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Development of Floods Economic Valuation Model for Residential Properties

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Introduction

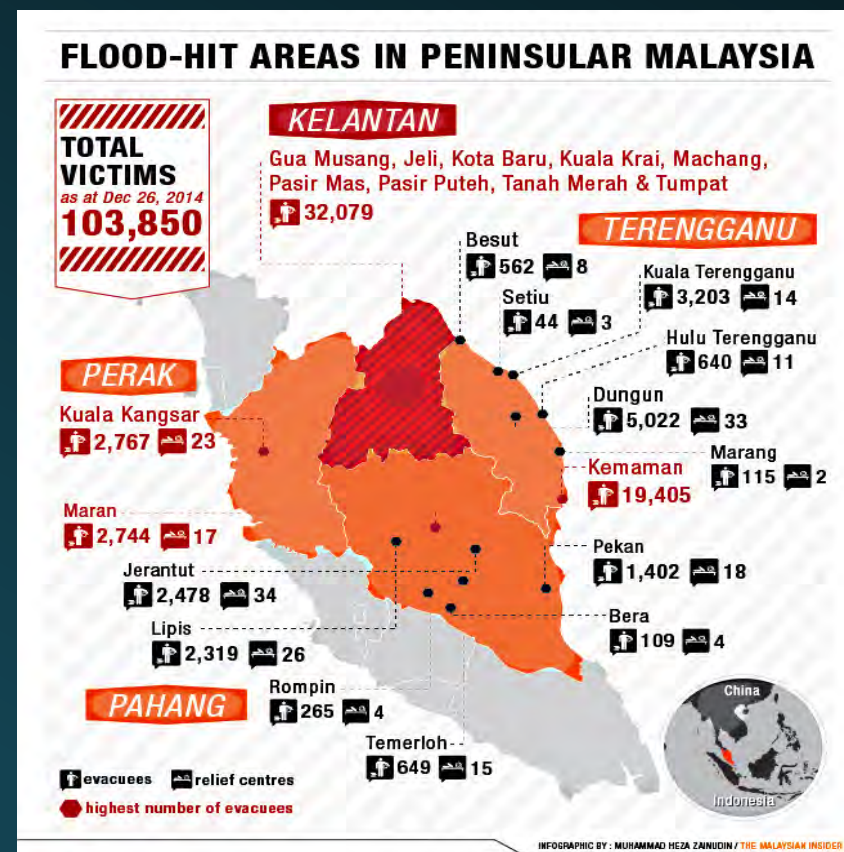
In Malaysia, floods are caused by a combination of natural and human factors. Heavy rains continue in Malaysia since the seasonal rains began from the end of December 2016 and have cause flooding in six (6) states in Peninsular and East Malaysia. The situation of floods in several areas affected and most of the families need to be evacuated and the figure involved in the evacuation as Table 1.

The frequent occurrence of flooding in 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.

Table 1: Evacuation of floods as 1 February 2017

| States | Total number of families | Total number of people |
|------------|--------------------------|------------------------|
| Kelantan | 21 | 105 |
| Terengganu | 30 | 93 |
| Perak | 181 | 576 |
| Pahang | 891 | 3210 |
| Johor | 384 | 1390 |
| Sabah | 0 | 0 |
| Selangor | 11 | 62 |

(Source: National Disaster Management Authority (NADMA))



Flood scenario in Malaysia



Pulau Pinang (15 Sept 2017)



KL- Petaling Jaya (March, 2017)



Rantau Panjang (Jan, 2017)



Kuala Lumpur (Dec, 2014)

