

A COMPARATIVE STUDY OF SPATIAL VARIATION BETWEEN THE STATES OF PENINSULAR MALAYSIA IN TERMS OF WATER SUPPLY CHARACTERISTICS AND CONSUMER'S PERCEPTION

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ABSTRACT: Peninsular Malaysia is made up of 11 states with different landforms, natural resources, population patterns and lifestyle patterns. This paper aims to compare the spatial variations between water supply characteristics in terms of price, non-revenue water (NRW) and domestic water consumption by states and domestic water consumers' perception in terms of their satisfaction of their water service suppliers. The methodology is based on both primary and secondary data. Primary data is derived from a questionnaire survey on 400 domestic water consumers and secondary data obtained through a survey of books, articles, journals, annual reports and official websites that are related to water issues. The results conclude that different states show different levels of performance by various water service suppliers and different perception amongst consumers which is caused by spatial variation.

Keywords: spatial variation, water service provider, water supply, consumers perception, non-revenue water

INTRODUCTION

Malaysia is a country located in the equatorial region with rainfall throughout the year and an average of 3000mm of rain per year. The country is rich in water resources such as rainwater, rivers, lakes and underground water and has 189 river basins that contribute to water resources 900billion cubic meters of annual budget (Sulaiman, 2014). Malaysia consists of thirteen states separated by South China Sea into Peninsular Malaysia and East Malaysia. Peninsular Malaysia also known as West Malaysia consists of 11 states that are divided into four regions: Northern Region, East Coast Region, Central Region and Southern Region. Peninsular Malaysia population is roughly 23.5 million on year 2010 (Department of Statistics, 2010), average rainfall of 2500mm per year (Department of Irrigation and Drainage Malaysia, 2011). Though Malaysia experiences abundance of rainfall annually, however rainfall are seasonal and unevenly distributed (Chan, 2007).

HISTORY OF WATER SUPPLY IN PENINSULAR MALAYSIA

According to Malaysia Water Industry Report (1996/1997), first water supply system began in Pulau Pinang in 1804 when the population then was about 10,000 people where clean stream water from hill was brought along brickwork channel to town and tin pipes conducted to house, and in 1930's, modern rapid gravity filtration plants just only introduced to the country. Due to the pristine raw water quality or by gravity slow sand or rapid sand filtration, water treatment was either not necessary. Disinfection technology using hypochlorite and later gaseous chlorine made its first appearance in 1915 (Chan, 2007). Before Second World War, all the major towns had treated water supplies and there were 100 water treatment plants in the country.

According to Chan (2007), after independence, major development in water supply took place and continued. The launching of the National Five Year Development Plans commencing in 1966 play a vital role in accelerating the development of water supply in the country. Legislations were introduced to identify jurisdiction on control of raw water sources and assurance of raw and treated water quality. To ensure effective development and operation of water supply in the country, a new known as the Ministry of Energy, Water and Communications was created on March 2004 and National Water Services Commission was established under Act 2005 under the Ministry.

WATER SUPPLY AT PENINSULAR MALAYSIA

According to the Department of Water Supply, Ministry of Energy, Green Technology and Water Malaysia, in mid-2005, Malaysia Parliament passed amendments to the Ninth Schedule of Federal Constitution which move matters related to water supply and services from State List to the Concurrent List. With the amendment, the Federal Government will regulate water services industry in terms of licensing and regulatory services operation. State Government is to maintain its power over water resources, watersheds and river basin. Treatment and distribution of water in every state in Malaysia is carried out by government agencies of each state. For each state, these agencies are different, either by Public Works Department (JKR), Department of Water (JBA) or the State Water Supply Authority (Kamarudin et al., 2014). This has led to 11 states in Peninsular Malaysia to having different water supplier and different water prices. And due to the difference in terms of space and physical factors: the amount of rainfall, the number of rivers and water quality also varies. In addition, the use of water also difference from state to state in term of domestic use, industrial and irrigation. Figure 1 shown the difference of water supplier of every state in Peninsular Malaysia.

