livelihood Resilience (LR), by providing the necessary support for learning process, flexibility in operations or actions and robustness for continued functionality. Yet, empirical literature is scarce on the effect it has on LR, The research while filling this gap, claims initial application of Protective Motivation Theory to assess the effect of ICTs on LR of agricultural communities like Fisher Folks in Malaysia. Findings reveals Social networking as the main reason for use of ICTs by fisher folks, while early warning dissemination is always channelled through radio with other ICTs complementing. The Multiple Regression revealed additional source of income, threat appraisals (perceived vulnerable and severity of flood), coping appraisal of (self-efficacy) to be key determinants of adaptive behaviour and hence are precursor for LR. Thus it can be said that both ICTs Use and PMT constructs affect the LR, suggesting a focus on innovative use of ICTs for adaptation motivation in flood risk reduction communication.

**Keywords:** risk perception; Livelihood Resilience; Flood risk; Early Warning; ICTS

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### **II. Introduction**

The achievement of the core goals for Sustainable Development Goals (SDGs) of ending hunger, achieving food security and improving nutritional status of countries is at the mercy of climate change and its resultant weather anomalies. Increasing frequency of disaster has been eroding developmental gains and threatening life (Ismail, Karim, & Basri, 2016). Hence, these disasters especially flood are labelled as serious developmental and humanitarian issues that need urgent attention (The United Nations Office for Disaster Risk Reduction (UNISDR), 2015; Wahlstrom & Guha-Sapir, 2015). Consequently, the social dimension to adaptation which is building resilience is seen as a necessary action for the achievement of sustainable development and in doing that ICTs role in this has been underscored. Agriculture is the worst hit by disasters and as such an obvious threat to food systems, food security is apparent and therefore the need to Livelihood Resilience (LR) of agricultural systems is prioritized by development practitioners and policy makers (FAO, 2013, 2016; Heeks et al., 2015) of both governments and Non-Governmental Organizations (NGOs). The fisher folks are among the most vulnerable population within the agricultural systems in the world, due to their habituation nature and socio-economic characteristics which is marked by poverty and educational backwardness. Building upon structural mitigation measures, policy makers have recognized the need to focus on social dimensions of adaptation through building resilience. This is because the basis for risk reduction is primarily a social construct, where resultant personal choices, constraints and behaviours plays significant roles. In order to achieve such actions or behaviour, there has been conscious attempts to motivate a proactive behaviour and actions by organizations, governments and NGOs. Central to which is the aspect of communication of climate information and services like early warning among others, which form the basis for preparedness to avert or at least reduce risks to weather extreme events. The Information Communication Technologies (ICTs) has been highly utilized in the communication of risks and resilience building of agricultural livelihoods (Ospina & Heeks, 2015; M.Tjoa & S. Tjoa, 2016). Yet, there is scarce empirical evidence at best of the effect of such flood risks communications through ICTs, especially on agricultural LR (Haer, Botzen, & Aerts, 2016; Kellens, Terpstra, Schelfaut, & De Maeyer, 2013). Most often, studies of ICTs have highlighted their effect on general socio-economic wellbeing and or work performance of agricultural practitioners (Alderete, 2017); its facilitative role in development (Malaquias, Malaquias, & Hwang, 2017); its importance in information dissemination among farmers

