Japan-ASEAN Science, Technology and Innovation Platform (JASTIP)
Report of JASTIP-Net Activity

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<tr><td>2. Collaborative research</td><td>Collaborative research theme</td><td>Headquarters
☐ To Develop Operational Linkages and Human Resources among Academic Sector, Government Agencies, and Private Sectors in ASEAN countries and Japan.
☐ To Introduce Various STI Collaborations for Effectively and Efficiently into the Society based on the three joint laboratories' activities.

Energy & Environment Joint Lab
☐ Studies on Rural/Community Renewable Energy.
☐ Development of Renewable Energy Technology adapted to the ASEAN region.
☐ Studies on Energy Policy/Security in the ASEAN region.

Bioresources & Biodiversity Lab
☐ Studies on Biodiversity in the ASEAN Region Contributing to the Improvement of Identification, Collection and/or Information.
☐ Sustainable Utilization of Bioresources for Biorefinery, Bioremediation, Wood Construction, Food or Medicine.
☐ Plant Improvement for Agroforestry Systems and Carbon Sequestration Contributing to the Mitigation of and/or Adaptation to Climate Change.</td></tr>
</table>

		Disaster Prevention Joint Lab ☐ Innovative Ideas on Disaster Prevention, Mitigation and Recovery Technologies and Policies Peculiar to Each ASEAN Country. ☐ How to Cope with Trans-Boundary Disasters in the ASEAN Region Such as Tsunami, Flood, Drought and Haze. ☑ Understanding and Quantitative Evaluation of Disaster Risks Peculiar to ASEAN Countries.
	Collaborative research title	Assessing Water Quality in the Langat River Basin during Disaster Period using Integrated Remote Sensing & Modelling Technologies
	Host core-researcher	Prof Kaoru Takara

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4. Report of activities

Please describe 1) research activities and major findings and 2) their academic and social implications toward achieving the SDGs within 2 pages. You can include tables, figures and photos if necessary.

Our research group went to Kyoto University in February 2017 to extract Japanese Global Climate Model (MRI-AGCM – SOUSEI PROGRAM) data extraction in Professor Nakakita's Lab. For this JASTIP-Net Grant, 2 students are working for this research; Siti Hafsah Zulkarnain (PhD candidate registered in February 2017) and Muhammad Hassim (MPhil candidate registered in September 2017). Siti Hafsah Zulkarnain PhD title is "Framework of Determining the Property Value using Valuation Method Toward Flood Disaster in Langat River Basin" and Muhammad Hassim MPhil title is "Modelling of flood water quality in Langat River Basin".

This research will focus at Langat River Basin. Langat River Basin is a rapid development area. Some major construction projects such as new federal government administrative capital of Putrajaya, the multimedia super corridor

(MSC), Cyberjaya, and the Kuala Lumpur International Airport (KLIA) are located on the river basin area. The Langat River Basin is also centre to the manufacturing industry in the State of Selangor. In addition to its important role in basin ecology, Langat River is also one of the major contributors to drinking water, industrial and agriculture.

Our entire study will use the XPSWMM software and Arc-GIS software (purchased by Kyoto University under JASTIP-Net) to analyze the collected data ie secondary data and observed data. This software is a fully dynamic hydraulic and hydrologic modelling software that combines 1D calculations for upstream to downstream flow with 2D overland flow calculations so that we can see what truly happens to our storm water system, foul water system or floodplain when waters flow, populations increase or catastrophic events hit. Its use over the last 25 years, as well as its UK Environment Agency benchmark testing and U.S. FEMA approval, has made it one of the most stable and well-used simulation software programs in the world. XPSWMM allows us to integrated analysis of flow, pollutant transport and sustainable design measures in engineered and natural systems including ponds, rivers, lakes, overland floodplains and the interaction with groundwater.

This research will also focus on determining property value using economic valuation method towards flood disaster and water quality analysis in Langat River Basin. This study will analyse how flood modelling can be used to simulate flood and estimate the property valuation damages cause by flood in Langat River Basin.

