

THE CONCEPTUAL DESIGN OF MALAYSIA GEOPOSTCODE AND ITS
IMPLEMENTATION

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Specially dedicated to King, Mak and Abah

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ABSTRACT

The study of Malaysia Geopostcode structure has been done by Wan Mohamad Nazmeen *et al.* (2015) and Nur Baizura (2015). Their study area covered the states of Johor Bahru (Othman *et al.* , 2015), Kuala Lumpur and Selangor (Napiah, 2015). They proposed the structure to be in eight alphanumerical characters. The structure by Wan Mohamad Nazmeen *et al.* (2015), Nur Baizura (2015) and this study was named as Geopostcode V1, Geopostcode V2 (Napiah, 2015) and Geopostcode V3 respectively. Geopostcode V1, Geopostcode V2 and the potential Geopostcode V3 structure being presented to the stakeholders in order to collect their perceptions on these Malaysia Geopostcode structures. Geopostcode V3 was designed by considering the administrative boundaries for every state in Malaysia and enhanced according to the input from the interviews with the stakeholders. The issues in Malaysia Geopostcode implementation have also been discussed. The structure of Geopostcode V3 has been shortened to seven characters. On top of that, the implementation issues are ranked in order to determine the biggest issues in Malaysia Geopostcode Implementation. The methodology of interviewing the stakeholders, analysing and designing the Malaysia Geopostcode are presented in this report. The final product from this study is the enhanced Malaysia Geopostcode structure which look suitable to be used for every states in Malaysia and the biggest issues in Malaysia Geopostcode implementation.

ABSTRAK

Kajian tentang struktur Geoposkod Malaysia telah dijalankan oleh Wan Mohamad Nazmeen *et al.* (2015) dan Nur Baizura (2015). Kajian mereka melibatkan kawasan kajian di negeri Johor Bahru (Othman *et al.*, 2015), Kuala Lumpur dan Selangor (Napiah, 2015). Kajian ini telah mencadangkan struktur yang melibatkan lapan askara. Struktur yang dicadangkan oleh Wan Mohamad Nazmeen *et al.* (2015), Nur Baizura (2015) dan kajian ini telah dinamakan sebagai Geoposkod V1, Geoposkod V2 dan Geoposkod V3. Geoposkod V1, Geoposkod V2 dan cadangan Geoposkod V3 telah dibentangkan kepada pihak berkepentingan untuk menerima persepsi mereka terhadap struktur Geoposkod Malaysia. Geoposkod V3 telah direka dengan mengambil kira sempadan pentadbiran setiap negeri di Malaysia dan struktur ini telah dinaiktaraf mengikut dapatan daripada temu ramah bersama pihak berkepentingan. Isu implimentasi Geoposkod Malaysia yang bakal timbul juga telah ditemu ramah. Struktur Geoposkod V3 telah dipendekkan kepada tujuh askara. Selain itu, isu implimentasi telah di susun mengikut keutamaan isu terbesar yang bakal timbul akibat implimentasi Geoposkod Malaysia. Metodologi yang digunakan di dalam temu ramah, analisis dan rekaan struktur Geoposkod Malaysia telah diterangkan di dalam kajian ini. Produk akhir daripada kajian ini adalah struktur Geoposkod Malaysia yang telah dinaiktarafkan dan ia sesuai digunakan untuk semua negeri di Malaysia. Isu implimentasi terbesar yang bakal timbul juga telah dibincangkan di dalam kajian ini.

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LIST OF ABBREVIATION

A	-	Alphabet
BP	-	Blok Perancangan
BPK	-	Blok Perancangan Kecil
BO	-	Branch Office
D	-	Digit
GIS	-	Geographic Information System
GPO	-	General Post Office
GPS	-	Global Positioning System
HO	-	Head Office
JPBD	-	Jabatan Perancangan Bandar dan Desa
JPJ	-	Jabatan Pengangkutan Jalan
JUPEM	-	Jabatan Ukur dan Pemetaan Malaysia
KLCC	-	Kuala Lumpur City Centre
KM	-	Kilometre
LBS	-	Local Based System
LDU	-	Local Delivery Unit
m	-	metre
MacGDI	-	Malaysia Centre for Geospatial Data Infrastructure
MBJB	-	Majlis Bandaraya Johor Bahru
MBPJ	-	Majlis Bandaraya Petaling Jaya
MBSA	-	Majlis Bandaraya Shah Alam
MDHS	-	Majlis Daerah Hulu Selangor
MDKL	-	Majlis Daerah Kuala Langat
MDKS	-	Majlis Daerah Kuala Selangor
MDSB	-	Majlis Daerah Sabak Bernam
MPAJ	-	Majlis Perbandaran Ampang Jaya
MPK	-	MajlisPerbandaran Klang

MPS	-	Majlis Perbandaran Selayang
MPSJ	-	Majlis Perbandaran Subang Jaya
MPJBT	-	Majlis Perbandaran Johor Bahru Tengah
MPKu	-	Majlis Perbandaran Kulai
MPPG	-	Majlis Perbandaran Pasir Gudang
NGV	-	Natural Gas Vehicle
PIN	-	Postal Index Number
PON	-	Position Oriented Navigation
SPR	-	Suruhanjaya Pilihanraya
SO	-	Sub Office
UK	-	United Kingdom
UKM	-	Universiti Kebangsaan Malaysia
UPI	-	Unique Parcel Identifier
UPU	-	Universal Postal Union
US	-	United States
V	-	Version
ZIP	-	Zoning Improvement Plan

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The main purpose of postcode is for the mail sorting. Different country used different term of postcode. For example, United Kingdom and most of Asia country includes Malaysia, the term used is postcode. But for India, they used PIN code. United States and Philipines used the term ZIP code.