(Mwombe, Mugivane, Adolwa, & Nderitu, 2014) and even its empowering ability to agro-entrepreneurs (Hashim, Razak, & Amir, 2011). However, little attention is given to the assessment of the impact of ICTs on LR, this is despite their wide acceptability and deployment for resilience building. The global agreements like Paris Agreement, the SDGs, Sendai Framework and the National Adaptation Plans signed in 2015, have all highlighted the need for adaptation and resilience. Adaptation to climate change and building a resilient population are seen as key to ensuring sustainable development, within which the role of ICTs as a tool is crystal in promoting the adaptive behaviour and achievement of these goals (Imam, Hossain, & Saha, 2017; Maiye & McGrath, 2010). In this regard, countries like Malaysia has deliberately deployed ICTs as drivers of national development with an aim to build a knowledgeable and resilient population (Malaysia Economic Planning Unit, 2016). Specifically, the government has promoted the use of ICTs for fishing communities in both their fishing activities and extension services (Omar et al., 2011). Furthermore, ICTs have been promoted in all spheres of life, from the educational system (Hoque, Ahmad Zabidi Abdul Razak, & Zohora, 2012), to the extension service delivery (Siraj et al., 2012), and has been used and shown to have greater potentials in the incessant flood risk reduction efforts of the country (Imam, Hossain, & Saha, 2017; Khalid et al., 2015; Khalid & Shafiai, 2015; Yazid et al., 2017). This research therefore is aimed at answering the following questions; what is the reason of ICTs use among fisher folks in east coast Malaysia, which ICTs is mostly utilized for flood risk communication and how has it helped developed the LR of the respondents. These questions are answered through utilizing for the first time the Protective Motivation Theory (PMT), both in the context of fishing communities and in assessing flood risk communication effect on LR in the country. The objectives therefore are to assess the ICTs use by the fisher folks in the study area, the ICTs utilized by authorities for disseminating climate information like early warning and risks communication and its effect on the Livelihood resilience of the respondents.

## **1.1 Background**

### **1.1.1 Flood risk threat to fishing industry and food security in Malaysia**

Climate change and its extreme events of temperature rise, storms and flood are known to be seriously threatening the environment and sustainability of the fishing livelihoods (FAO, 2016). The effect of the weather anomalies affects the fish population through the disruption of their reproductive cycles and the overall productivity of the fishing venture. To the fisher folks there is a social and economic impact where their physical assets can be destroyed and this will cascade down on the economic capacity of the family, which will in turn affect their food security and overall development. It has been reported that on the usual reaction for fishermen to incessant flood is to move out of the fishing practice (FAO, 2016). Conversely, the fisher folks are exiting the fishing activities in Malaysia in an attempt to reduce vulnerability. The authorities have identified this and have taking corrective measures to attract and retain the fisher folks in the fishing activities by incentivizing the fishing industry by some token money amounting to RM 200 (66 USD) on monthly basis (Hamzah et al., 2014). The attraction of the youth and other citizens has long been seen as a non-sustainable solution to the vulnerability problem but rather a focus on the increase of the adaptive capacity for a better preparedness and eventual LR should be the goal (Shaffril, Abu Samah, & D'Silva, 2017).

### **1.1.2 Livelihood Resilience**

Livelihood Resilience (LR) is the capacity and or ability of people to sustain and function in the face of shocks and or disturbances, which could be environmental, economic, social and or political (Tanner et al., 2014). LR has been described as an additional value that is used to describe the livelihood systems as being able to deal with extreme consequences, enhance its capabilities and as such underscoring its sustainability or otherwise (Chinwe Ifejika, Wiesmann, & Rist, 2014). These extreme events are great threats to the endurance of environmental or socio-economic development and slows the rural livelihood rejuvenation process (Osbahe, Twyman, Neil Adger, & Thomas, 2008). The findings of a research by (Islam, Sallu, Hubacek, & Paavola, 2014) suggests that for such vulnerabilities to be reduced in especially coastal fishing communities, there should be a multi-faceted approach which emphasizes adaptive capacity and resilience building. Livelihood resilience is therefore acquired through the building of adaptive capacity and taken adaptive actions like preparedness and other proactive effort, in this regard the research considers all the adaptation efforts as LR.

## **III. Theoretical Background**

The Protective Motivation Theory (PMT) is the guiding theory in this research, the interest is to identify the effect of information on flood risk issued through ICTs on the livelihood resilience of fisher folks in the area. This is viewed from the perspective of the PMT where information about risk is said to trigger some appraisal in the recipients mind and thus adaptive or maladaptive action, which in turn makes the individual to