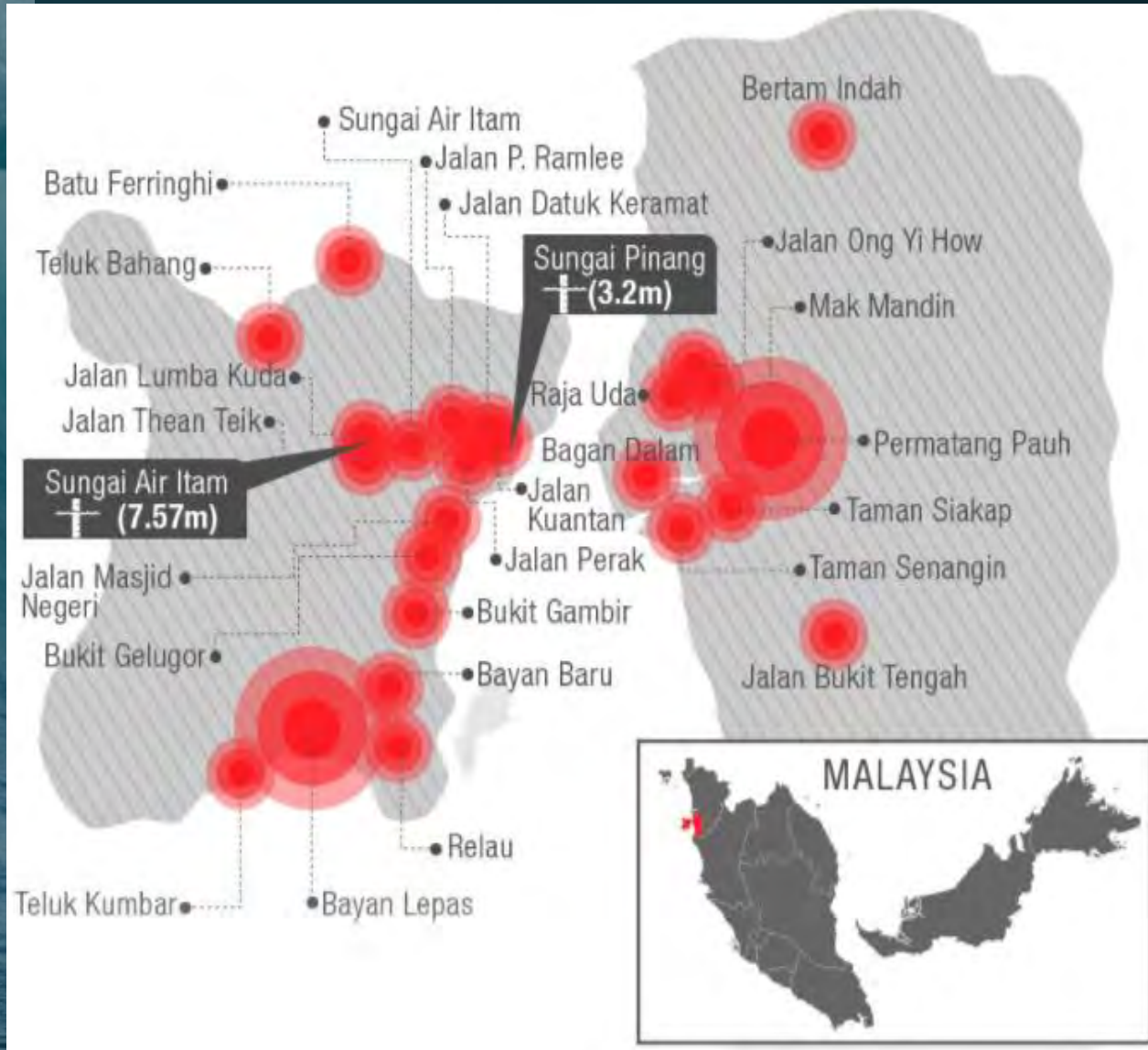


Kuala Krai (Dec, 2014)



Cameron Highland (Oct, 2013)

Latest flood – Pulau Pinang (23 Sept 2017)



Heavy rain in Penang.



Problem statement

Lack of knowledge amongst valuer

- the difficulties in assessing flood damage because of the lack of knowledge amongst valuer.

Lack of consistency in assessing flood damage

- During the flood generally the valuer not present and they must rely on second hand information from local residents about flood velocities and contamination content.
- The valuation process in determining the current market after disaster might be different between one and another property in same location. Only rely on Dept of Social Welfare.

Building material

- Basically, building in flood-prone area were constructed with more porous material including block and concrete including bricks with vulnerable services located on the ground floor.