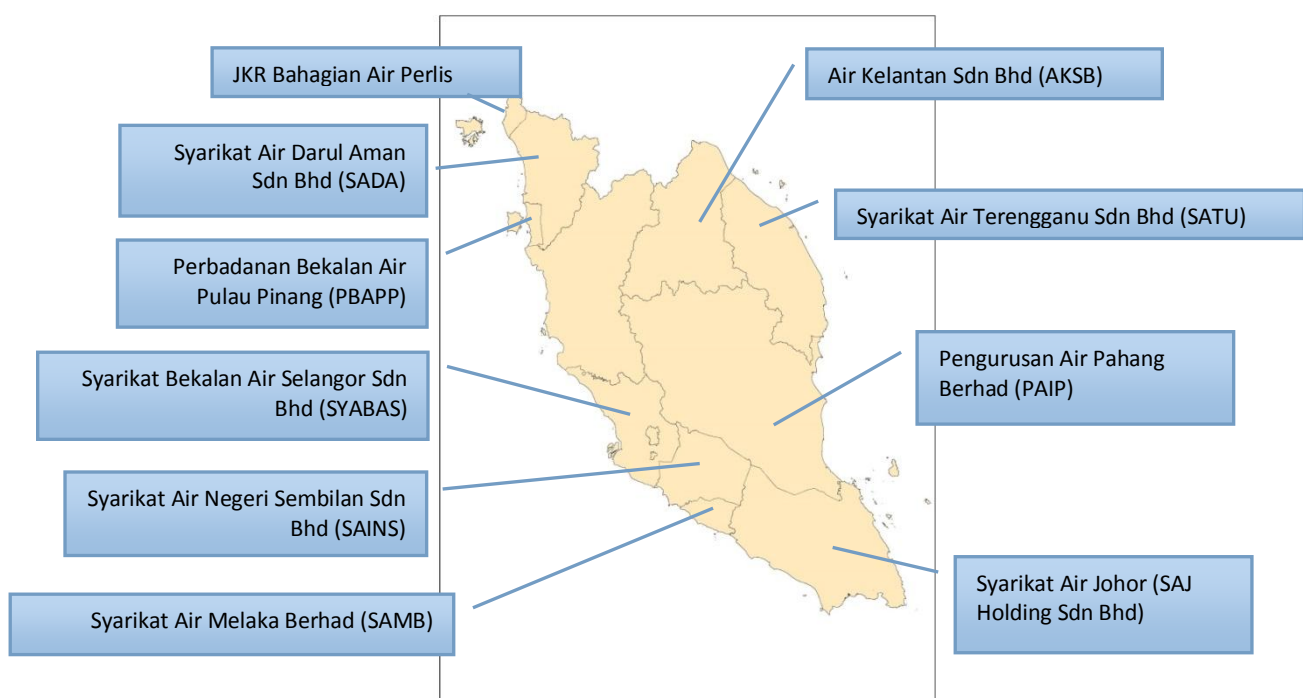


Figure 1: List of Water Supply for every state in Peninsular Malaysia

Source: Name list of water Supply by state: Department of Water Supply
<http://h2o.water.gov.my/v2/fail/locrfe/peninsula.html>

This paper aims to compare water suppliers among the states of Peninsular Malaysia in term of price, NRW and domestic water use by states. The study also examines the satisfaction of domestic water users to their water suppliers.

METHODOLOGY

This paper is based on both primary and secondary data. A total of 400 domestic water consumers from every state of Peninsular Malaysia were invited to fill in a questionnaire regarding their daily water consumption and SPSS was used for data analysis. Respondents were chosen by random sampling method from urban and rural area of every state and sample stratification was based on racial composition of Malaysia, composition of urban- rural, sex, age group and level education. Secondary data were obtained through a survey of book, articles, journals, annual report and official website that related to water issues, water data like price, consumption and NRW rate. Based on

primary and secondary data collected, comparison of price, water consumption, NRW rate and level of satisfaction from domestic water consumers was used to form the basis of discussion of the paper.