be resilient or otherwise. The theory has had several application to test the effect of communication in health sector (Xiao et al., 2014), sedentary behaviour (Wong, Gaston, DeJesus, & Prapavessis, 2016), tobacco smoking (Karen MacDonell, Xinguang Chen, 2013) and for protective behaviour to climate change extreme events (Bočkarjova, Veen, & Geurts, 2011; Fox-Rogers, Devitt, O'Neill, Brereton, & Clinch, 2016). It has been described as very suitable model to predict adaptation behaviour (Grothmann & Patt, 2005), PMT is posited to be a useful tool in the assessment of flood risk and protective behaviour especially when communication tools like ICTS are used (Floyd, Prentice-Dunn, & Rogers, 2000; Koerth, Vafeidis, Hinkel, & Sterr, 2013). However, there has not been any empirical research that seeks to find the effect of ICTs mediated communication on the protective adaptive behaviour which makes an individual resilient or not. Furthermore the application of the theory in the context of adaptation of fisher folks has not been discovered in grey and academic literature.

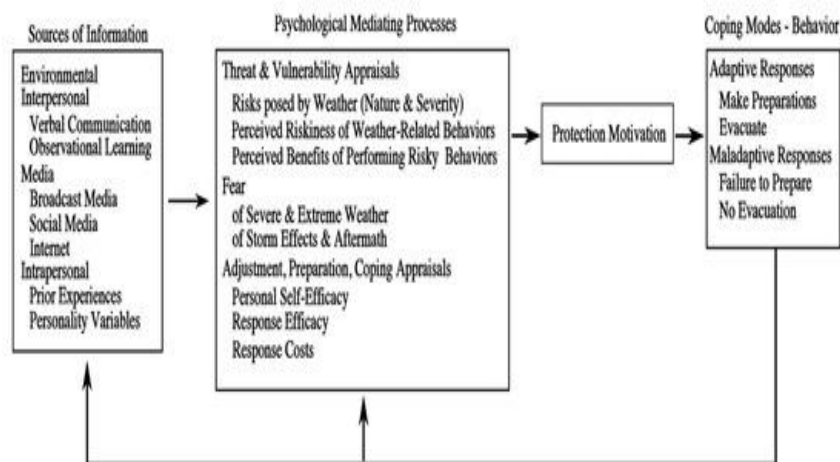
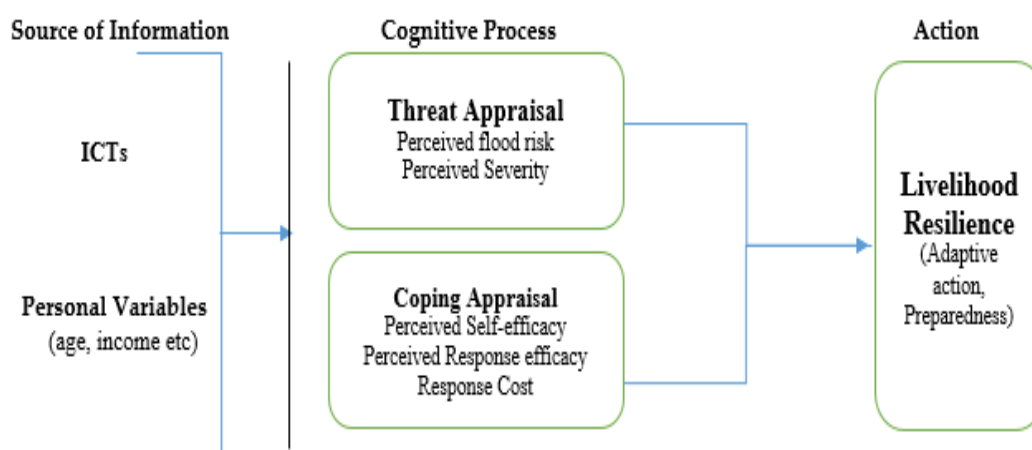


Fig 1.1.: The PMT model Source: Rogers, Floyd, Stewart(Floyd et al., 2000; Rogers, 1975; Stewart, 2015)