The coverage area of Malaysia postcode is up to hectares (Othman *et al.* 2015). In this study, the term geopostcode has been used to represent the new proposed postcode system for Malaysia where the coverage area for geopostcode is around 10 to 12 parcel lot (Othman *et al.* 2015). The purposes of improving Malaysia postcode to Malaysia Geopostcode are to improve addressing quality, saves time and to avoids errors instead of the long address.

User will also easy to remember the codes compared to addresses. Masrek and Razak (2010) stated that, the main reason of the undelivered mail in Pos Malaysia is because the addresses written by the user were nonconforming to the SIRIM address standard. The users usually ignored the standard of the address structure. Thus, by using Malaysia Geopostcode, users will not need to understand the address structure, as the address has been converted to eight alphanumeric structure (Othman *et al.* 2015). This is more conveniently can be used and easy to be understood by people all over the world as compared to different languages in the address that will end up confusion to the user.

Other than that, it also will assist government and private agencies in using spatial data for policy planning and operations. Every government and private agencies normally will named, numbered and coded their area of operation based on their requirement. It involved high cost and time consumed to create the database. By using Malaysia Geopostcode, these can be centralized. The agencies can used the same boundary line with the same codes of the specific area. These able to provide efficient integration between the agencies, hence, efficient operation can be achieved.

Malaysia Geopostcode will allow integration with global positioning and navigation system, Global Positioning System (GPS). Pos Malaysia will not need to take so many years to train the posman to get familiar with the specific area. Posman can use GPS to assist them in delivering the mails. Malaysia Geopostcode also will lead to faster and more efficient postal delivery.

In Ireland, they use the Position Oriented Navigation Codes, PON Codes with 7 characters alphanumeric code that defined the plus minus 6 meters to the Latitude and Longitude (Collins *et al.* , 1998). Same case as Malaysia Geopostcode, where it allowed the users to simply key in the geopostcode to get navigated to the destination (Othman *et al.* 2015).

The previous researches for Malaysia Geopostcode have been done by Wan Mohamad Nazmeen (2013) and Nur Baizura (2015) which proposed and introduced Malaysia Geopostcode framework. Their findings show that the Malaysia Geopostcode able to assist people to navigate to their destination more precise compared to the conventional postcode. The precision is plus minus 10 parcel lots for every one geopostcode. This is because the geographic area assigned to the geopostcode has smaller coverage area compared to the conventional Malaysia postcode area. Users can simply key in the 8 alphanumerical geopostcode characters to search location and arrive to it rather than inserting long addresses.

Geopostcode involved many advantages and disadvantages, especially in the phase of starting the implementation. In Ireland, the user struggle using Eircode (Lucey, 2015). Government also have to pay millions for the implementation and maintenance (McManus, 2010). The structure of the geopostcode must be easy to remember and flexible (Othman *et al.* 2015) in order to provide the efficient Malaysia Geopostcode implementation.

In order to propose the efficient Malaysia Geopostcode structure, the perceptions of eight respondents from JUPEM, Pos Malaysia and Department of Statistics Malaysia were interviewed. The inputs from the interviews were used to design the structure. The implementation issues also been discussed with the stakeholders in order to analyze the biggest implementation issues in Malaysia Geopostcode.


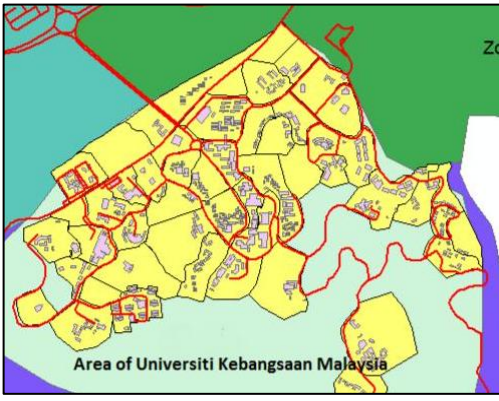
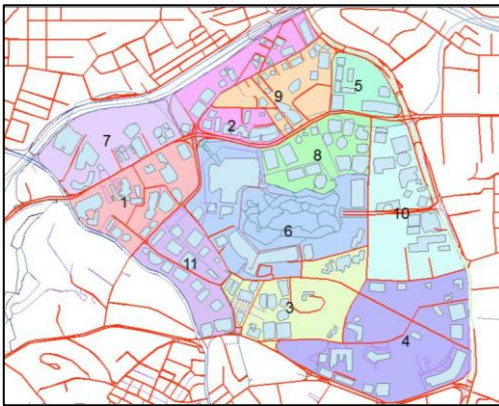
1.2 Background of the Problem