Magnitude of flood

- Depths of over 1 metre (m) can damage the structure due to increased hydraulic pressure and velocities of water. Contamination of floodwater will change the absorption and drying out characteristics of material and treat to human health and increases the clean-up cost.

Research Objective:

1

To develop Economic Valuation Model of flood impact to property value.

2

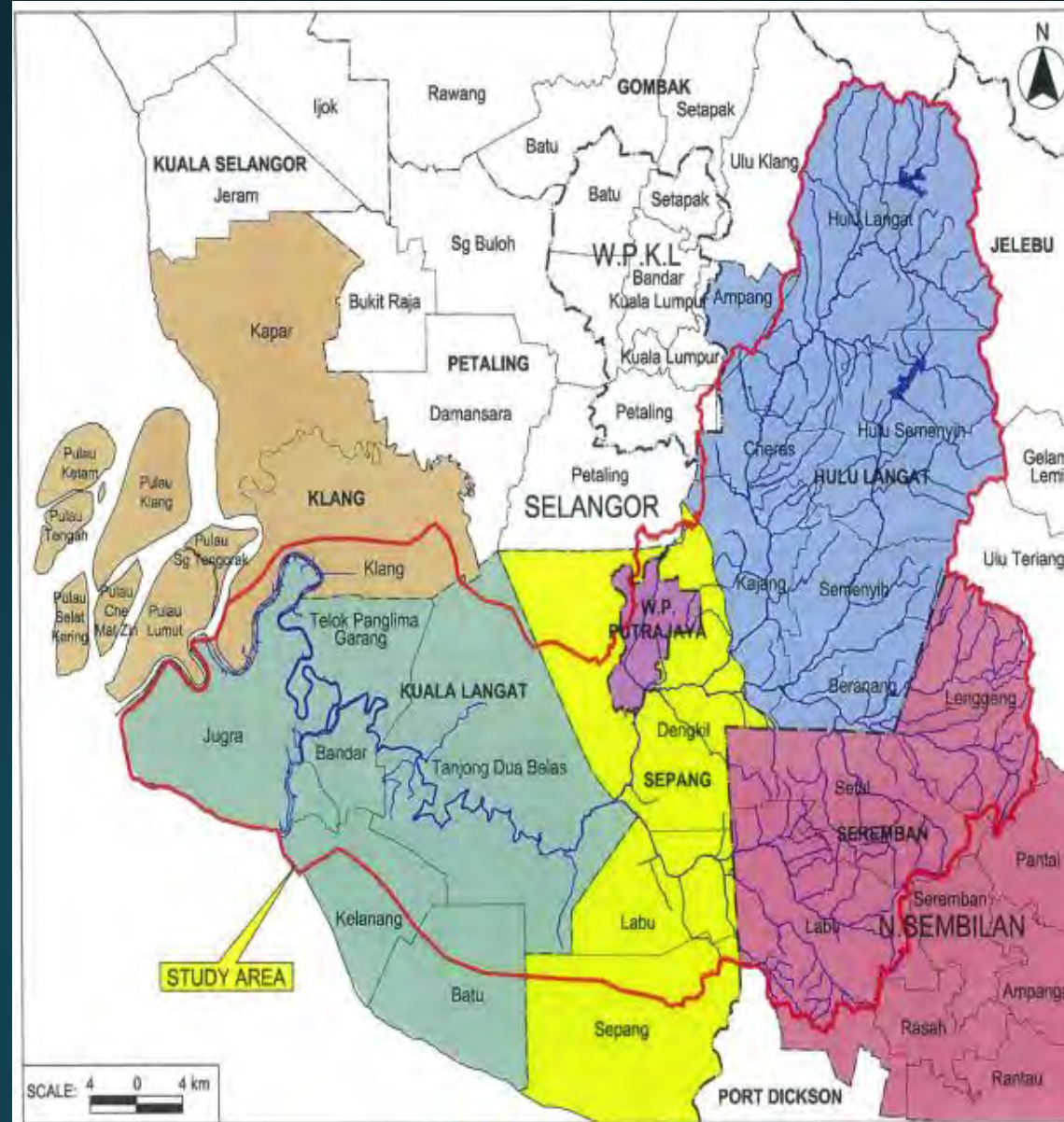
To investigate the property valuation model based on economic characteristics from the impact of flooding.