#### IV. Methodology

The research adopted a cross-sectional method of gathering data, in which data was captured at a point in time across the study locations. A structured questionnaire was adapted and used to elicit data. The questionnaire being in English language was translated back and forth from English to Malay language for easier and intended understanding by the respondents who are mainly Malay. A 100% double entry protocol was adopted to ensure minimal entry errors, discrepancies were corrected from this process. Items developed were based on the work of Koerth et al.,(Koerth et al., 2013) that utilized the PMT in their work on causes of adaptation on flood risk in Germany. It was further modified to suit the research interest. Data on perceived vulnerability (PV), Perceived severity(PS), self-efficacy(SE) and response cost(RC), Perceived Response Efficacy (PE) and adaptive action for reduce vulnerability which is referred to as Livelihood Resilience were measured using a five point likert scale designed as 1=Strongly Disagree to 5=Strongly Agree. Sample questions asked in the questionnaire were: (PS) = I am reminded to prepare for flood through ICTs due to its short and long term effect on me and my family. (PV) = I am reminded through ICTs that due to climate change the risk of flooding is ever increasing for coastal locations. (SE) I am taught through ICTs basic survival tips therefore I am confident I can save myself and family (RE) Information communicated through ICTs suggest private adaptation is unnecessary as government will rescue us. (RC) I would rather spend my money on something else like ICTs than spend on adaptation. (LR)= The ICTs enable me connect all source of help within and outside my family and community etc. East coast Malaysia is the study area and it is located on the latitude 10 and 60 N and 1000 and 1030 E. The climate is humid and highly influenced by the southwest monsoon in May through august and the Northeast in November through February, the latter brings heavy rainfall in the peninsular (Wan Zin, Jamaludin, Deni, & Jemain, 2010), which is usually accompanied by flooding. The east coast Malaysia consist of three states namely Pahang, Terengganu and Kelantan. The research population are the 28,533 registered fisher folks of the east coast Malaysia, which are spread across Kelantan 9,736, Terengganu 10,489 and Pahang 8,330 (Department of Fisheries Malaysia, 2015). The Krejcie and Morgan table was used to determine the population size of 380 respondents. Districts or Mukim/Daeraas as they are referred to in Malay language. Within these fishing districts three Mukim were chosen from each state, however rate of return was at about 96%. The total cases used in the analysis are 362 fisher folks. The Focus group discussion was conducted prior to instrument development, this was done in the month of November, 2015. A pre-test was conducted on 50 respondents after the instrument was developed, the SPSS 22 Version was used to test reliability and a suitable Cronbachs alpha of above .70 was achieved for all the constructs which indicates the reliability of the tool used.

Having satisfied the criteria, the composite scales of the psychosomatic responses were used to run the multiple linear regression analysis. The descriptive analysis was used to achieve objective 1 and 2 while multiple regression was used to achieve the third objective



**Fig. 1.2.:** Framework of the study adapted from Stewart (Stewart, 2015)

## V. Results

### 4.1. Socio-economic characteristics of the fisher folks

Table 1.1 revealed that Malay ethnicity formed most of the fisher folks (98.1 percent), and majority are married (83.1 percent) with moderate income level (RM600-1000). This shows that for the most part, the fisher folks are within the earning range prescribed by the Malaysian Economic Planning Unit as the poverty line of RM 720 which is equivalent to \$167 monthly income (Hassan, Shaffril, & Azril, 2009; Yusof, Kamaruddin, Omar, Bolong, & Shaffril, 2014). Majority of the fisher folks are between the age range of 48-62, revealing an aging population as reported in (Mazuki & Man, 2014) that the fishing industry has a problem of an aging population. Respondent were mostly with education up to primary level (63.3 percent) with very few having diploma and above (5.3 percent).

