Spatial Analysis: Where Are They Now After Graduation?

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Abstract. Graduate's employability and unemployment in Malaysia has been one of the main national agendas. As more and more graduates are produced, the percentage of unemployed graduates is also increasing. This study aims to explore the spatio-temporal distribution of the employment status and mobility of graduates with the usage of GIS technique to see whether there is any spatial change over the time. Various visualization maps displayed information on the relocation or mobility of the graduates and high dense areas with unemployment. This research found that the distribution of employment increased over the time and the state with high employment was located in Selangor, Kuala Lumpur and Johor while Kelantan and Sabah recorded high unemployment rates. Besides, the spatial mobility of graduates showed that the graduates are less spatially mobile especially those from Sabah and Sarawak. The willingness to relocate would be an alternative solution to increase the chances of being employed among the graduates.

Keywords: GIS · Tableau · Spatio-Temporal Distribution · Mobility

1 Introduction

The phenomena of unemployment among graduates are worrying the Malaysian government. In this era, education level is the important thing to have a better life and be employed. Currently, the number of job vacancies is decreasing, which could add to graduates' concerns about future employment. Institutions of higher education produce about 341,311 graduates in 2018 from all universities, colleges and other institutions in Malaysia. According to [1] among the fresh graduates, 58.6% of them have been employed, 15.7% was continuing their studies and the balance 25.7% still unemployed. The unemployed include persons who were available for work but did not work during a reference period. The negative impact of high unemployment rate lead to the failure of the country to produce quality youth in helping to grow the country's economy as well as the development of Malaysia. In addition, the graduates tend to do crimes as their initiative to survive and graduates' mental health could also affect in the process of their transition from university to the labor market [2].

Unemployment may be caused by two aspects such as oversupply of graduates in the job market, and graduates are unable to meet the skills needed by the industry.

As mentioned before, the number of graduates enrolled in university, private or public institutions increases from year to year. All the graduates compete with each other to secure a job. Based on a report of graduates tracer study done by [3], about 41,161 thousand persons still unemployed within six months after finishing studies in 2019 from the total of 346,686 graduates in that year. Employability is now looked upon as the main target in most labour market policies and manpower strategies in most countries especially for the employability of graduates [4]. Graduates should have the employability skills as a key to secure a job and have a better chance to enter the labour market. According to [5], employability skills is a set of achievement, understanding, and personal attitudes or qualities that mark the individual as potentially more able to get a desired job and successful in career choice. Generally, employability skills are those aspects of skills and knowledge graduates need to have to equip them to fulfil various employment demands in the labour market after they have completed their studies. One of the factors that determine the effectiveness of an academic institution is through the employability of its graduates. Based on graduates tracer study that conducted by [1], there are five universities that show the highest employability; the first one is UMP with 96.2 percent, followed by UPNM with 93.8 percent, UPM with 83.5 percent, UiTM with 83.4 percent and lastly UM with 80.3 percent.

The Graduate tracer study involves identification and follow-up of graduates from Higher Education Institutions (HEIs) to consider how graduates view their experiences during their study and transition to the job market. The main purpose of this study is to obtain information on graduate employment status after finishing studies. Graduates are required to fill up the survey form that conducted by the Ministry of Higher Education before their graduation day. In Malay, graduate tracer study called as SKPG I (*Sistem Kajian Pengesanan Graduan*).

The implementation of SKPG I helps in producing the information of graduates for HEIs such as graduates employability, employment status, monthly income and graduate's employer. In addition, the survey also emphasized the views and evaluations of their institutions including the effectiveness of selected programs, facilities infrastructure, learning and teaching processes. The SKPG I only obtained the information of graduates before their convocation. Thus, HEIs launched another survey as a complement to the previous studies which is SKPG II. The SKPG II focuses more on the graduates that had their graduation within a six months period. The graduates will update their current job status from day to day. This will give the real scenario about the graduate's career such as graduates employability, job trend and job mobility.

Spatial analysis evaluates suitability and capability, estimate and predict, interpret and understand. Moreover, spatial analysis provides new perspectives which are the insight of the data and decision making. The objective is to find patterns in data that are meaningful in relation to the researcher's existing domain knowledge. Spatial distribution is used to see the distribution of employment status over time. The employment status of graduates may different according to year. This study uses the Geographical Information System (GIS) technique to increase our understanding of the spatial distribution. By employing the mapping by using Table Desktop, various pieces of information can be analysed such as finding patterns, assessing trends and making decisions. It is useful to see locations with high rates of employment as well as unemployment. Hence, the proper

allocation of graduates can be achieved by visualizing the distribution of employment status.

