

## Chapter 3

# Modelling Urban Crime Pattern, Factors and Evaluate Effectiveness Policing Policy using GIS

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### **ABSTRACT**

If cities are to be a city that is sustainable, competitive and safe, crime incidents must be immediately addressed as a high priority in the sustainability of the city. Incidents of crime happen every day is a big bladder to the government, especially the law enforcement agencies in the course of anxiety fear in the lives of the citizens of the city. The lack of urban crime problem and what level of crime pattern in neighbourhood is becoming a growing concern in nation. The urban crime problem cannot be solved simply by providing more police staff and spending more money on development and management in policing policy programme. There is an urgent need for innovation, for better understanding of the current and potential role of the urban crime to meet the needs in sustainability and liveable city. Thus, the adoption of a strategic approach is needed to be planning and managing that city to carry out its function and roles. This research aim is to study and map the crime pattern, factors of urban problem that influence the crime pattern, and evaluate effectiveness policing policy prevention reduce programme in Petaling and Klang district in Selangor. This research is based on data obtained from official government, observation and survey questionnaire that polled public attitudes regarding the factors of crime attributes based. The data was analysed to evaluate and determine mapping the pattern attributes and its level of preferences that influence the strategic approach to the planning and management of successful urban city using Geographical Information System (GIS) with Spatial Regression Modelling. The research suggested that successful urban safe city and neighbourhood as are linked to the distance decay criminal's home location, population risk, land use risk, safer cities programme and frequency of omnipresence police patrol. The results of the study also suggested that a holistic strategic approach is needed for the police and local authority to successfully managing the urban crime. It is hope that the study can contribute to the improvement of urban safe with better policing policy in Petaling and Klang district.

**Key Words:** crime mapping, urban crime, GIS, Emerging Hot Spot Analysis, Spatial Regression

## **1. INTRODUCTION**

United Nation (UNDESA, 2017, p.3) stated that “crime is studied in order to prevent it”. National Transformation Programme Annual Report (NTP, 2017) expressed at an average of 400 criminal cases reported daily in Malaysia. That means, in a month, a total of 1,200 people in Malaysia became victims and trauma of crime. Therefore, if cities are to be a city that is sustainable, competitive and safe, crime incidents must be immediately be addressed as a high priority in the sustainability of the urban city. To prevent the crime, firstly the study must determine urban crime pattern.

Urban is defined a gazette area and its built-up area adjacent to it and the combination of two areas has a population of 10,000 or more, or special development area, or district administrative centre even though the population is less than 10,000 and at least 60% population age with 15 years and above engaged in non-agricultural activities (Second National Urbanization Policy Malaysia, 2016). The population provides a variety of positive and negative effects to everyday life, and among its negative side effects is the crime incidents daily are higher in urban than in rural areas. In Malaysia, high crime areas are in states with major urban hierarchy status and local cities such as in Selangor, Kuala Lumpur, Penang and Johor and are recognized by the government official report (GTP Annual Report, 2010; GTP Annual Report, 2011; GTP Annual Report, 2012; GTP Annual Report, 2013; GTP Annual Report, 2014; NTP Annual Report, 2015; NTP Annual Report, 2016; NTP Annual Report, 2017). Interestingly, in Malaysia, high-risk urban areas have experienced a significant reduction in crime - from 486 crimes that occur daily in 2010 year decreased to 272 crimes each day in 2017 year when the government launched a transformation plan 2010-2020 years to reduce the national crime rate, while Malaysia urban population is expected will increase from 74.8% in 2015 year to 83.3% in 2025 year (Second National Urbanization Policy Malaysia, 2016). This issue raises the question that, is its true crime reduction occurs while population increases every year or are there a crime pattern in certain urban areas are still high (hot spot) compared to other urban areas in the city.

United Nation (UNDESA, 1995) by resolution 1995/9 issued a white paper titled "Guidelines for the prevention of urban crime" which explains the importance of research in urban crime prevention with the emphasis on "a local diagnostic survey of crime phenomena, their characteristics, factors leading to them, the form they take and their extent" (p.1) to be given priority in addressing urban crime issues. There are several problems that have been identified to enable this study to be implemented as follows:

- i. Lack of study on crime pattern hot spots and cold spots-based location (crime mapping and spatial analysis).
- ii. Lack of local studies identified the factors influencing the crime pattern-based location.
- iii. Lack of local research to test the effectiveness of existing policing policy on crime pattern-based location.

Therefore, the aim of study to model the spatial crime pattern of the study area. The objectives of this study are to map the crime pattern, to determine the factors that influencing the crime pattern and to evaluate effectiveness of policing policy prevention.