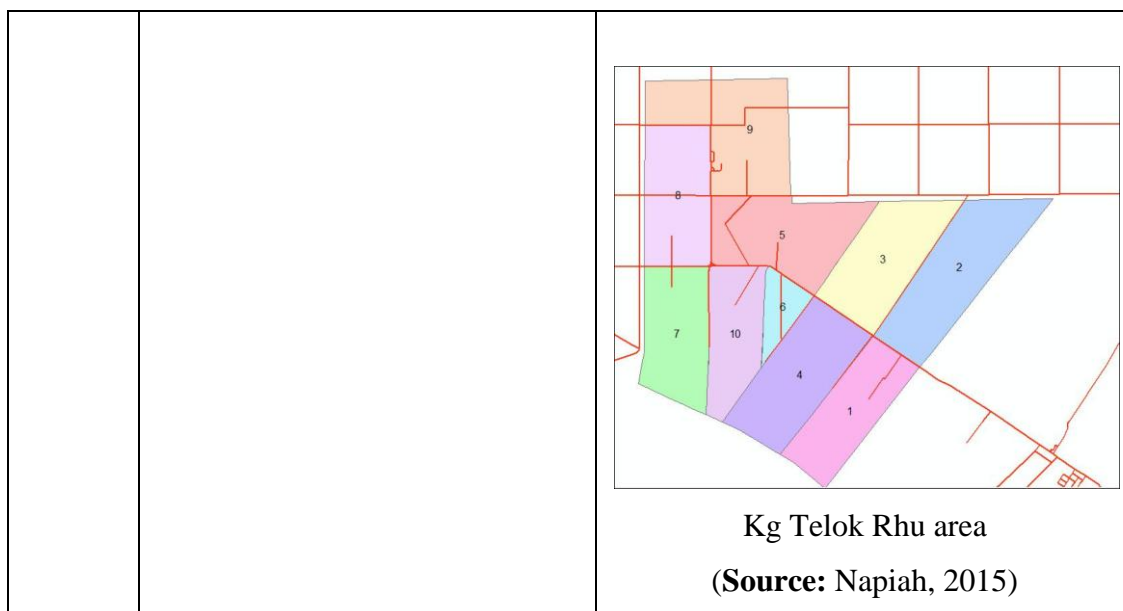
The biggest issues in geopostcode implementation is the cost and time constraint. A developed country such as Ireland, they have implemented the geopostcode. However, some issues in the implementation have occurred. In Ireland, the implementation caused high cost and time constraint to the government and private agencies especially in updating the old system and databases. For example, the hospital patients details and banks customers details (McManus, 2010). The users in Ireland also will need to pay for geopostcode database updating and will consumed memory space in the devices as well. They claimed, the geopostcode structure is hard to memorize and it has poor design (Lucey, 2015).

On the other hand, in United States, the GIS analyst and researchers claimed, the United States ZIP code is lack of standardization and dynamic. Hence, the spatial analysis is challenging to be done by the researcher. Other than that, the ZIP codes can be split, discontinued and expanded between months or years. This case will confuse the unfamiliar analyst and researchers who not familiar to this field and the modification of the ZIP code can cause spatio temporal discontinuity (Grubestic and Matisziw, 2006). Vashistha and Thies (2013) stated that, in India, postcode has an uncertainty regarding accuracy, robustness, usability and granularity of location data. She also stated that, postcode is not suitable to be used for those applications that require accurate location.

In Malaysia, the previous study has proposed the Malaysia Geopostcode structure by Othman *et al.* (2015) and Napiah (2015). The study areas for these researchs were described in Table 1. 1.

Table 1. 1 Previous research study area

	Geopostcode V1	Geopostcode V2
	Othman <i>et al.</i> (2015)	Napiah (2015)
Study area states	Johor Bahru	Selangor and Kuala Lumpur
Study area type	Well plan residential	Rural area and urban area
Study area	Kg Skudai Kiri	Kg Telok Rhu, Masjid UKM and Petronas NGV KLCC
Study area map	 <p>Kg Skudai Kiri (Source : Othman <i>et al.</i> , 2015)</p>	 <p>UKM (Source: Napiah, 2015)</p>
		 <p>KLCC area (Source: Napiah, 2015)</p>



The standard structure of the Malaysia Geopostcode still not been fixed yet to conveniently use for the Malaysia because these studies only focused on two states of Malaysia, Johor Bahru and Selangor. The geopostcode structure design is based on the administrative boundary for every state (Othman *et al.* , 2015). The issue occurred when, Malaysia's administrative boundaries are different for every state. The structure designed must be suitable to be used for all states' boundaries in order to proceed to the implementation level. This study is relevant to be conducted because the proposed structure is not flexible and standard yet to be use for all states. Some issues still leave in uncertainty regarding the states that do not have any district such as Putrajaya and Labuan. Every code in the structure is not been study yet whether it is suitable to use numbers as the code because some zones has more than 9 zones such as Kuala Lumpur need to use alphabet as the code for more flexibility. Figure 1. 1 explained the comparison of the two researchs proposed Malaysia Geopostcode data layers structure.