Moreover, spatial distribution also used to see the mobility of employed graduates. The residence after graduation which is defined as the current residence of graduates, which can be considered as the best indicator of the dynamics of migratory movements of students. Over time, graduates are becoming less spatially mobile. Mobility is an important instrument enabling people to improve their earnings and labour market position [6]. The mobility and dynamic distribution of graduates is a great significance to reasonable allocation and import of professionals as well as career planning. The graduates must be willing to relocate themselves to get a job and have a better life.

GIS can be used as a tool in both problem solving and decision-making processes, as well as for visualization of data in a spatial environment. The use of GIS has recently been spread in the area of humanities. Mapping is a common practice of presenting spatial data which is initially complex into an easily understood visualisation. In other words, the information gained is easier to interpret hence making the manipulation of the data more meaningful. Furthermore, maps allow us to convey information that is difficult to express verbally. There are different types of GIS software tools such as Geo Da, QGIS, ArcGIS, Tableau Desktop, ArcMap and MapInfo.

2 Literature Review

According to [7], the number of graduates in Malaysia was 5.29 million persons in 2019, increased 6.9 percent from 4.94 million persons in 2018. In addition, based on the study conducted by [8] stated that one out of five graduates remain unemployed after 6 months of graduation from the total number of 290,000 students that graduate from institutions of higher learning and majority of them were degree holders. The difficulties in getting employment and graduates unemployment issues are the problems that cause the negative view of the country's higher education development policies. Employability skills play a major role in current job trends. [9] highlights that to secure a job there must be an effort of the individuals to polish the employability that encompasses the aspects of communication, initiative and efficiency, personal management attitude and career management attitude.

Spatio-temporal or spatial temporal being applied in data analysis when the information contains both space and time. Spatial refers to the space, which is a geographic area, while temporal refers to the time. The main reason to use spatio-temporal analysis is to see the spatial pattern in the specific area with the time occurrence. In addition, the analysis also has the additional benefits over purely spatial or time-series analyses because they allow the investigator to simultaneously study the persistence of patterns over time and illuminate any unusual patterns. The inclusion of space time interaction terms may also detect data clustering, that may be indicative of emerging environmental hazards or persistent errors in the data recording process. The analysis of extracting valuable information and getting useful insights from spatio-temporal data grow to be very important in recent years [10].

Application of spatio-temporal distribution have been widely used in many fields including unemployment, medical, crime and others. [11] identifies the spatio-temporal

pattern concerning the unemployment problem in South Africa. The result indicates that the distribution of unemployment spread in the northwest area within the time periods. [12] conducted a study to discover the level of unemployed people in Sheffield city. The result shows that there is a high percentage of the unemployed people in the middle and east of the city. Another study conducted by [13] to explore the spatial patterns of unemployment rates for the periods of 2004, 2011, 2012 and 2013 at the regional level in Turkey. They reported that there is a high unemployment rate over time in the east of Turkey.

Furthermore, GIS have played great roles in the field of special analysis and relationship between different aspects. GIS appropriately used to support planning sectors in having a good future local plan to reduce the unemployment rate [12]. Unemployment has an effect on society and this phenomenon needs to be defined and organized in order to reduce the impact on both society and individuals. It can simply identify the location with a higher or low of unemployment rate. The powerful display capabilities contained in a GIS also provide excellent tools for the visualization of the results of statistical analyses. Data visualization was carried out using Tableau to gain more insights on the patterns and behaviours for the employment status of graduates.

3   Methodology

The data used about UiTM's Tracer Study for 13 years from 2006 to 2018. It was obtained from the Department of Deputy Vice Chancellor (Academic & International) UiTM Shah Alam. There are some steps being performed before proceed with the mapping analysis. The researcher replaces and deleting any inconsistencies or missing values in the data. For data selection, the researcher excludes for year 2018 since the data is not representative. Hence, there are only 53,864 out of 55,664 instances been use for the mapping. Table 1 shows the variables used to produce the map employment status and mobility of graduates.

The research design used in this study is exploratory data analysis. Exploratory data analysis uses a graphical representation as well as descritive statistics to summarize the main characteristic of the data. The visual methods such as bar chart and pie chart often use to visualize the categorical data. Adding to the visualization, the researcher also uses map to describe the findings of the research.