**Table Error! No text of specified style in document..1:** Socio-economic characteristics of the fisher folks in east coast Malaysia:

| Socio-economic characteristics    | Variables | Frequencies | Percentages |
|-----------------------------------|-----------|-------------|-------------|
| Age Category                      |           |             |             |
|                                   | 19-32     | 82          | 22.7        |
|                                   | 33-47     | 116         | 32          |
|                                   | 48-62     | 141         | 39          |
|                                   | 63-77     | 23          | 6.4         |
| Ethnicity of respondent           |           |             |             |
|                                   | Malay     | 355         | 98.1        |
|                                   | Chinese   | 6           | 1.7         |
|                                   | Indian    | 1           | 0.3         |
| Marital status of the respondents |           |             |             |
|                                   | Single    | 44          | 12.2        |
|                                   | Married   | 296         | 81.8        |
|                                   | Widowed   | 8           | 2.2         |
|                                   | Divorced  | 2           | 0.6         |

|                                      |                        |     |      |
|--------------------------------------|------------------------|-----|------|
| Additional job                       |                        |     |      |
|                                      | No                     | 302 | 83.4 |
|                                      | Yes                    | 58  | 16   |
| Educational level of the respondents |                        |     |      |
|                                      | Primary                | 229 | 63.3 |
|                                      | SPM                    | 105 | 29.0 |
|                                      | Diploma&Above          | 19  | 5.3  |
|                                      | Pondok (Islamic based) | 9   | 2.5  |
| Income categories (RM)               |                        |     |      |
|                                      | 200-599                | 26  | 7.2  |
|                                      | 600-999                | 157 | 43.4 |
|                                      | 1000-1399              | 131 | 36.2 |
|                                      | 1400-1800              | 48  | 13.3 |

#### 4.2. Reasons for the use of ICTs

The fisher folks have indicated as shown in table 1.2 different reasons why they use communication based ICTs. For the most part the greater use of the ICTs is reflected in the use for social networking (26.90%), to contact friends and relatives. This is followed by the use for access to extension service (25.80), then for news and entertainment (25.00%) and to access the weather information and other advisory services like early warning (22.30%).

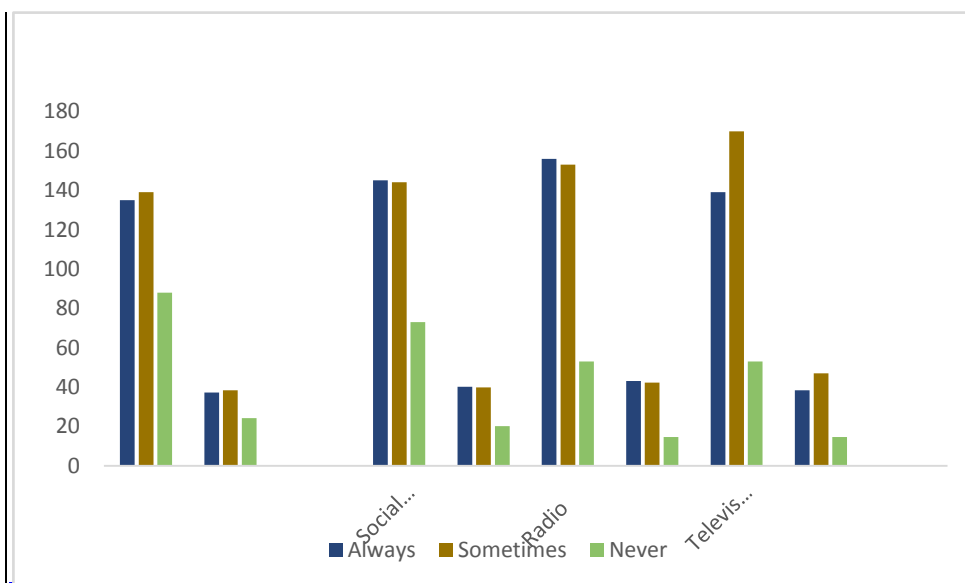
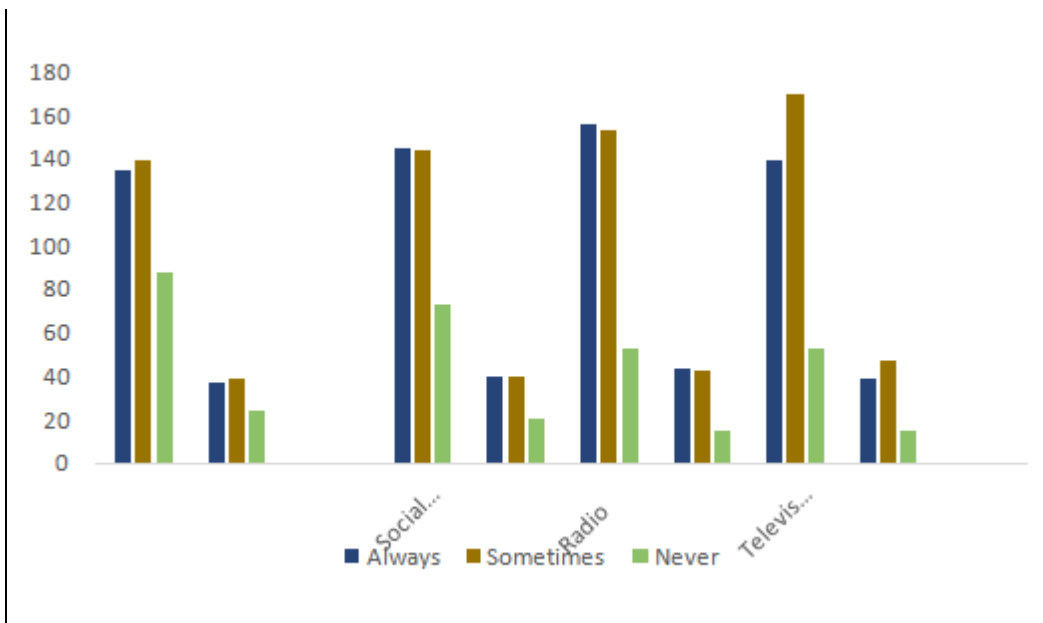
**Table Error! No text of specified style in document..2: Utility of ICTs by the Fisher Folks**