Siti Hafsah Zulkarnain

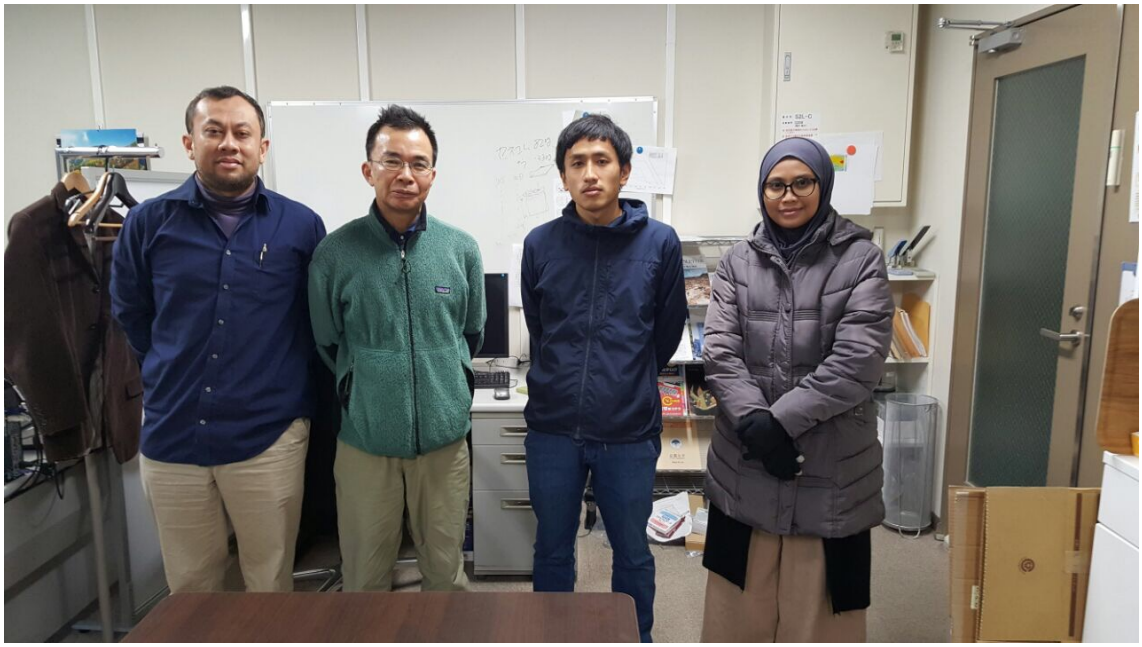
Framework of Determining the Property Value using Valuation Method Toward Flood Disaster in Langat River Basin

PhD

Muhammad Bin Hassim

Modelling of flood water quality in Langat River Basin

MPhil



At Kyoto University on 24th February 2017 to extract Japanese Global Climate Model (MRI-AGCM – SOUSEI PROGRAM) data extraction in Professor Nakakita's Lab

Oral Presentation at 3rd JASTIP Symposium in Bangkok, Thailand on 5th February 2017

5. List of publications

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6. List of oral presentations

Siti Hafsah Zulkarnain, Muhamad Ali Muhammad Yuzir, Muhammad Najib Razali, “A Conceptual Framework of Determining the Property Value using Economic Valuation Method Towards Floods Disaster in Langat River Basin” The 5th Regional Conference of Natural Disaster (RCND) 2017, Bangkok, Thailand, 20-21st Sept. 2017

A CONCEPTUAL FRAMEWORK OF DETERMINING THE PROPERTY VALUE USING ECONOMIC VALUATION METHOD TOWARDS FLOODS DISASTER IN LANGAT RIVER BASIN

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***Abstract* —** The purpose of this paper is to inform a conceptual framework of economic valuation towards floods disaster. The existing pattern, themes and issues associated with economic of valuation towards flooding were identified and used to inform the conceptual framework. The review approach was based on related literature contributing to identify themes as "floods disaster" and "property value". The generic conceptual framework presented explores the interaction between different internal and external factors affecting the economic value of properties. An extensive review of previous studies in economic valuation of property for different floods disaster studies considered to be main restrictive factor resulting in lack of empirical studies in this field. Practitioners and researchers will find this study useful in developing an improved understanding of the economic valuation to flooding. The conceptual framework is important outcome of the research which will encourage further research in this area of study.

Keywords: *Conceptual framework, Floods, Economic Valuation, Property value*

I. INTRODUCTION

Natural disaster have many different causes and include geophysical disasters such as earthquakes, tsunamis, and hydro-meteorological disaster such as cyclones and floods [34]. Many disaster occur on widely different scale with different impact and little warning is given. The resulting damage takes many different forms, including death and displacement of many people, as well as damage to land, building, crops and livestock.