Spatial data analysis allows the researcher to explore the distribution of the employment status using mapping analysis. The combination of spatial and temporal making the map more useful since it manages both space and time. Other than that, the researcher also wants to explore the relocation among UiTM graduates over the time.

3.1   Spatial-Temporal Distribution

This research focuses on the spatio-temporal distribution to explore the employment status of UiTM graduates and relocation of employment over time. The main reason to use spatio-temporal analysis is to see the spatial pattern in the specific area with the time occurrence. The researcher can identify whether the distribution of employment status is either increasing or decreasing over the time. This can be achieved using the geographic

Table 1. Data description

Variables	Description		Level of Measurement
State	13 States and 3 Federal Territories in Malaysia		Nominal
	1. Johor 2. Melaka 3. Pahang 4. Kelantan 5. Terengganu 6. Negeri Sembilan 7. Selangor 8. WPKuala Lumpur	9. Perak 10. Pulau Pinang 11. Kedah 12. Perlis 13. Sarawak 14. Sabah 15. WP Labuan 16. WP Putrajaya	
Year	Year of graduation from 2006 to 2017		Ordinal
Status	Employment status of graduates 1. Employed 2. Unemployed 3. Further study		Ordinal
Relocation	Mobility of graduates 1. Yes 2. No		Binary

information system (GIS) technique; a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.

The employment status of graduates will be mapped at the state level for the 12 years of time periods which is from 2006 until 2017 to highlight any spatial changes over time. The maps will highlight the state with a high percentage of employment, unemployment and graduates who opt for further studies according to year. Besides, the mapping of spatial mobility among graduates is also being visualized to see whether UiTM graduates are most likely to relocate or not over time. In this study, ArcGIS software being used to build the shapefile and then, the mapping visualisation of employment status and relocation of employment among graduates is done using Tableau Desktop.

4   Results and Discussion

4.1   Employment Status of Graduates

The employment status of UiTM graduates within six months after finishing studies for the period of 2006 till 2012. The employment status consists of three categories; employed, further studies and unemployed is shown in Fig. 1. Based on the bar chart, the total number of graduates slightly increase from year to year starting from 2006 to 2013. According to year, it shows the graduates tend to further studies to a higher level. In 2006, 350 (29.31%) of the graduates being employed, 613 (51.17%) of them further their studies and another 233 (19.51%) still unemployed within six months after finishing their studies. Spatio-temporal analysis is visualized using the map to get another insight

on the distribution of employment status for UiTM graduates for each state. With the help of these features, it is easy to evaluate and recognize the difference of employment status distribution for each state in Malaysia. Figure 2 to Fig. 5 shows the distribution of each employment status for three different years; 2013, 2014 and 2015. The aim is to see the employability of the graduates within a six months period after finishing their studies.

The distribution of employment status in 2013 for each state in Malaysia is illustrated in Fig. 2. The color display ranges from lighter to darker. Darker color represents the high percentage of graduates. The number of states with high employment rate recorded at 5 states which are Selangor, Johor, Pulau Pinang, Negeri Sembilan and Melaka. All the states have the percentage of employment higher than 30%. The highest employment rate is Selangor with 39.28%, followed by Kuala Lumpur and Johor with 38.66% and 34.57% respectively. Meanwhile, the distribution of further studies shows that graduates from all states having the same intent to further studies since have the percentage higher than 30%. Moreover, extremely high unemployment rates that are higher than 30% are recorded in 5 states which are Kelantan, Sarawak, Sabah, Kedah and Perak. The highest unemployment rate belongs to Kelantan and Sabah with 36.84% and 36.72% respectively.