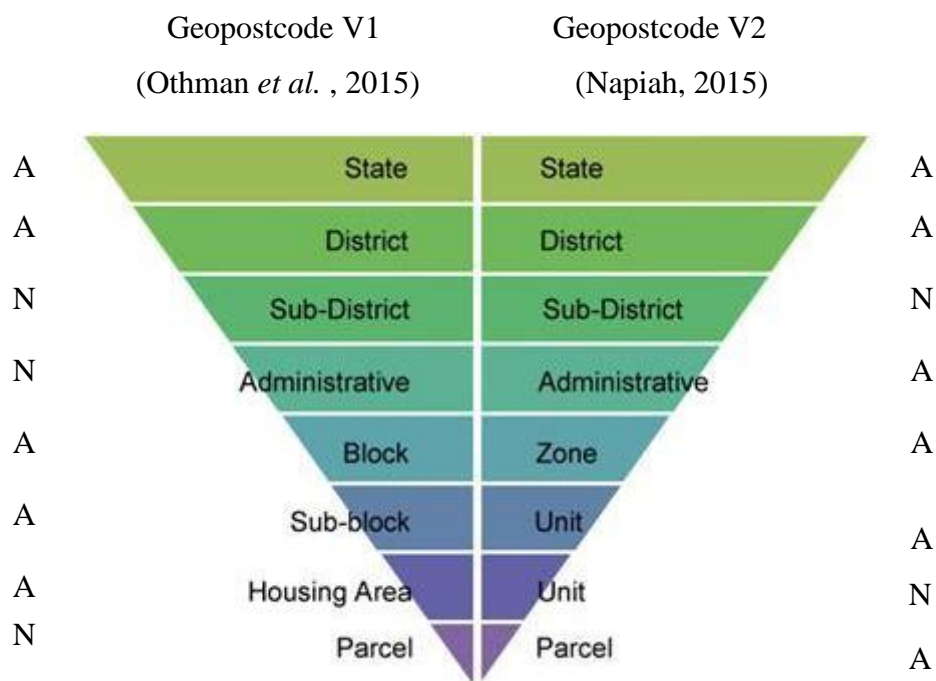


Figure 1. 1: Comparison of the proposed Geopostcode frameworks
(Napiah, 2015)

Where;

A = Alphabets

N = Numbers

In Malaysia, the government agencies defined their own geospatial data boundary lines for inner operations. Pos Malaysia, Department of Statistics Malaysia and Election Commission Malaysia (SPR) defined their own boundary line according to their needs. The boundary lines also not fixed due to operation changes. For Department of Statistics Malaysia, the block boundary lines changed every 10 years. It would be more effective if all these agencies use the same boundary lines, which is by using Malaysia Geopostcode for the operations. It is centralized and can be intergrated among the agencies. The study on their needs is to make sure the Malaysia Geopostcode structure suits every agencies needs.

The conventional postcode in Malaysia needs to be improved for more efficient mailing and other field services. Current postcode in Malaysia is not spatially related and the postcode boundary covers very large area until up to hectares levels. Postcode only been used by the Pos Malaysia purposes and not for precise navigation (Othman *et al.* , 2015). Most of the developed countries have applied the modern, digital alphanumeric postcode and can be intergrated with the precise navigation system and technology.

In addition, address system in Malaysia have redundant names and variation in spelling and labeling. Many places in Malaysia have similar names and lack of consistency for reference (Othman *et al.* , 2015). User struggled to use the existing address system. This also leads to an undelivered mail due to incomplete or incorrect postal addresses. Masrek and Razak (2010) stated that, it was found that 58% of the addresses were nonconforming to the SIRIM address standard while 31% of the postcodes were wrongly stated. The findings also unveiled that 23% of the investigated addresses had dual addresses and 16% had wrong postcodes.

If the user want to use coordinate for location navigation, this is not efficient because when the user use the geographic coordinate as the input in the navigation, it will consumed a lot of time due to long value of number to be key in the device. Errors also can easily occur by this method (Othman *et al.* , 2015).

1.3 Statement of the Problem

The previous research by Othman *et al.* (2015) and Napiah (2015) only study on the specific state in Malaysia but not the nation. Close study need to be done for every state administration boundaries in order to produce an efficient geopostcode structure. The administrative boundary for the states in Malaysia is not the same. In Sabah, there is no district and sub-district. Kuala Lumpur and Selangor have sections in the sub-district which other states do not. This research investigates the administrative boundaries for all states in Malaysia.

Other than that, the alphanumeric characters proposed for the structures in these studies needed to be revised because some of the states have a lot of sub-district compared to others such as Kelantan, Melaka, Negeri Sembilan and so on. They have more than 26 sub-districts in the states which not suitable to used only one character for the structure.

The definition, concept and characteristics of the boundaries will be clarified to design the Malaysia Geopostcode structure for all states until level zone. In order to provide a convenient geopostcode stucture, the perception of the stakeholders will be examined to avoid implementation issues and to assist the Malaysia Geopostcode implementation planning in the future.

1.4 Aim of the Study

To analyze the Malaysia Geopostcode implementation issues and the perceptions of the stakeholders towards the Malaysia Geopostcode structure and conceptually designed the Malaysia Geopostcode structure for all states.