3

To calibrate and validate the economic valuation model with integration with GIS.

Case study: Langat River Basin

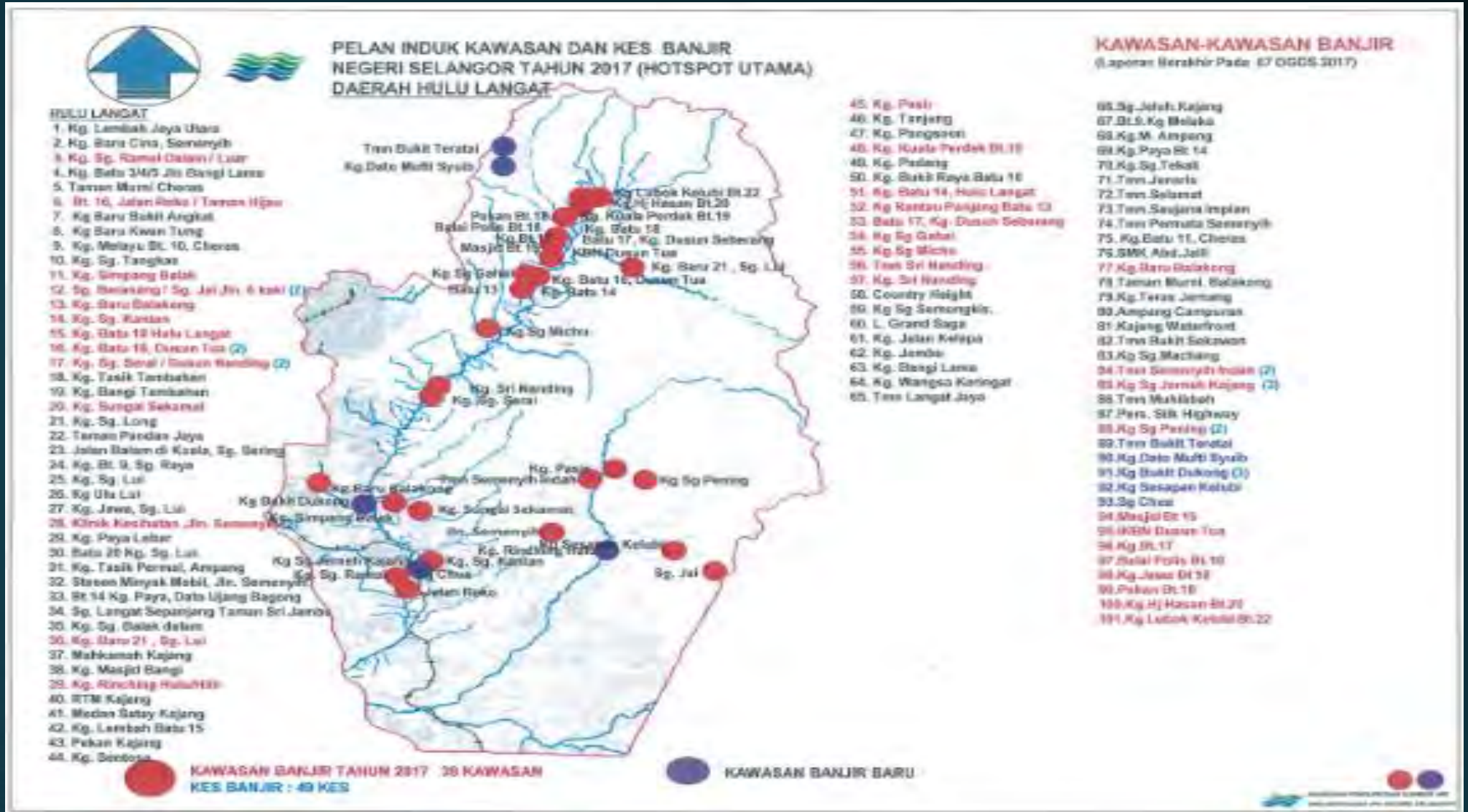
| Overview | Description |
|-------------------------------|---|
| Transboundary | Covers 3 states including Selangor (78%), Negeri Sembilan (19%) and Federal Territories of Putrajaya (3%). |
| Location | Situated approximately 27 km to the south of Kuala Lumpur (capital city of Malaysia). |
| Total 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. |
| Main catchment area | Divided into five (5) catchments comprising of the Lui, Kajang, Semenyih, Dengkil and combined small catchments of Beranang and Labu. |
| Monsoon seasons | Two monsoon seasons in a year, the northeast monsoon from November to March and southwest monsoon between May and September. |