Flooding has been more significant in recent years due to increased urban development, with subsequent increases in water run-off and changes in world weather patterns [12]. The occurrence of such heavy rainfall and subsequent flooding has not only raised the issues of climatic change and the effect on the environment but also the more local issues of the impact on residential property development, residential property price [26] and the ability of residential property owner to gain both finance and insurance for their properties [11].

Malaysia is a country very prone to flood risk, mostly by nature of its physical as well its human geography as land use pattern of settlements. Compared to other types of disaster in Malaysia, flood are the most frequent and gives greatest damage to the properties annually.

The frequent occurrence of flooding in Peninsular Malaysia the damage caused can be significant in relation to both property damage and service disruption. Property with physically damaged requires higher operating cost of repair and maintenance which might affect directly the value of the property.

II. PROBLEM STATEMENT

In Malaysia, floods are caused by a combination of natural and human factors. Coupled with natural factors such as heavy monsoon rainfall, intense convection rain storms, poor drainage and other local factors, flood have become a

common feature in the lives of a significant number of Malaysians [7].

During the floods generally the valuer not present and they must rely on second hand information from local residents about flood velocities and contamination content [22]. A lack of consistency in the process of assessing damage could result in varied repair methods being recommended for similarly affected properties. The valuation process in determined the current market value after disaster might be different between one and another property in same location.

The issues for the professional valuer is how to correctly identify the impact of flood and how to include these into valuation report [10]. The literature indicates the difficulties in assessing flood damages because of the lack of knowledge amongst valuer [25].

Seasonal rain began in northern and western Peninsular Malaysia starting by end of December 2016. Significantly heavy rain from 23 January 2017 have caused flooding to six (6) states in Malaysia including Kelantan, Terengganu, Perak, Pahang, Johor and Selangor. The statistic of number of evacuation of families at evacuation centres for each states are as Table 1.

Table 1: Evacuation families at evacuation centres as 1st February 2017

State	Total number of families	Total number of evacuation
Kelantan	21	105
Terengganu	30	93
Perak	181	576
Pahang	891	3,210
Johor	382	1,390
Selangor	11	62

Source: Portal Bencana, National Disaster Management Authority (NADMA, 2017)

As a results of seasonal floods occurring almost annually in one part of the country or another, flood losses in terms of loss of life and damage to properties are substantial. Damage caused during flood events can be attributed to several factors which can also affect the property value [3].

An appropriate economic valuation assessment also assists in valuing a property after disaster. The flood prone area need to take into account the risk elements while doing valuation of the property. The value of the risk is either the cost of not being affected by the disaster or the cost of bearing no loss when the disaster effectively occurs [11].

House price then reveal individual preferences [23] regarding the acceptance risk [21], assuming that appropriate control for difference in the property and the location [22] are included. There are difference between prices of houses located inside and outside a specific flood risk zone [15].

In response to these issues, the following problem statement has been developed:

"As floods and property value become more prevalent, improved valuation method practice are required for valuer and property stakeholders to determine the property value before and after disaster and developed an economic valuation model of valuation".

III. OBJECTIVE OF RESEARCH

The aim of this research is to develop an Economic Valuation Model using E-View Software in determining the residential property value after disaster occurs. Therefore, to achieve this aim, a list of research objectives are identified and listed as follows:

a. To determine the effects of floods on residential property value.
b. To develop Economic Valuation Model of flood impact towards property value.
c. To calibrate and validate the developed model using E-View software and integrated with GIS.
d. To estimate the property value before and after disaster within Langat River Basin.

IV. RESEARCH METHODOLOGY

The research methodology is presented in Figure 1. The research aims and objective were achieved through a literature review, questionnaire survey, development of equation and valuation modelling and integrated flood zone map, structured interviews or focal group amongst expert area, and analysis of case study. The methodology is designed by separating this research works into four main stages as below:-