1.5 Objectives of the Study

To accomplish this main aim, four vital objectives have been structured out which are:

- i. To review the existing issues in the implementation of Malaysia Geopostcode, the structures and other country postcodes.
- ii. To investigate and the issues in Malaysia Geopostcode implementation and the stakeholders perceptions for Malaysia Geopostcode structure.
- iii. To analyze the Malaysia Geopostcode implementation issues and stakeholders perception for Malaysia Geopostcode structure.
- iv. To design and develop the new conceptual design of Malaysia Geopostcode for all states until level zone from the Malaysia Geospatial framework.

1.6 Research Questions

The research questions have been derived from the aim and objectives of the study. The research questions were described in the Table 1. 2.

Table 1. 2: Research questions table

Aim	Objectives	Research questions
To rank the Malaysia Geopostcode implementation issues and the perceptions of the stakeholders towards the Malaysia Geopostcode structure and conceptually designed the Malaysia Geopostcode structure for all states.	To review the existing issues in the implementation of Malaysia Geopostcode, the structures and other country postcodes.	How Malaysia and other country design their postcode?
		How they improve and update the geopostcode?
		Why they choose the methods for geopostcode design and implementation?
	To investigate the issues in Malaysia Geopostcode implementation and the stakeholders perceptions for Malaysia Geopostcode structure.	Who are the stakeholders will be interviewed?
		How is the perception and why it accepted/not accepted by the stakeholder?
	To analyze the Malaysia Geopostcode implementation issues and stakeholders perception for	How to analyze the interview input?
		How to categorize the input?

	Malaysia Geopostcode structure.	How to present the analysis result?
	To design and develop the new conceptual design of Malaysia geopostcode for all states until level zone from the Malaysia Geospatial framework.	How to apply the design technique from other country geopostcode to Malaysia?
		How to apply input from the perception for geopostcode enhancement?
		How to improve the existing method to design the geopostcode?

1.7 Scope of the Study

In order to answer the research questions and achieve the targeted research objectives, the scope has been set up to two elements:

- i. Study Area
- ii. Data

1. 7. 1 Study Area

Peninsular Malaysia and Sabah Sarawak as in Figure 1. 2 is the study area for this study. This research investigates every state administrative boundary and design the Malaysia Geopostcode structure for all states implementation. The administrative boundaries line involved are states, districts, mukim/bandar/precinct and sections. Some states do not have any districts such as, Perlis and states do not have mukim such as Sabah was investigated. Most of the states do not have sections accept for Wilayah Persekutuan Kuala Lumpur and Selangor.

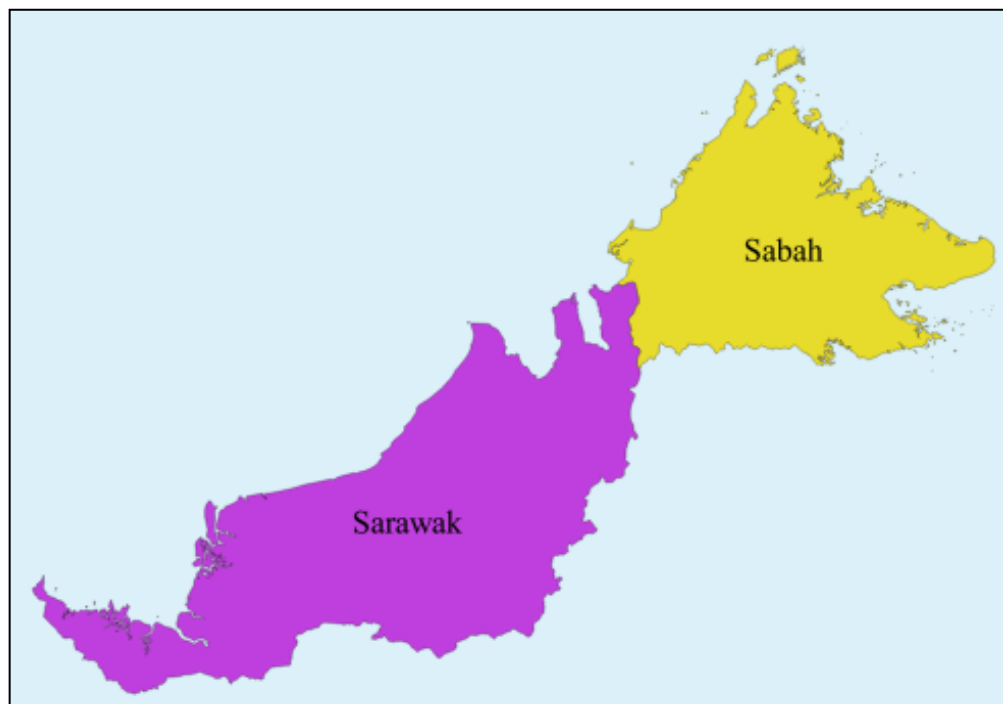


Figure 1. 2: The study area

1. 7. 2 Data

1. 7. 2. 1 Vector Data

The list of the states, districts, sub-district, sections and precinct was downloaded from the online MaCGDI application, Unique Parcel Identifier, UPI application. This online application is to identify parcel locations based on unique code that consists of states, districts, sub-districts, sections and lots number. The data consist for 13 states and 1,920 mukims in Malaysia. The data structure is the same data structure been used by JUPEM, Department of Statistic Malaysia and Pos Malaysia. The data structure been used as a reference to design the Malaysia Geopostcode structure.