| Reasons for the use of ICTs                          | N    | Percent* |
|--|------|----------|
| to access news and entertainment                     | 257  | 25.00    |
| to access weather, risks and other advisory services | 229  | 22.30    |
| Extension services                                   | 265  | 25.80    |
| social and economic networking                       | 276  | 26.90    |
| Total  | 1027 | 100.00   |

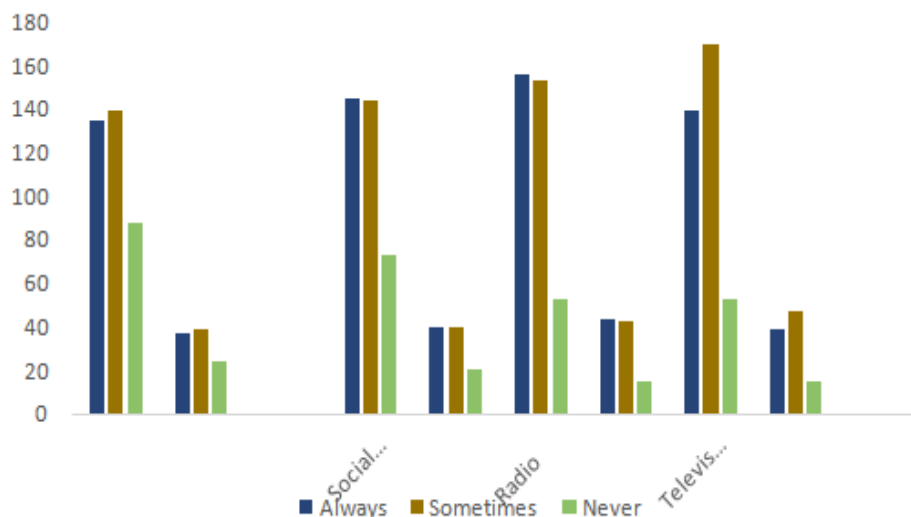
\*Multiple responses recorded

#### 4.3. Sources of getting Flood Early warnings

Majority of the fisher folks as shown in figure 1 expressed that they have access to early warnings through the SMS only sometimes (38.4%), Through Social media (40.1%) reports that they always been getting information through the Social Media, Radio is indicated to have been providing information always as reported by (43.1%) of the population, while Television is reported to be used sometimes as a medium of issuing early warning (47.0%) by authorities. This result is at par with the findings of (Mwombe et al., 2014) where they found that radio and television still remain the most accessible and used ICTs to farmers and other small holder families. It became evident that radio is the highest utilized medium of issuing flood risk communication by authorities while television is sometimes used, to issue communication on early warnings and protective strategies.