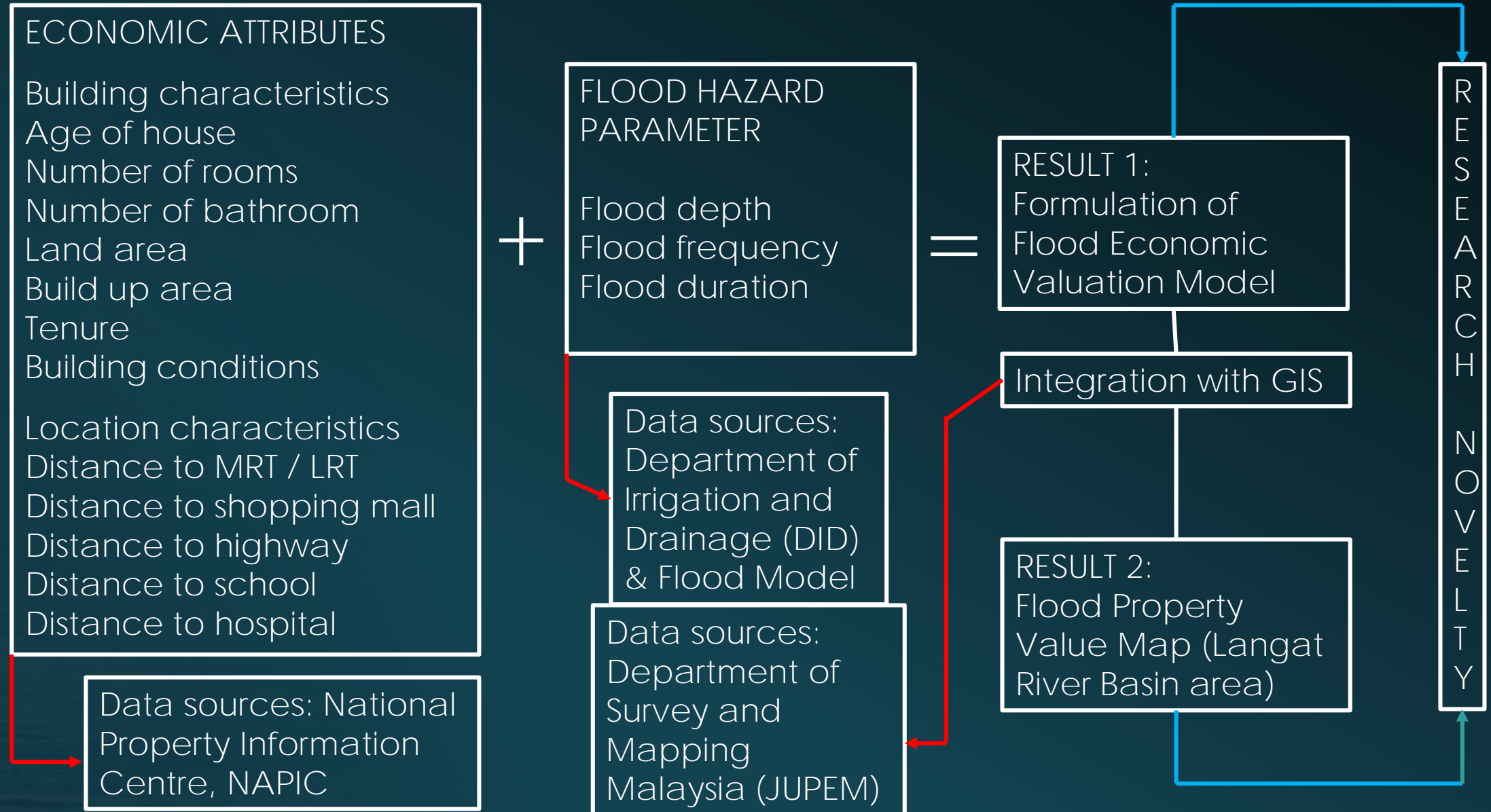
Selangor Flood Map



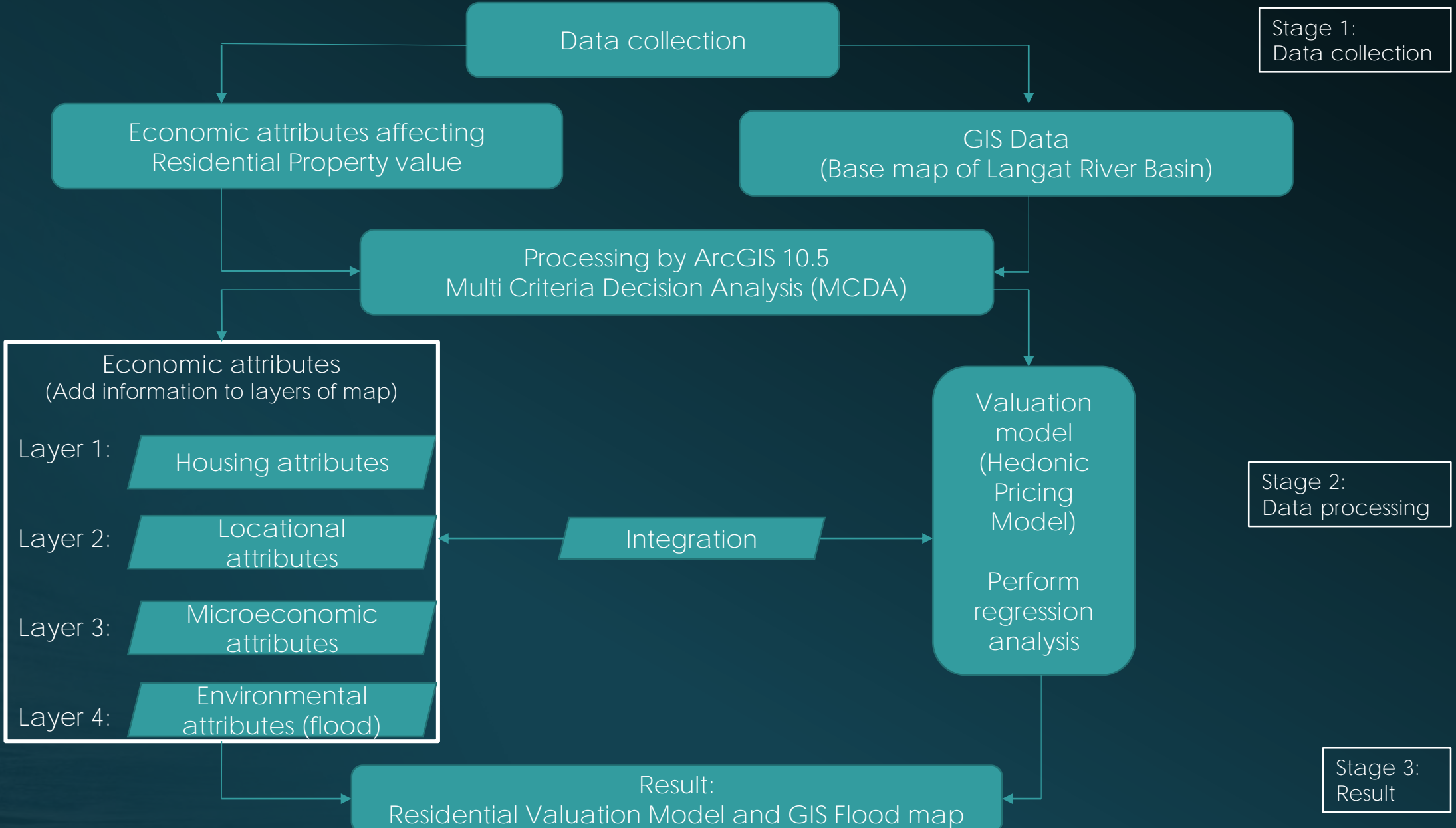
Hulu Langat Flood Map



RESEARCH NOVELTY : Development of Flood Economic Valuation Model and Integration with GIS



11.0 Integration of Valuation Model with GIS



Economic Valuation Model - method of estimating demand or value of properties

$$\begin{aligned} \text{Log } P_i = & \beta_0 + \beta_1 \text{FRE}_{it} + \beta_2 \text{DUR}_{it} + \beta_3 \text{DEP}_{it} + \beta_4 \text{BUS}_{it} + \beta_5 \text{BUS}^2_{it} + \beta_6 \text{CITY}_{it} \\ & + \beta_7 \text{CITY}^2_{it} + \beta_8 \text{AGE}_{it} + \beta_9 \text{LAND}_{it} + \beta_{10} \text{BUILT}_{it} + \beta_{11} \text{BATH}_{it} \\ & + \beta_{12} \text{BED}_{it} + \beta_{13} \text{AIRPORT}_{it} + \beta_{14} \text{AIRPORT}^2_{it} + \beta_{15} \text{HOSPITAL}_{it} \\ & + \beta_{16} \text{HOSPITAL}^2_{it} + \beta_{17} \text{SCHOOL}_{it} + \beta_{18} \text{SCHOOL}^2_{it} \\ & + \gamma_1 (\text{FRE} * \text{AGE})_{\bar{u}} + \gamma_2 (\text{FRE} * \text{LAND})_{\bar{u}} \\ & + \gamma_3 (\text{FRE} * \text{BUILT})_{\bar{u}} + \gamma_4 (\text{DUR} * \text{AGE})_{\bar{u}} + \gamma_5 (\text{DUR} * \text{LAND})_{\bar{u}} \\ & + \gamma_6 (\text{DUR} * \text{BUILT})_{\bar{u}} + \gamma_7 (\text{DEP} * \text{AGE})_{\bar{u}} + \gamma_8 (\text{DEP} * \text{LAND})_{\bar{u}} \\ & + \gamma_9 (\text{DEP} * \text{BUILT})_{\bar{u}} + \omega_i \end{aligned}$$

Description 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 | <u>Metres</u> (m) |
| BUS | Distance to the nearest bus station | <u>Kilometres</u> (km) |
| CITY | Distance to the nearest city <u>centre</u> | <u>Kilometres</u> (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 | <u>Kilometres</u> (km) |
| HOSPITAL | Distance to the nearest hospital | <u>Kilometres</u> (km) |
| SCHOOL | Distance to the nearest school | <u>Kilometres</u> (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) | |

Research Contribution

1. Represents how economic valuation method can be used to determined the impact of floods towards property value.
2. Represents a development of flood risk framework based the magnitude of floods.

Publications

1. *A conceptual Framework of Determining the Property Value using Economic Valuation Method towards Floods Disaster*, 1st Economic Business Conference (EBIC) 2017, Grand Aston Hotel, Medan Indonesia, 25 October 2017 (Scopus Index).
2. *A Conceptual Framework of Economic Valuation Towards Floods Disaster*, Asian International Multidisciplinay Conference 2017 (1-2 Mei 2017, Universiti Teknologi Malaysia, Johor).
3. Chapter of book – *Integration Of Disaster Management Towards Sustainable Housing And Community Redevelopment*.

Conclusion

The generic floods framework and modeling 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.

This study brings together two existing research domains of floods and property value. Practitioners and researchers will find this study useful in developing an improved understanding of the economic valuation to flooding. The flood framework and modeling are important outcome of the research which will encourage further research in this area of study.



THE END
THANK YOU