However, the spatial data used in this study in only cover the area of Selangor. This is because the administrative boundaries for other states are restricted data in JUPEM. The available Selangor administrative boundary data is for state, districts and sub-districts boundaries only.

1. 7. 2. 2 Interview Data

The data for the stakeholder perception was obtained by interviewing the upper level in the management of 3 agencies. Due to time constraint, only 3 agencies are selected to be interviewed. The agencies includes, Pos Malaysia, Department of Mapping and Surveying Malaysia (JUPEM) and Department of Statistics Malaysia. JUPEM has been chosen to be interviewed because this agency is the Malaysia geospatial data provider. On the other hand, Pos Malaysia has been interviewed because they are the main user for Malaysia Geopostcode as the main purpose of

Malaysia Geopostcode is to assist mail sorting. According to McManus (2010), demographic is one of the implementation user for the new postcode, hence Department of Statistics has been chosen to be interviewed. The data for interviews was received from the face to face interview, phone calls and emails.

1.8 Chapters Outline

Chapter 1: Introduction

This chapter shall discuss in brief on the introduction, problem statement, research questions, research objectives and the limitation of research. Chapter 1 is essential in order to clarify on the problem identified: choosing on the best methodology and other elements related shall assist researcher to understand in depth on the research carry out.

Chapter 2: Literature Review

Chapter 2 is in conjunction with previous chapter in which this chapter shall indicates on the definition of the research carry out, discussion on the other countries postcode designs, the previous research designs and also implementation issues in other countries and so on.

Chapter 3: Research Methodology

This chapter shall discuss on the best selected method on employ in the research. Additionally, approach applied, sampling method, data collection, techniques or method use to analyze data and structure design.

Chapter 4: Result and Analysis

Chapter 4 comprises of all data obtained. Every data will be analyze and interpret using approach and method applied in the research. Results from the interpretation of data will help to construct the conclusion of research. Additionally, the result will also interpret on new findings from the research.

Chapter 5: Conclusion and Recommendation

This is the last chapter of the research. This chapter shall consist of conclusion of the research and analysis from the previous chapter. On top of that, additional suggestions and recommendations shall be made relates to the research execute.

REFERENCES

- Acevedo-Garcia, D. (2001). Zip code-level risk factors for tuberculosis: neighborhood environment and residential segregation in New Jersey, 1985-1992. *American Journal of Public Health*, 91, 734.
- Archive. India. Gov. In (2012). PIN Codes in India. December 9, 2012 ed. 3rd Floor, National Informatics Centre
- Bates, A. (2008). The development of a 'Postcode Best Fit' methodology for producing Population Estimates for different geographies. *Population Trends*, 28.
- Berger, A. , Keenan, P. & Miscione, G. (2015). A Postcode not for Post.
- Bogdan, R. & Biklen, S. (2003). Research for education. *Boston: Allyn & Bacon*, 1, 56.
- Carcary, M. (2009). The research audit trial—enhancing trustworthiness in qualitative inquiry. *The electronic journal of business research methods*, 7, 11-24.
- Cass, A. , Cunningham, J. , Wang, Z. & Hoy, W. (2001). Regional variation in the incidence of end-stage renal disease in Indigenous Australians. *Medical Journal of Australia*, 175, 24-28.
- Clark, N. A. , Demers, P. A. , Karr, C. J. , Koehoorn, M. , Lencar, C. , Tamburic, L. & Brauer, M. (2010). Effect of early life exposure to air pollution on development of childhood asthma. *Environmental health perspectives*, 118, 284.
- Clinch, C. (1981). British postal engineering. *Physical Science, Measurement and Instrumentation, Management and Education-Reviews, IEE Proceedings A*, 128, 107-116.
- Collins, S. , Haining, R. , Bowns, I. , Crofts, D. , Williams, T. , Rigby, A. & Hall, D. 1998. Errors in postcode to enumeration district mapping and their effect on small area analyses of health data. *Journal of Public Health*, 20, 325-330.

- Corr, C. (2006). *Financial Exclusion in Ireland: An exploratory study and policy review*, Combat Poverty Agency.
- Counterflix (2016). Zip Codes & Post Codes from Around the World. 2016 ed. : <http://www.counterflix.com/>
- De Vries, S. , Verheij, R. A. , Groenewegen, P. P. & Spreeuwenberg, P. 2003. Natural environments—healthy environments? An exploratory analysis of the relationship between greenspace and health. *Environment and planning A*, 35, 1717-1731.
- Deonandan, R. , Campbell, K. , Ostbye, T. , Tummon, I. & Robertson, J. (2000). A comparison of methods for measuring socio-economic status by occupation or postal area. *Chronic Diseases and Injuries in Canada*, 21, 114.
- Dhl. (2005). *Country Code and Postcode Formats* [Online]. Singapore: dhl. com. Available: http://www.dhl.com/tw/content/dam/downloads/tw/express/forms/postcode_formats.pdf [Accessed].
- Drewnowski, A. , Rehm, C. D. & Solet, D. (2007). Disparities in obesity rates: analysis by ZIP code area. *Social science & medicine*, 65, 2458-2463.
- Dugandzic, R. , Dodds, L. , Stieb, D. & Smith-Doiron, M. 2006. Environmental Health: A Global Access Science Source. *Environmental Health: A Global Access Science Source*, 5, 3.
- Dunne, M. 2014. (2014) Annual Report of the Comptroller and Auditor General and Appropriation Accounts. *The Development of Eircode, the National Postcode System*. Ireland: Communications, Energy and Natural Resources.
- Eircode (2014). What Is Eircode. Retrieved November 11, 2014 from <http://eircode.ie/what-is-eircode>
- Eisner, M. D. , Balmes, J. , Katz, P. P. , Trupin, L. , Yelin, E. H. & Blanc, P. D. (2005). Environmental Health: A Global Access Science Source. *Environmental health: a global access science source*, 4, 7.
- Ewell, D. (2004). Canadian Postal Codes. Mon Apr 12 09:40:29 2004 ed. Fullerton, California: <http://users.adelphia.net/~dewell/>.
- Given, L. M. (2008). *The Sage encyclopedia of qualitative research methods*, Sage Publications.