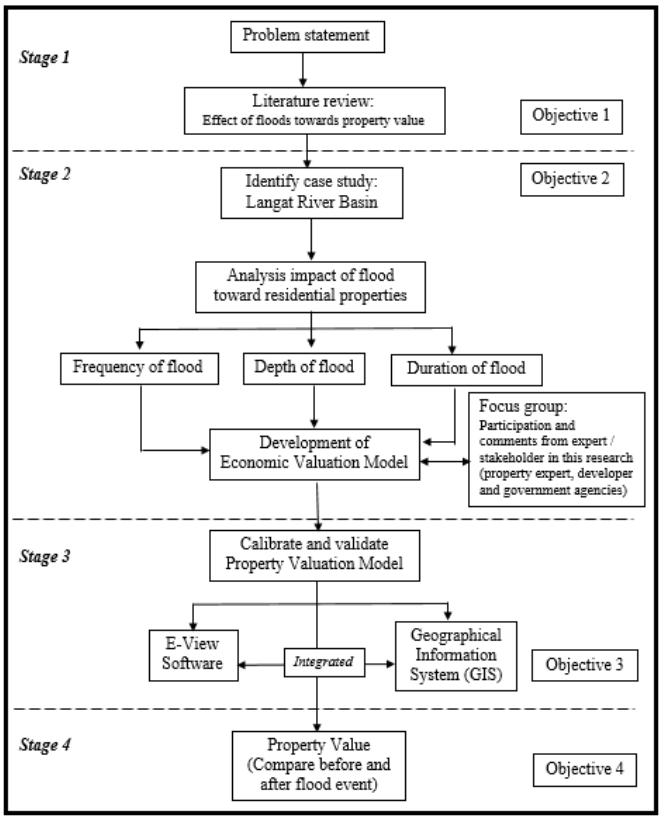

Figure 1: Research Methodology Flowchart

A. Stage 1:

At first stage, problem statement, objectives and research methodology will be determined. The research began with literature review relating to flood-risk and property, examining previous research journal and report. The literature review covered oversea and local experience and focus on flood and the impact to property value.

B. Stage 2:

The case study and model development need to be determine at this stage. Langat River Basin is chosen as case study and analysis of impact of flood in terms of frequency, duration and depth of flood as research variables.

The development of Economic Valuation Model with the participation from property expert panel as a guidance in determination of the valuation factor that will give impact to property value. The key stakeholders in this research are valuer, developer, lender, property occupier, investors and related government agencies.

The survey was followed by a structured discussion with representatives of the key stakeholders groups to develop more details on the results and highlights other significant issues.

C. Stage 3:

At this stage, Property Valuation Model need to be calibrate and validate. Identification of relevant variables to formulate an Economic Valuation Modelling and integrated with Flood Zone Map using Geographical Information System (GIS). The formation of the Residential Valuation model for flood disaster risk is using E-View Software.

D. Stage 4:

At this stage, the determining of property value will be done. Data collected from National Property Information Centre (NAPIC) will be used to determine the property value before and after flood disaster event in Langat River Basin area.

V. CASE STUDY: LANGAT RIVER BASIN

Langat River Basin is currently the fastest developing area in the country and being important water catchment area, a source of hydropower, and a source of raw water supply and another amenities [16]. The surrounding area of Langat River Basin is facing mass development in terms of urbanisation, industrialisation, highways and agriculture to more than 1.59 million people in towns such as Kajang, Bangi, Cheras and Putrajaya.

Table 2: Overview of Langat River Basin

Overview	Description
Transboundary	Covers 3 states including Selangor (78%), Negeri Sembilan (19%) and Federal Territories of Putrajaya (3%).
Location	Situated approximately 27 km to the south of Kuala Lumpur (capital city of Malaysia).
Total basin area	2,350 km.sq. and 200 km long
Topography	Approximately 90% mountainous with a maximum height of 1400m above sea level.
Climate	Tropical with a mean annual temperature of 32°C.
Average annual rainfall depth	Approximately 2,400mm ranging from 1,800 to 3,000mm.
Population	1,184,917 million in 2000, growth rate 7.64%
Geographical location	Located ant latitude 02°50’ 48” N and longitude 101°40’ 48” E.

<table>
<tr><td>Main catchment area</td><td>Divided into five (5) catchments comprising of the Lui, Kajang, Semenyih, Dengkil and combined small catchments of Beranang and Labu.
<table>
<tr><th>Catchment area</th><th>Area km^2</th></tr>
<tr><td>Lui</td><td>70.7625</td></tr>
<tr><td>Dengkil</td><td>234.273</td></tr>
<tr><td>Kajang</td><td>310.77</td></tr>
<tr><td>Semenyih</td><td>695.548</td></tr>
<tr><td>Lower Langat</td><td>698.713</td></tr>
<tr><td>Total (Langat basin)</td><td>2012.07</td></tr>
</table></td></tr>
<tr><td>Monsoon seasons</td><td>Two monsoon seasons in a year, the northeast monsoon from November to March and southwest monsoon between May and September.</td></tr>
</table>

(Sources: Billa, Assilzadeh, Mansor, Mahmud, & Ghazali, 2011)

The event of flood can cause significant damage to the lives and properties [18] of those living within the affected area. The overview of Langat River Basin as Table 2 and Figure 1.