**Figure: Use of ICTs for Early warning and risks information in east-coast Malaysia**



#### 4.4. Multiple linear regression analysis

The result as reflected in table 1.4, of Multiple regression that was conducted in order to analyse the simultaneous influences of threat appraisal constructs (perceived flood risks, Perceived severity of flood) and coping appraisal constructs (Response efficacy, self-efficacy and response cost) and some socio-economic variables as independent variables and the Livelihood resilience as the adaptation behaviour by assuming that

$$Y = b_0 + b_1x_1 + \dots + b_jx_j + e_j \quad (1)$$

Where  $X_1, X_2, \dots, X_j$  are the PMT elements and other variables as independents variables,  $b_0$  is the constant and  $b_1, b_2, \dots, b_j$  are the regression co-efficient. They shows how  $y$  changes when  $x_1$  changes by a unit etc  $x_2$  and  $x_j$  are constants. A multiple linear regression analysis was conducted to evaluate the influence use of ICTs, perceived vulnerability to flood, perceived severity of flood, self-efficacy feeling, response efficacy, Response Cost to the livelihood resilience of fisher folks. The data being a composite was used for the regression analysis. The normality inspection reveals, the skewness and kurtosis, confidence interval and the shape of the normality curve, box blots are all demonstrating a normal distribution of the data.

**Table Error! No text of specified style in document..3: Multiple Linear Regression**

| Variables                   | B     | Std. Error | Beta  | t- value | Sig.    |
|-----------------------------|-------|------------|-------|----------|---------|
| Age                         | -.001 | .002       | -.036 | -.618    | .538    |
| Income                      | .000  | .000       | .070  | 1.171    | .244    |
| additional income           | .000  | .000       | -.134 | -2.144   | .034**  |
| Perceived Vulnerability     | .212  | .064       | .265  | 3.338    | .001**  |
| Perceived Severity          | .255  | .052       | .390  | 4.938    | .000**  |
| Response Cost               | -.038 | .028       | -.082 | -1.382   | .170    |
| Self-efficacy               | .213  | .049       | .352  | 4.368    | .000**  |
| Perceived Response Efficacy | -.002 | .043       | -.004 | -.048    | .962    |
| ICTs Use                    | .139  | .073       | .112  | 1.912    | .059*** |

\*significant at 1%, \*\*significant at 5% and \*\*\*significant at 10%

The regression equation predicting the relationship of ICTs, socio-economic variables and Livelihood Resilience

LR =

$$.801 + (-0.001)\text{age} + (0.000)\text{income} + (0.000)\text{add. Income} + (0.212)\text{PV} + (0.255)\text{PS} + (-0.038)\text{Responsecost} + (0.213)\text{SE} + (-0.002)\text{PR} + (.139)\text{ICTsUse}$$

(II) Results indicated that approximately 66 % of the total variance is LR is explained by the independent variables,  $F=24.454$ ,  $P<.05$ . The Durbin Watson (1.757) constant reveal a well specified model with important variables included. The correlation between additional income (-.13,  $\beta<.05$ ), Perceived vulnerability (.265,  $\beta<.05$ ), perceived severity (.390,  $\beta<.05$ ), self-efficacy (.352,  $\beta<.05$ ) and ICTs use (.112,  $\beta<.05$ ) were statistically significant. The result revealed the perceived severity self-efficacy and perceived vulnerability has the strongest influence on LR.

## VI. Discussion

**4.1. Age:** The age of the respondents is negatively and insignificantly related to the DV. This reveals an un-important role of age in determining LR, this may be due to the fact that the communication reaches all age groups through the various combination of ICTs and could spur a feeling of perceived risk and thus action of preparedness to all age groups. This is conforms to the apriory expectations because all age groups are expected to access the information through any of the ICTs, although the younger may have multiple access due to combined use of Social Media etc.