Figure 3 shows the distribution of employment status in 2014 shows that the graduates most likely to further studies for all states. The distribution of employment among graduates increased quite extensively in 2014 since there are 8 states recorded the percentage of employment higher than 30%. The state with the highest employment is Kuala Lumpur by 48.95%. The second highest is Selangor with 44.94% of employed graduates and the third highest is Johor by 40.57%. Besides, seven states recorded with an unemployment rate higher than 30%. The distribution of unemployment extends to Pahang and Terengganu. The highest unemployment rate is the state of Kelantan followed by Sabah with the percentage of 37.58% and 35.27% respectively.
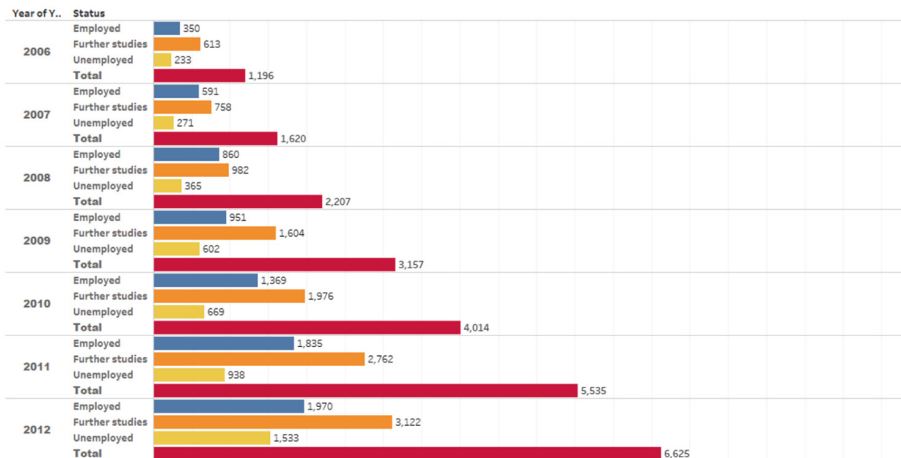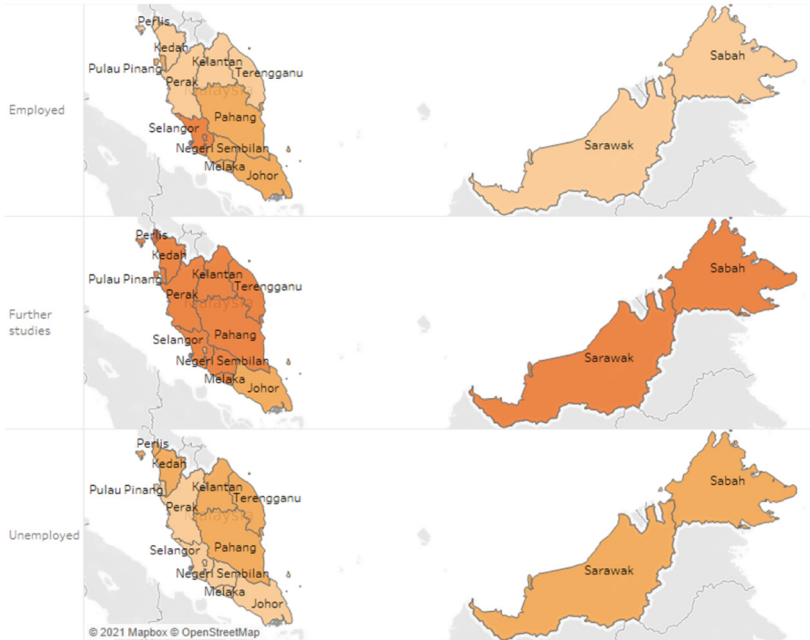

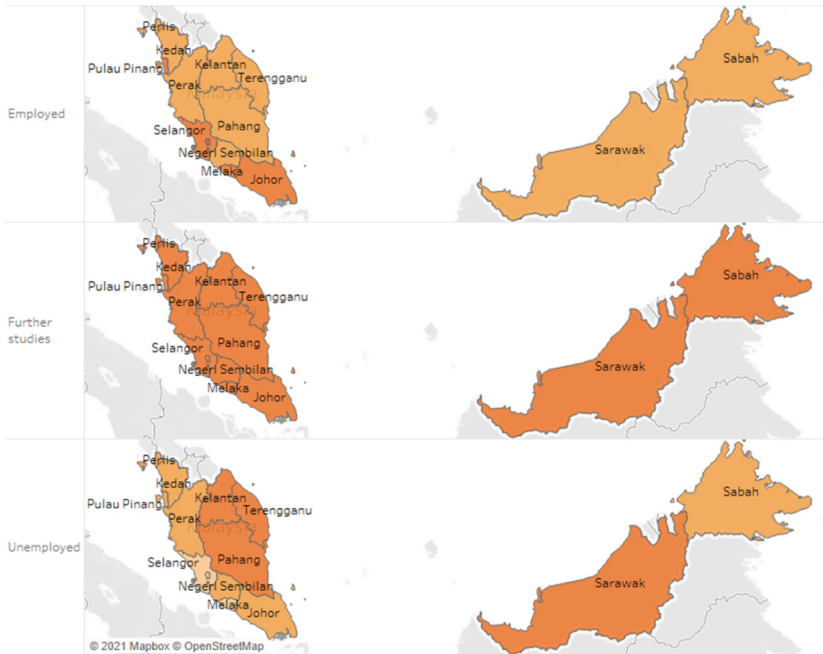**Fig. 1.** Employment status of UiTM graduates