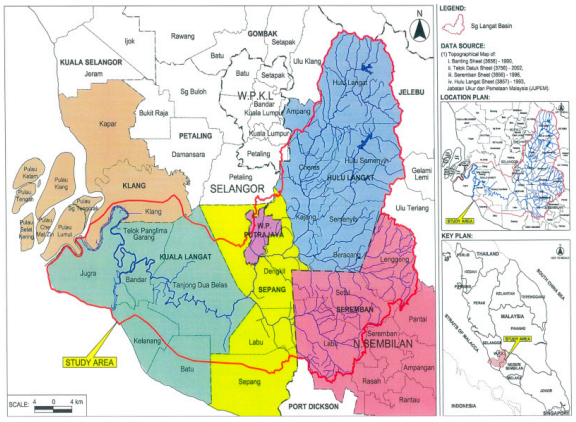

Figure 1: Langat River Basin

VI. FLOOD DISASTER INFORMATION FOR PROPERTY VALUATION

Floods are an inevitable phenomena, their impact could be minimized by appropriate action prior to and after the flood [43]. In flood scenario, the most critical part in evaluate the flood damage assessment are rely on how to quantifying flood impact and expressing these impact in monetary values.

During the inspection and preparing the valuation report, the valuer need to have the information regarding the flood events in the early stage as Figure 2.

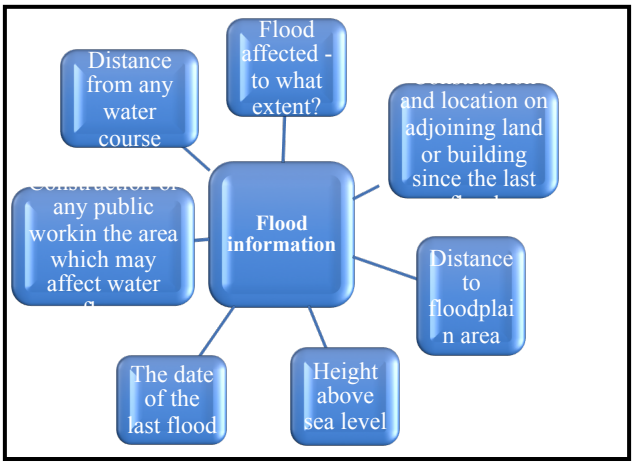

Figure 2: Flood information

Handling the valuation task related to flood is more challenging to the valuer in determining the water risks and address the potential and actual risks in the valuation report [10].

The issues rising to the professional valuer:

a. How to correctly identify potential water risk?
b. How to include the risk to valuation report? - failure to identify and address the risk in the valuation report may lead to litigation.

Valuation reports need to be prepared by the valuer based on the instruction given from the clients. In order to derive the property value after disaster, many aspect need to be taken into account. [11] identified two (2) difficulties in the context of flood risk valuation. First, the bias subjective to individual level of perception in acceptance of risk among the property owner.

Second, the coincidence of water-related amenities and water-related risks. In this case, valuer need to compare house prices before and after flood events. The integration of valuation process with Geographical Information System (GIS) may improve the organization of data in terms of distance to the elevation and water front.

VII. ECONOMIC VALUATION MODEL FOR FLOOD DISASTER IMPACT ANALYSIS

A. Flood Hazard Parameter

Impact due to urban floods are significant in terms of economic losses both direct and indirect. This is due to high density of population, large impervious areas, clogging of drainage system, high economic values of properties and infrastructures. The impact of urban floods can be physical and

The model identified the damaged caused by floods consists of two (2) key factors, that is building and flood

characteristic as Table 3.

Table 3: Key factor of damaged caused by flood

Key factor	Description
1. Building characteristic	Include: (a) Frequency of the dwelling being flooded. (b) Material the building is constructed from. (c) Drying characteristic of the material. (d) Condition of the building prior to being flooded.
2. Flood characteristic	**(a) Flood depth** - influencing the scale of flood damage. Flood depth greater then 1m above floor level may damage the building structure. **(b) Velocity of floodwater** - related to distance from the flood source and hence the depth of floodwater. The greater the floodwater velocity, the greater the probability of structural damage. **(c) Flood water contaminants** i. Influence the water absorption of the building material. ii. Influence the drying time of material. iii. Influence repair costs through the work involved in the removal of physical deposits. iv. Embryonic form may become a danger to occupier's health. **(d) Duration of flood** - the longer the duration of the flood, the more damage it will cause to the building and prolonging subsequent drying and repair works. **(e) Source of the flood** - river, stream, dam, sewer, which relates to the location of the dwelling.