- Grubestic, T. H. & Matisziw, T. C. (2006). On the use of ZIP codes and ZIP code tabulation areas (ZCTAs) for the spatial analysis of epidemiological data. *International journal of health geographics*, 5, 1.
- Hanchette, C. L. (1999). GIS and decision making for public health agencies: childhood lead poisoning and welfare reform. *Journal of Public Health Management and Practice*, 5, 41-46.
- Hoffmann, A. O. , Post, T. & Pennings, J. M. (2013). Individual investor perceptions and behavior during the financial crisis. *Journal of Banking & Finance*, 37, 60-74.
- Horby, P. , O'brien, S. , Adak, G. , Graham, C. , Hawker, J. , Hunter, P. , Lane, C. , Lawson, A. , Mitchell, R. & Reacher, M. 2003. A national outbreak of multi-resistant *Salmonella enterica* serovar Typhimurium definitive phage type (DT) 104 associated with consumption of lettuce. *Epidemiology and infection*, 130, 169-178.
- Hsieh, H. -F. & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, 15, 1277-1288.
- Hume, D. & Womersley, J. (1985). Analysis of death rates in the population aged 60 years and over of Greater Glasgow by postcode sector of residence. *Journal of epidemiology and community health*, 39, 357-363.
- Humpel, N. , Owen, N. , Iverson, D. , Leslie, E. & Bauman, A. (2004). Perceived environment attributes, residential location, and walking for particular purposes. *American journal of preventive medicine*, 26, 119-125.
- Humpel, N. , Owen, N. & Leslie, E. (2002). Environmental factors associated with adults' participation in physical activity: a review. *American journal of preventive medicine*, 22, 188-199.
- Jacob, F. (2015). *The Postcode Map of United Kingdom* [Online]. Big Think Available: <http://bigthink.com/strange-maps/113-the-postcode-map-of-the-united-kingdom> [Accessed].
- Jenner, B. , Flick, U. , Von Kardoff, E. & Steinke, I. (2004). *A companion to qualitative research*, Sage.
- Jones, K. & Simmons, J. W. (1990). *Location, location, location*, Nelson Canada.
- Lallie, H. S. 2013. External Validity and Referential Ambiguity in Geospatial Patterns.

- Jones, K. & Simmons, J. W. (1990). *Location, location, location*, Nelson Canada.
- Kamilaris, A. , Pitsillides, A. & Fidas, C. (2016). Social Electricity: a case study on users perceptions in using green ICT social applications. *International Journal of Environment and Sustainable Development*, 15, 67-88.
- Kamilaris, A. , Pitsillides, A. , Fidas, C. & Kondepudi, S. (2015). Social Electricity: The evolution of a Large-Scale, Green ICT Social Application through two Case Studies in Cyprus and Singapore.
- Kimura, F. & Shridhar, M. (1992). Segmentation-recognition algorithm for zip code field recognition. *Machine Vision and Applications*, 5, 199-210.
- Lallie, H. S. (2013). External Validity and Referential Ambiguity in Geospatial Patterns.
- Lam, L. & Suen, C. Y. (1988). Structural classification and relaxation matching of totally unconstrained handwritten zip-code numbers. *Pattern Recognition*, 21, 19-31.
- Lazarus, L. , Chettiar, J. , Deering, K. , Nabess, R. & Shannon, K. (2011). Risky health environments: women sex workers' struggles to find safe, secure and non-exploitative housing in Canada's poorest postal code. *Social Science & Medicine*, 73, 1600-1607.
- Lee, C. K. & Leedham, G. Year. Empirical design of a holistic verifier for automatic sorting of handwritten Singapore postal addresses. *In: Document Analysis and Recognition*, (1999). ICDAR'99. Proceedings of the Fifth International Conference on, 1999. IEEE, 733-736.
- Limited, S. P. (2016). *Postal Code Finder* [Online]. Singapore. Available: <http://www.singpost.com/quick-guide-a-others/postal-code-finder.html> [Accessed 2016 2016].
- Localplaces (2014). Local Places. Retrieved November 10, 2014 from <http://www.localplaces.com/>
- Lucey, B. M. May (2015). What's wrong with Eircode? [Accessed April 14 2014].
- Lu, Y. & Tan, C. L. (2002). Combination of multiple classifiers using probabilistic dictionary and its application to postcode recognition. *Pattern Recognition*, 35, 2823-2832.
- Mack, N. , Woodsong, C. , Macqueen, K. M. , Guest, G. & Namey, E. (2005). *Qualitative research methods: a data collectors field guide*.