Fig. 2. Distribution of employment status in 2013

It can be seen that graduates tend to further studies right after finishing their study as shown in Fig. 4. All states with the darker color represent the high number of graduates to opt for further study. High employment rate recorded at 7 states with the percentage higher than 30%. The states include Johor, Selangor, Kuala Lumpur, Melaka, Pahang, Perak and Pulau Pinang. State of Selangor, Johor and Kuala Lumpur indicates highest employment with the percentage of 43.22%, 40.69% and 39.15% respectively. Furthermore, levels of unemployment had slightly decreased since all states indicated the percentage of unemployment rate lower than 30%. But Kelantan and Sabah still recorded the high unemployment rate by 26.97% and 29.11% respectively.

According to the three maps from 2013 to 2015, it illustrates that the distribution of employment among graduates increases over time. Meanwhile, the distribution of further studies and unemployment decrease over time. Furthermore, the states with a high percentage of employed graduates are Selangor, Kuala Lumpur and Johor. The high unemployment rate is located in the state of Kelantan and Sabah. The graduates that come from the high unemployment state can have a proper planning to find a job in the state with a high percentage of employed where the job opportunities vary and the chance of being employed is higher.

4.2 Spatial Mobility of Graduates

Spatial mobility of graduates indicates that graduates make a movement, migration or relocate to another state in securing a job after finishing studies. It may be necessary to
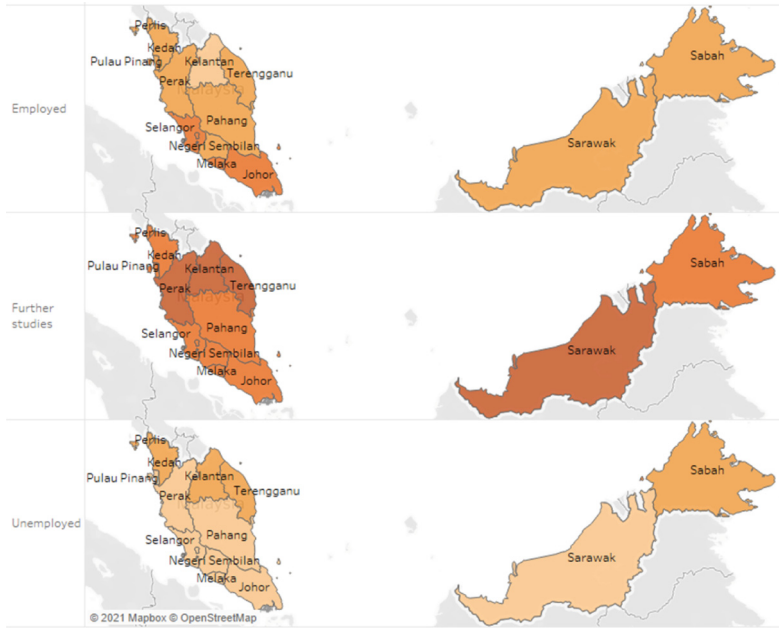
Fig. 3. Distribution of employment status in 2014

relocate for the job. The clustered bar chart below shows the mobility of UiTM graduates within six months after finishing studies.

The bar chart in Fig. 5 shows that graduates are less spatially mobile over year. They tend to stay at their place rather than moving to other places after finishing studies. Mapping for the distribution of mobility among employed graduates being produced to give an insight of which state contributes to the most migration. Graduates are considered as spatially mobile if their working region was different from their residence. Company address being used as an indicator of migratory movements among graduates.

Figure 6 shows that UiTM graduates from Peninsular Malaysia are more spatially mobile than Sabah and Sarawak. It indicates that about 8 states recorded a percentage higher than 50%. This includes the states of Perlis, Kedah, Perak, Kelantan, Terengganu, Pahang, Negeri Sembilan and Malacca. Graduates from Kelantan and Negeri Sembilan showed more spatially mobile than with the percentage of 74.81% and 67.36% respectively. Meanwhile, about 6 states show the graduates remain in their states after finishing studies with the percentage higher than 60%. Graduates from Sarawak are much less spatially mobile with the highest percentage of graduates staying in their region by 80.91%. The second highest is the state of Sabah indicates that 73.26% of graduates staying in their region secure a job.