(Source: Soetanto & Proverbs, 2006)

B. Factor effecting the property value

Residential properties is a unique product that need to meet the requirements of purchasers to own or buy a house for the purposes of investment. The complexity of the residential development nowdays, give more challenging to the developers to produce more comprehensive development of residential area with a conducive living environment and excellent amenities to the residents. Many factor involved in determining the market value of residential property instead of consideration of demand and supply as a main determination of property price.

A comprehensive summary of the literature reflect that there exist several study related to the factor affecting the residential property value focusing both at local and international scenario. Based on the previous research, the factor that effecting the property value are location [47], structural, neighborhood [42], community, environment [39], housing features [8] such as number of room, bathroom, age of property, size of land and build up area of the building.

The formation of model equation in evaluating the effect of flood on residential property value in this study are as follows:

$$\text{Log } P_i = \beta_0 + \beta_1 FRE_{it} + \beta_2 DUR_{it} + \beta_3 DEP_{it} + \beta_4 BUS_{it} + \beta_5 BUS^2_{it} + \beta_6 CITY_{it} + \beta_7 CITY^2_{it} + \beta_8 AGE_{it} + \beta_9 LAND_{it} + \beta_{10} BUILT_{it} + \beta_{11} BATH_{it} + \beta_{12} BED_{it} + \beta_{13} AIRPORT_{it} + \beta_{14} AIRPORT^2_{it} + \beta_{15} HOSPITAL_{it} + \beta_{16} HOSPITAL^2_{it} + \beta_{17} SCHOOL_{it} + \beta_{18} SCHOOL^2_{it} + \square_1 (FRE * AGE)_{ij} + \square_2 (FRE * LAND)_{ij} + \square_3 (FRE * BUILT)_{ij} + \square_4 (DUR * AGE)_{ij} + \square_5 (DUR * LAND)_{ij} + \square_6 (DUR * BUILT)_{ij} + \square_7 (DEP * AGE)_{ij} + \square_8 (DEP * LAND)_{ij} + \square_9 (DEP * BUILT)_{ij} + \mu_i$$

Table 4 shows the description and measurement unit of the variable for the above equation.

Table 4. Description and Measurement Units of Variables

Variable	Description	Measurement Unit
P	Price of residential property value	Ringgit Malaysia (RM)
FRE	Frequency of flood	Number of times within 5 years study
DUR	Duration of flood	Number of days
DEP	Depth of flood	Metres (m)
BUS	Distance to the nearest bus station	Kilometres (km)
CITY	Distance to the nearest city centre	Kilometres (km)
AGE	Age of house	Number of years
LAND	Size of land area	Square foot (sq. ft)
BUILT	Size of built area (floor)	Square foot (sq. ft)
BATH	Bathroom	Number of rooms
BED	Bedroom	Number of rooms
AIRPORT	Distance to the nearest airport	Kilometres (km)
HOSPITAL	Distance to the nearest hospital	Kilometres (km)
SCHOOL	Distance to the nearest school	Kilometres (km)
FRE*AGE	Interaction term of flood frequency and house age	
FRE*LAND	Interaction term of flood frequency and size of land	
FRE*BUILT	Interaction term of flood frequency and size of built area (floor)	
DUR*AGE	Interaction term of flood duration and house age	
DUR*LAND	Interaction term of flood duration and size of land	
DUR*BUILT	Interaction term of flood duration and size of built area (floor)	
DEP*AGE	Interaction term of flood depth and house age	
DEP*LAND	Interaction term of flood depth and size of land	
DEP*BUILT	Interaction term of flood depth and size of built area (floor)	

VIII. CONCLUSION

These findings is very useful as a benchmarks to valuers and property players while carried out a valuation inspection and assessing the flood risk for residential property. The characteristic of flood events in several places is vary and critical in determining of impact of flood towards property value. The conceptual framework is important outcome of the research which will encourage further research in this area of study.

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b. National Property Information Centre (NAPIC)
c. Department of Irrigation and Drainage
d. Universiti Teknologi MARA (UiTM)
e. Universiti Teknologi Malaysia (UTM)

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