RESULTS AND DISCUSSION

Peninsular Malaysia consists of 11 states and there are 11 companies / different water suppliers as shown in Figure 1. Water consumption can be divided into two, namely domestic consumption and non-domestic consumption. Domestic consumption is the water used by households for drinking, cooking, washing, watering plants, and use in the toilet. Non domestic water consumption is water that is used in agriculture/irrigation, industrial and commercial (Abrashinsky, 2004) Figure 2 shows the use of domestic and non-domestic water by states in Peninsular Malaysia. Domestic water consumption rate is found to be highest in the Kedah state (81.5 per cent) and lowest in the Malacca state. In average, 61.5 per cent of water used by domestic and 38.5 per cent water use on non-domestic purpose (SPAN, 2012-2013). This figure shows that most water (more than 50 per cent) is used for domestic purposes. From Figure 2, the highest non-domestic water consumption is Malacca (48.6 per cent) and the lowest is Perlis (18.5). Average for non-domestic water consumption is 38.5 per cent.

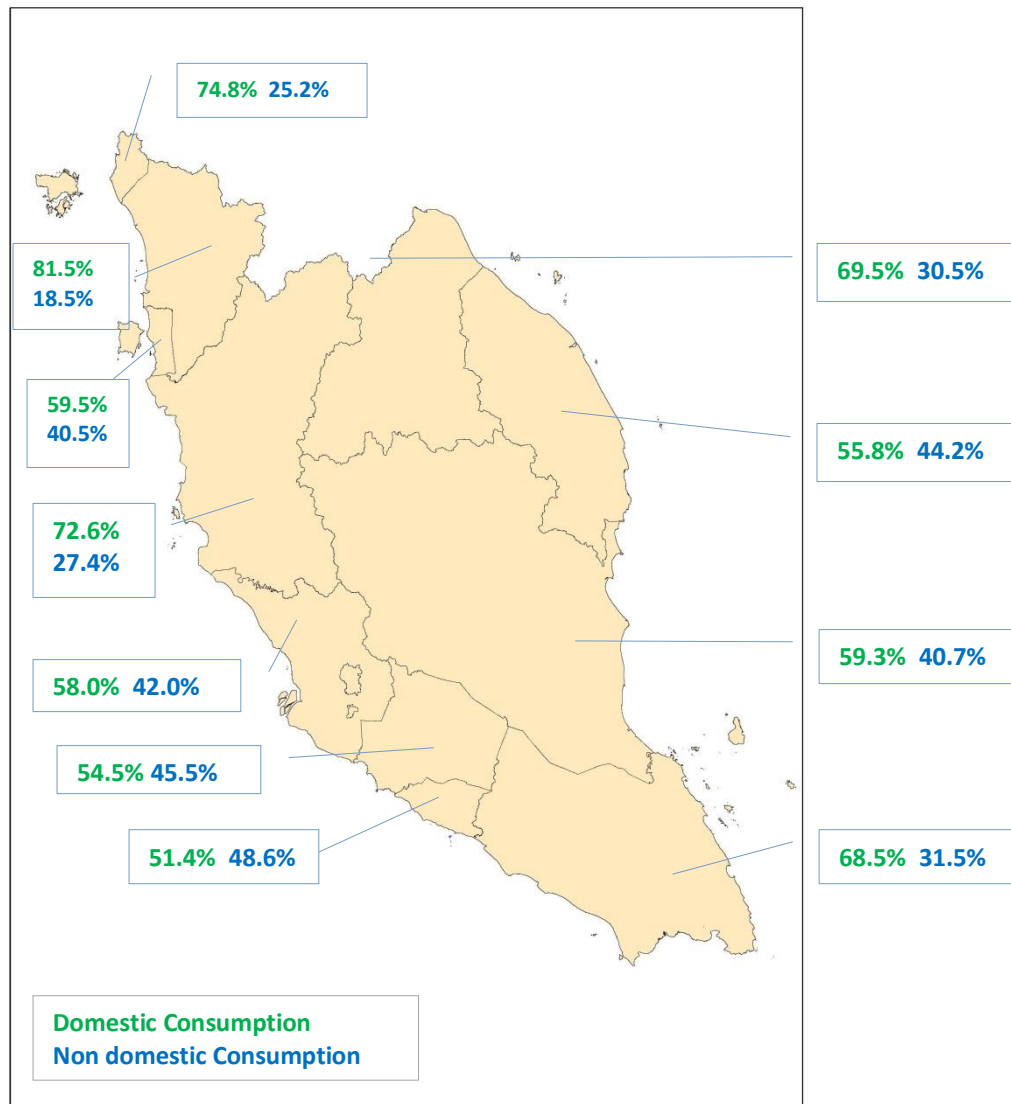


Figure 2: Comparing the domestic and non-domestic water use by state in year 2013
 Source: SPAN Water Consumption (2012-2013)

Figure 3 shows the water supply coverage by state for urban and rural area. Penang, Perak, Perlis, Selangor, Negeri Sembilan, Malacca, Johor and Pahang had 100 per cent water supply coverage at urban area and only Kelantan and Terengganu state does not achieve 100 per cent water supply coverage at urban area. For rural area, there are only Melaka state achieve 100 per cent water supply coverage at rural area.