## **2. METHODOLOGY**

The study area is Petaling and Klang district in Selangor with 43 police station boundary neighbourhood. Software used is ArcGIS pro 2.3. Coordinate systems used is WGS84 / World Mercator. unit area analysis with standard distance interval is 400 meters with interval time for entire study for 72 months (2011-2017 years) and 1 month for each year for 7

years. This study used 93,462-point crime all types incident with 95% score of geocode address street level including violent crime index and property crime index. To test a significant level for crime neighbourhood location, Emerging Hot Spot Analysis (EHSA) tool provides z-score and p-value for each polygon crime hot and cold spot as the map result in attribute data analysis. A confidence level for EHSA as standard by ESRI (2018) is at least 90% and above, is confidence accepted for determines a pattern and trend for features data analysis and to reject the null hypothesis that there is a clusters pattern with hot and cold spot crime with polygon-based fishnet result. Workflow method for EHSA as showing in Figure 1.

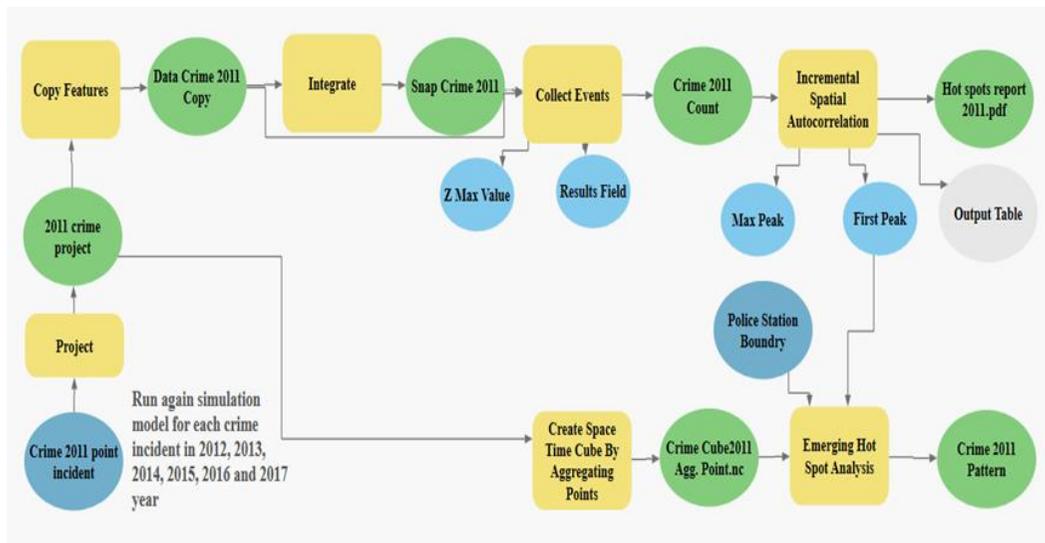
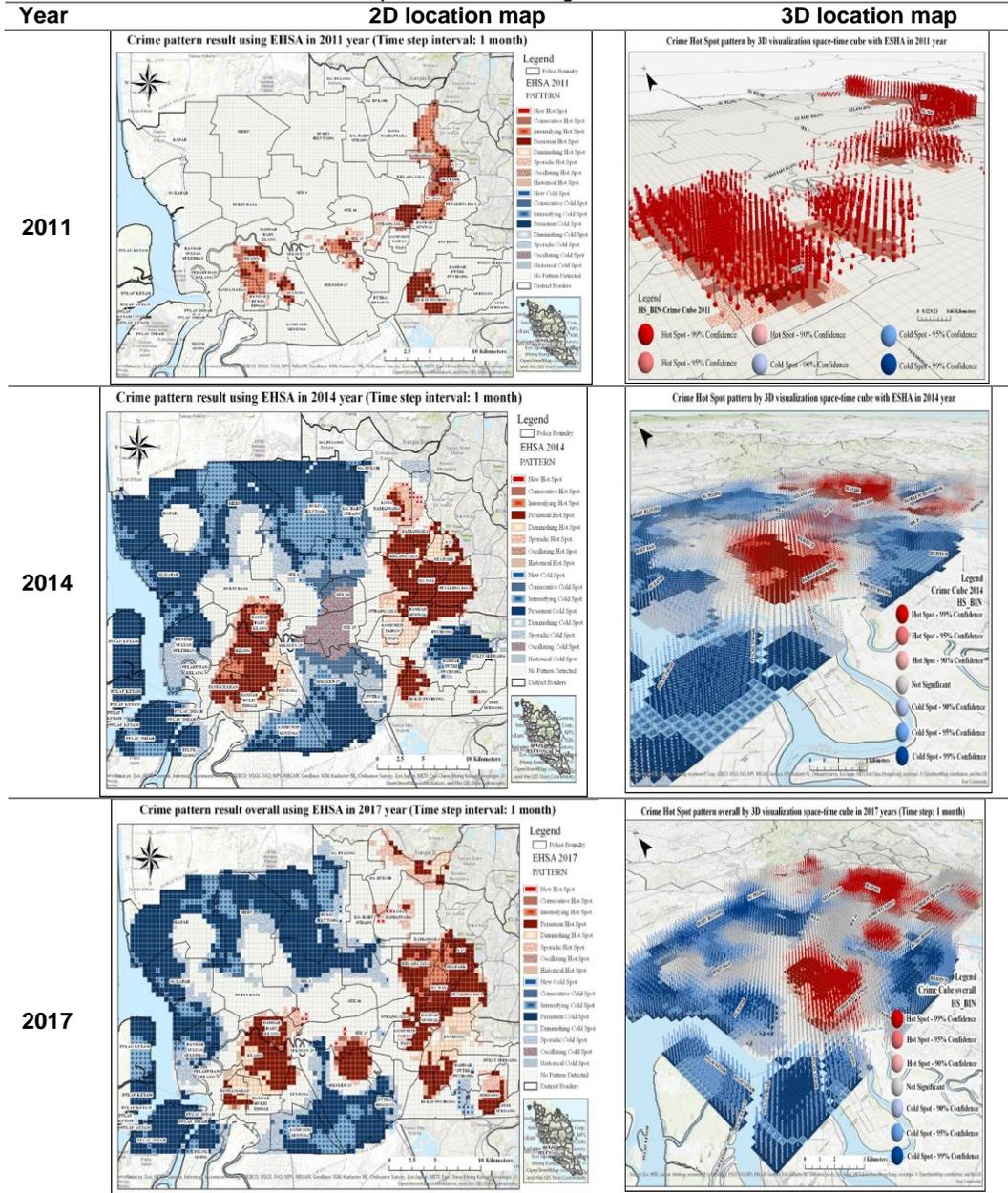