**4.2. Income:** Income is also seen to have an insignificant role in determining the LR of the fisher folks, this may be due to the low level of income of most of the respondents which may not be beyond the use for upkeep, and hence any extra savings is not possible. It therefore is not used for any activities of adaptation and hence does not contribute to LR.

**4.3 Additional Income:** This came out as positively significant to LR which is in consonance with the apriory expectation. Literature has point to the fact that for people with an extra source of income from their principal employment they will have the flexibility and robustness to cope with shock on livelihood, this is because of the extra cash which they can commit to adaptation (Heeks & Ospina, 2013).

**4.4 Perceived Vulnerability:** The perceived vulnerability is seen to be positively significant to the LR, which shows that the more an individual feel threatened by the flood the more he prepares and take action which give him LR. This is well established in the literature that Perception of vulnerability do make individual to act (Lieske, Wade, & Roness, 2014; Taylor, Dessai, & Bruine de Bruin, 2014)

**4.5. Perceived Severity:** The result showed a positive significant relationship at 1% which showed that for any individual that appraise his situation and perceive being at risk he is expected to take preparedness action to reduce the effect flood may have on him. This is because the appraisals by individual triggers the evaluation of being at risk and the severity of the damage the flood may bring. This is known to have inspire protection motivation in flood risk situation as reported by (Koerth et al., 2013)

**4.6. Response Cost:** The response cost showed an insignificant negative relationship with livelihood resilience, this means that the more an individual think about the cost of responding to flood event the less



adaptation action he takes. This may be due to low income that prevents them from sparing some amount for the preparedness actions (Floyd et al., 2000).

**4.7. Self-efficacy:** The positive significant relationship demonstrate that the self-efficacy of an individual do makes him to be a resilient individual and may make him take all actions that maintains his functioning in the fishing activities. Self-efficacy comes with the motivational persuasion of leaders and the realizations of ones potential to save oneself, which may come through experience sharing with peers etc.(Floyd et al., 2000; Xiao et al., 2014).

**4.8. Perceived Response Efficacy:** The negative insignificant relationship by this relationship demonstrate that the response efficacy which is the confidence with which authorities communicate their readiness and arrangement to save individuals when it flood, as such it makes people not to take any proactive action towards adaptation. It therefore came out the communication of such arrangement makes people to be reluctant in taking the necessary action. This is seen to have been discovered in countries like Netherlands and England where confidence on the government came out as an impediment to act to risk communications(Martin, Bender, & Raish, 2007; Taylor et al., 2014).

**4.9. Use of ICTs:** The positive relationship at 5% showed that there is increase in taking preparedness and proactive measures when an individual uses ICTs to access flood risk information. This means for individual that get different access to ICTs the frequency of information may propel them to act and take adaptive measures and therefore become resilient in both their activities. It therefore give them the impetus to have flexibility and self-organization power which has been hinted as among the benevolence of ICTs(Imam et al., 2017; Kassenga, Mbegha, Guido, Malele, & Rugai, 2012; A. V. Ospina & Heeks, 2010)

#### IV. Conclusions

The use of ICTs by the fisher folks is more for social activities as reflected by the result and also the authorities are seen to be utilizing the radio more for issuing the early warning. This points to a need to assess the preferred medium of communication for such activities, which will ensure more effect on the recipients. It is obvious that the effect of ICTs mediated risk communication to flood risk are impacting on the Livelihood Resilience of the fisher folks. The flood risk communication is seen to have impacted on the core constructs of the PMT like threat appraisal and it motivate the individual to have some impressive level of self-efficacy, however it is evident that the coping appraisal is seen to be negatively affected by the communication. The discovered effect on the widely accepted PMT has presented an area policy workers can improve their strategy to raise the motivation for adaptation in the quest to build resilience of vulnerable people. The findings of the coping appraisal highlight an interesting trend and an area for future research as to disentangle what made the individuals to be reluctant. Previous studies have shown the entitlement feeling of the citizens is always a barrier towards preparedness and thus may be the reason in this context.

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