Non-revenue water (NRW) represents water lost in the water supply value chain. For year 2014 national average NRW is 36.6 per cent (PBAPP). Figure 3 shows that 4 states NRW rate are above the average. The state are Perlis, Kelantan, Pahang and Kedah. However, 7 states NRW rates are below the average. The states are Penang, Johor, Terengganu, Melaka, Negeri Sembilan, Perak and Selangor. The highest NRW state is Perlis (62.4 per cent) and the lowest is Penang (18.3 per cent).

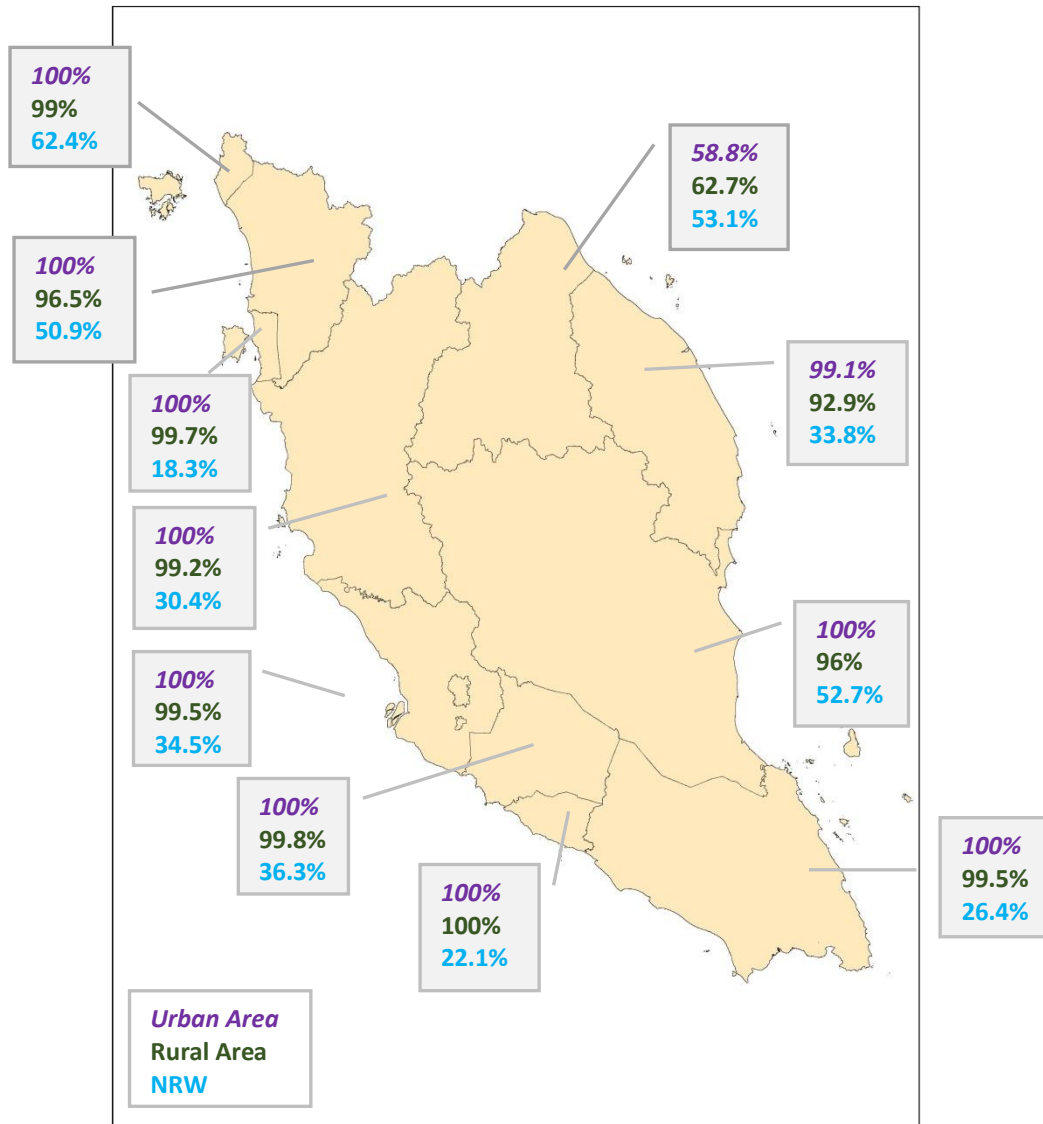


Figure 3: Coverage of Water Supply and NRW by State
 Source: KeTTHA Annual Report 2013 and PBAPP)