As shown in Fig. 7, the distribution of mobility among graduates in 2014 slightly decreased since there are 7 states recorded the percentage higher than 50% for those having a migration from their residence. Graduates from Kelantan and Negeri Sembilan are more spatially mobile in getting a job with the percentage of 67.19% and 67.92%
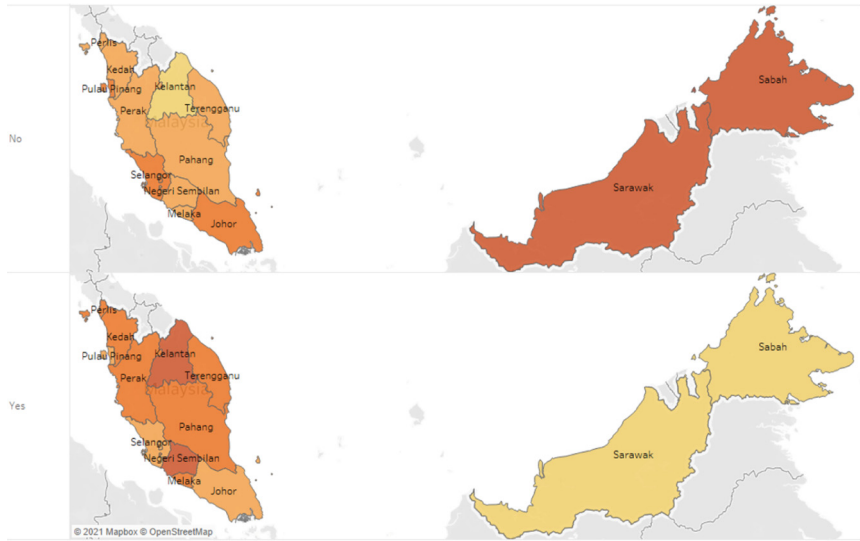
Fig. 4. Distribution of employment status in 2015

Fig. 5. Clustered bar chart for mobility of graduates

Fig. 6. Mobility of Graduates in 2013

respectively. Conversely, the number of states with the graduates staying in their region slightly increases to 7 states compared to last year. This includes the state of Selangor, Kuala Lumpur, Pulau Pinang, Johor, Melaka, Sabah and Sarawak. Sarawak indicates the highest percentage since 86.67% of the graduates remain in the region in securing a job. The state with the second highest percentage of graduates not having migration shifted to Kuala Lumpur by 73.70%.

Figure 8 illustrates the mobility of graduates in 2015 for all states. The mobility of graduates slightly decreased in 2015 indicates that around 6 states with the percentage higher than 50%. The graduates from that region move to other states after finishing study. The states with the most spatially mobile are Kelantan and Perlis with the percentage of 69.70% and 65.43% respectively. State of Negeri Sembilan also shows most graduates tend to move to other states in getting a job with the percentage of 59.35%. Meanwhile, there are 7 states that show the graduates remain in their region to be employed. Graduates from Sabah and Sarawak tend to stay in their region after finishing study and not moving to other states in getting a job with the percentage of 90.18% and 80.31% respectively.