Table 1 EHSA workflow using Model Builder ArcGIS Pro 2.3

### 3. FINDINGS AND DISCUSSIONS

In 2011 year, the space time cube has aggregated 7,479 points into 6,460 fishnet grid locations over 12-time step intervals. There is a statistically significant crime increase in point counts over time. The result as show in Table 1. In 2014 year, the space time cube has aggregated 14,816 points into 7,956 fishnet grid locations over 12-time step intervals. There is a statistically significant crime decrease in point counts over time. In 2017 year, the space time cube has aggregated 13,655 points into 9,744 fishnet grid locations over 12-time step intervals. There is a statistically significant crime decrease in point counts over time.

Table 1 Crime pattern result using EHSA in 2011- 2017



From Exploratory Regression, only model population size and rate of urbanization indicators meet the requirements of passing model's predetermined test with Adjusted R-Squared ( $R^2$ ) is larger than  $> 0.3$  (30%) where is .56 (56%), coefficient (Koenker BP Statistic) p-value cut off is less than  $< 0.05$  (95%) where is  $p > 0.055$  (stationary), VIF is less from  $< 7.5$  where is 3.56, Jarque Bera p-value larger than  $>$  is 0.31 (not significance), and spatial autocorrelation p-value is also larger than  $> 0.1$  where is 0.2 (random). The survey data also did not show multicollinearity problems. Summary of variable significance shows that the exploratory variable for population density indicator has no significance ( $p > 0.10$ )

compared to rate of urbanization indicators has positive significance level ( $p < 0.05$ ) with 95% confidence level with negative linear relationship and size population have positive significance level ( $p < 0.01$ ) with 99% confidence level with positive linear relationship. Significance, this model is substantial factors and contributes 56 percent ( $R^2 = 0.56$ ) variance to the index crime rate throughout the study year (2011-2017).

#### **4. CONCLUSION**

The urban crime pattern shows half the neighbourhood in the study area reaches 99.9 percent significance with a very large z-score of 3.2381 and a very small p-value ( $p < 0.001$ ) at SS 2 Sea Park, Petaling Jaya. Interestingly, there are 26 locations of new hot spot categories within the study area with each year of study. New hot spot locations are changing location position but cluster pattern within 12 months of time step interval analysis for each year. Overall in urban crime pattern and factors, neighbourhood areas in Sg. Way (Taman Sri Medan), S 17 (Section 17) and Kota Damansara in Petaling Jaya and Bukit Puchong were major contributors to the crime index rate that have positive significance level ( $p < 0.01$ ) with 99% confidence level. For policing policy effectiveness, the knowledge about the crime pattern can be used in practice for determining targeted where police patrols and other crime prevention initiatives should be implementing to reduce the crime at certain hot spots location.

#### **5. RECOMMENDATIONS FOR FUTURE WORK**

For the future work, studies by each type of crime violence and crime property should be a more in-depth analyse on the crime pattern and the relationship with other factors such as economic that influencing the crime pattern in study area.

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The first author is the PhD candidate at Centre of Studies for Surveying Science & Geomatics, Faculty of Architecture, Planning & Surveying, Universiti Teknologi MARA. He is also the member of International Association of Crime Analysts (IACA) and Institution of Geospatial and Remote Sensing Malaysia (IGRSM).

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