Figure 4 shows domestic water tariff at Peninsular Malaysia. Due to different water suppliers for every state, there are different domestic water tariff by state. Average domestic water tariff at Malaysia is RM 0.66 per 1,000 L for the 1st 35,000L. Penang, Terengganu, Perlis, Kelantan and Pahang domestic water tariff is below the average domestic water tariff. Water tariff for Kedah, Negeri Sembilan, Johor, Melaka, Perak and Selangor domestic water tariff is above the average. Penang has the lowest domestic water tariff of RM0.32 per 1,000 L for the 1st 35,000L and Johor has the highest domestic water tariff (RM1.05 per 1,000 L for the 1st 35,000L).

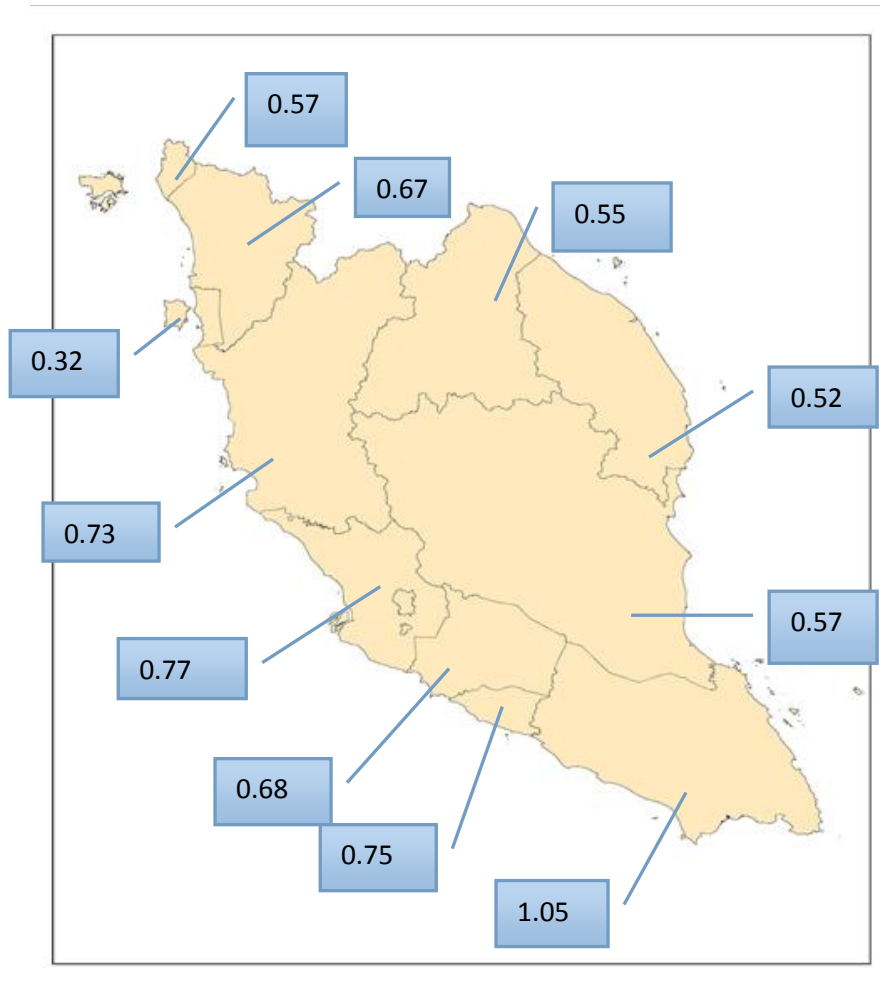


Figure 4: Domestic Water Tariffs (RM per 1,000 L for 1st 35,000L)
Source: PBAPP http://www.pba.com.my/?page_id=603