- Masrek, M. N. & Razak, Z. A. Year. Malaysian Address Semantic: The Process of Standardization. *In: Computer Research and Development*, (2010) Second International Conference on, 2010. IEEE, 77-80.
- Matheson, F. I. , Moineddin, R. , Dunn, J. R. , Creatore, M. I. , Gozdyra, P. & Glazier, R. H. (2006). Urban neighborhoods, chronic stress, gender and depression. *Social science & medicine*, 63, 2604-2616.
- Mcmanus, L. (2010). *The Postcode Report*. *In: Report, S. (ed.) The Postcode Report*. Ireland: Communications, Energy and Natural Resources.
- Miller, D. L. (1997). One Strategy for Assessing the Trustworthiness of Qualitative Research: Operationalizing the External Audit.
- Moriarty, J. (2011). Qualitative methods overview.
- Morse, S. P. (2008). *Decoding Canadian Postal Codes in One Step 2008 ed.* San Francisco
- Napiah, N. B. B. M. 2015. *The Conceptual Design of Malaysia Geopostcode : Re-Evaluation and Redevelopment*. Universiti Teknologi Malaysia.
- Nunn, A. , Bickerstaffe, T. , Hogarth, T. , Bosworth, D. , Green, A. & Owen, D. (2010). *Postcode Selection?: Employers' Use of Area and Address-based Information Shortcuts in Recruitment Decisions*, Department for Work and Pensions.
- Othman, W. M. N. W. , Yusof, Z. M. & Amerudin, S. (2015). Conceptual Design of Malaysia Geopostcode System. *Jurnal Teknologi*, 73.
- Pal, U. , Roy, R. K. , Roy, K. & Kimura, F. Year. Indian multi-script full pin-code string recognition for postal automation. *In: Document Analysis and Recognition*, 2009. ICDAR'09. 10th International Conference on, (2009). IEEE, 456-460.
- Pfeffer, K. , Deurloo, M. C. & Veldhuizen, E. M. 2012. Visualising postcode data for urban analysis and planning: the Amsterdam City Monitor. *Area*, 44, 326-335.
- Postal India (2013). *India Postal Guide*. Retrieved on April 9, 2014, from, <http://www.indiapost.gov.in/Pincode.aspx>
- Provo, UT 84606-5512: SmartyStreets. Available: <https://smartystreets.com/articles/zip-codes-101> [Accessed 2016].

- Raknes, G. & Hunskaar, S. (2014). Method paper–distance and travel time to casualty clinics in Norway based on crowdsourced postcode coordinates: A comparison with other methods. *PloS one*, 9, e89287.
- Smartystreets. 2016. *ZIP Codes 101* [Online]. 2335 S State St Ste 300
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for information*, 22, 63-75.
- Simons, H. (2009). *Case study research in practice*, SAGE publications.
- Tay, Y. H. , Khalid, M. , Tan, K. K. & Yusof, R. Year. Hand-Written Postcode Recognition by Fuzzy ARTMAP Neural Network. *In: COSTAM National Science Congress*, (1997). Citeseer.
- Toledano, M. B. , Nieuwenhuijsen, M. J. , Best, N. , Whitaker, H. , Hambly, P. , De Hoogh, C. , Fawell, J. , Jarup, L. & Elliott, P. (2005). Relation of trihalomethane concentrations in public water supplies to stillbirth and birth weight in three water regions in England. *Environmental health perspectives*, 225-232.
- Turner Iii, D. W. (2010). Qualitative interview design: A practical guide for novice investigators. *The qualitative report*, 15, 754.
- Ulvr, J. & Kho, A. T. (1997). Mail piece bar code having a data content identifier. Google Patents.
- Vashistha, A. , Cutrell, E. & Thies, W. (2013). Mapping Interactive Voice Response Call Data in Developing Regions. *In: Workshop on Geographic Human Computer Interaction, CHI*, 2013.
- Vashistha, A. & Thies, W. (2013). How should users convey their location to an interactive voice response system? *In: Proceedings of the 4th Annual Symposium on Computing for Development*, 2013. ACM, 26.
- Wikipedia (2012a). Postal Codes in Canada. Retrieved November 9, 2014, from http://en.wikipedia.org/wiki/Postal_codes_in_Canada
- Williams, D. (2011). Qualitative inquiry in daily life: Exploring qualitative thought. Provo, UT: Online. Retrieved from <https://qualitativeinquirydailylife.wordpress.com>.

Wirz-Dittus, S. , Belloy, L. , Hüsey, D. , Waldvogel, A. S. & Doherr, M. G. (2010). Seroprevalence survey for Salmonella Abortusovis infection in Swiss sheep flocks. *Preventive veterinary medicine*, 97, 126-130.

Www. Mapsofindia. Com. (2014). *Pin Code*. C-62, Community Center, Janakpuri, New Delhi-58 (India): Compare Infobase Limited.

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan*, 1-6.

Zipboundary 2016. ZIP Code FAQs.