Overall, it is clear that the distribution of migration among UiTM graduates decreases over time. Kelantan, Negeri Sembilan and Perlis show that most of the graduates move to other states in order to get a job. Meanwhile, the state of Sabah and Sarawak showing the high percentage of less spatially mobile among the graduates. Graduates tend to stay in their region after finishing studies and not moving to another state to secure a job. Moreover, graduates from Selangor, Kuala Lumpur and Johor also remain in their region to secure a job. This is particularly true for graduates in that region which is the largest city in Malaysia that provided the rich opportunity of job.
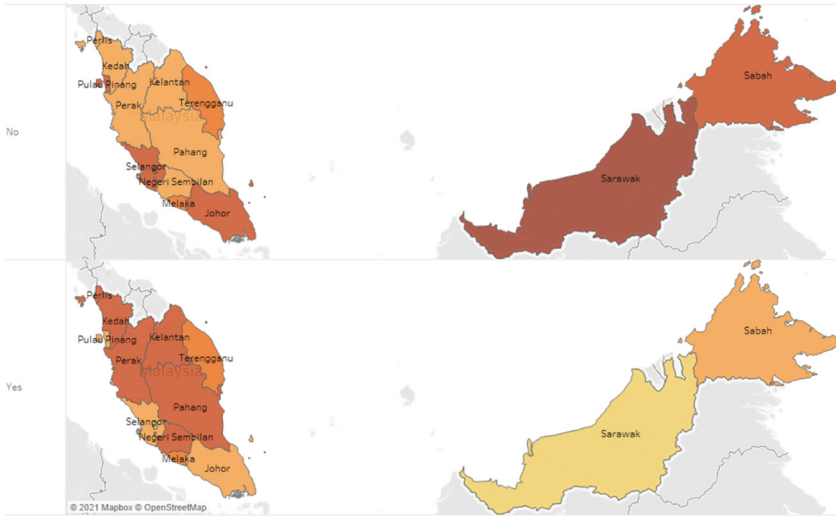
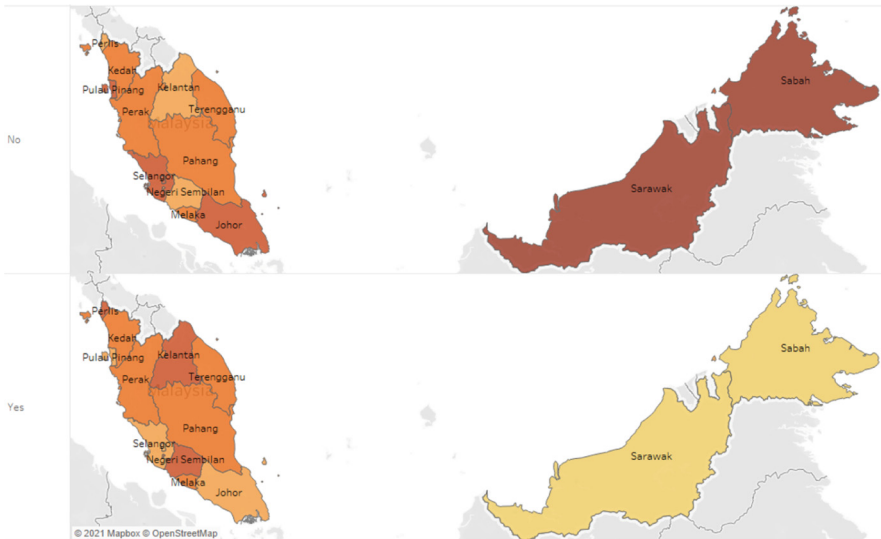**Fig. 7.** Mobility of Graduates in 2014

Fig. 8. Mobility of Graduates in 2014

5   Conclusion

This study explored the spatio-temporal distribution of employment status among UiTM graduates within six months after finishing studies from 2006 to 2017. Mapping in Tableau is one of the tools of GIS technique to assess the spatio-temporal analysis and it is very useful to gain more insight about the distribution of employment status over the time for each state in Malaysia. Moreover, this study has filled the gap since there

is lacking research that highlights the employability of graduates using GIS technique in Malaysia. Based on the mapping analysis, the distribution of employment among graduates increases over time. The state with high employment is located in Selangor, Kuala Lumpur and Johor. Meanwhile, the distribution of further studies and unemployment among graduates decreases over time. The map indicates that Kelantan and Sabah recorded high unemployment rates every year.

Besides, this study also highlighted the migration of employed graduates to identify whether mobility of graduates increase or decrease over the time. The maps illustrate that the distribution of migration among UiTM graduates decreases over time. Graduates from Kelantan, Negeri Sembilan and Perlis are more spatially mobile than other states. Most of the graduates from these states move to other states to enter the labour market and have a proper life after finishing studies. However, graduates from Sabah and Sarawak tend to stay in their region in securing a job. In addition, graduates from Selangor, Kuala Lumpur and Johor are less spatially mobile. This is particularly true since Selangor and Kuala Lumpur are the largest cities in Malaysia and there are many labour market that provide a job for the graduates. By analyzing the mapping of employment status and migration of graduates, higher unemployment does not necessarily cause migration of graduates. It depends on the graduates to have their greater flexibility in finding work.

This research provided useful information by illustrating the high employment region as well as high unemployment. Thus, the graduates can have a proper allocation on their planning career. The government and human resources also can have a proper planning to reduce the unemployment issues in the high unemployment region. Willingness to relocate would be an alternative solution to increase the chances of being employed.

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