From Figures 3 and 4, the research found that Penang water supplier (Perbadanan Bekalan Air Pulau Pinang) performed well where there are 100 per cent water coverage at urban area, with the lowest NRW rate and water tariff and so on the consumer perception where 51.3 per cent of consumer rank PBAPP is good and 10.3 per cent rank as very good (Table 1). From Table 1, the research found that a majority of Perlis consumers rank their water supplier as average (47.7 per cent) and poor (41.5 per cent).

Table 1: Consumers Ranking of their Water Supplier by State

| State | Consumer rank their water provider | | | | |
|------------------------|------------------------------------|------|---------|------|-----------|
| | Very poor | Poor | Average | Good | Very good |
| Kelantan | 1.5 | 7.7 | 31.5 | 48.4 | 10.9 |
| Terengganu | 0.3 | 1.8 | 16.3 | 63.9 | 17.7 |
| Pahang | 0 | 1.8 | 34.2 | 54 | 9.9 |
| Johor | 2.6 | 1.3 | 29.5 | 56.4 | 10.3 |
| Melaka | 2.8 | 8.3 | 33.3 | 47.2 | 8.3 |
| Negeri Sembilan | 0.7 | 4.6 | 28.3 | 50.2 | 16.1 |
| Selangor | 0.9 | 3.3 | 30.5 | 52.1 | 13.1 |
| Perak | 2.8 | 4 | 39 | 42.7 | 11.4 |
| Penang | 2.2 | 3.6 | 32.7 | 51.3 | 10.3 |
| Kedah | 2.3 | 2.3 | 32 | 54 | 9.3 |
| Perlis | 0 | 41.5 | 47.7 | 8.3 | 2.5 |

Source: Questionnaire survey

From Figure 4, the research found that Penang has the lowest water tariff in Peninsular Malaysia where there are only RM0.32 per 1,000 L for the 1st 35,000L. However, there are only 27.4 per cent of Penang domestic water consumer think the tariff is low/ cheap and 15 per cent of consumer think the tariff still high / expensive. For Johor state which has the highest domestic water tariff in Peninsular Malaysia where is RM1.05 per 1,000 L for the 1st 35,000L, 20.4 per cent of their water consumer said that the water tariff was high/ expensive and only 11.3 per cent of consumer said the tariff was low/ cheap.

Table 2: Consumer's Perception on Water Tariff

| State | Consumer Perception on water tariff (%) | | |
|------------------------|---|----------|-------------|
| | High (Expensive) | Moderate | Low (Cheap) |
| Kelantan | 12.2 | 71 | 16.8 |
| Terengganu | 19.1 | 71.5 | 9.4 |
| Pahang | 13.6 | 72.8 | 13.6 |
| Johor | 20.4 | 68.3 | 11.3 |
| Melaka | 10.3 | 82.7 | 6.8 |
| Negeri Sembilan | 18.9 | 67 | 14.1 |
| Selangor | 14.6 | 69.3 | 16 |
| Perak | 21 | 65.3 | 13.7 |
| Penang | 15 | 57.6 | 27.4 |
| Kedah | 16.2 | 70.7 | 13.1 |
| Perlis | 2.1 | 33.2 | 64.7 |

Source: Questionnaire survey

CONCLUSION

Spatial variations certainly affect water issues, water supply and consumers' characteristics. Different areas create a difference in performance, demand, and perception. This paper conclude that Perbadanan Air Pulau Pinang (PBAPP) demonstrate good performance as they supply the cheapest water to consumers with the lowest NRW rates and 100 per cent coverage water supply for urban area compared to all other states. However, satisfaction and perceptions of the population varies greatly

between states. Many factors cause these differences and further study is needed to identify these factors so that they can be addressed towards sustainable water resources management.

Acknowledgements

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