Check for updates

CC BY

RESEARCH PAPER

TOWARDS A STRATEGIC APPROACH OF COVID-19 CLUSTER WEB MAPPING IN MALAYSIA

Noorfatekah Talib[1*], Nur Nabila Mohd Fuad[1], Nurhafiza Md Saad[1], Nurul Ain Mohd Zaki[1], Nurhanisah Hashim[2], Mohd Amsyar Abdullah[3]

[1]Centre of Studies for Surveying Science and Geomatics, Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA, Cawangan Perlis, Kampus Arau, 02600, Arau, Perlis, Malaysia

[2]Centre of Studies for Surveying Science and Geomatics, Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia

[3]Affinivo Consultant Plt, 43300 Seri Kembangan, Selangor, Malaysia

***Corresponding author:** noorf492@uitm.edu.my

Received: July 31th, 2021 / Accepted: November 9th, 2021 / Published: December 31st, 2021

https://doi.org/10.24057/2071-9388-2021-088

ABSTRACT. The world was shocked by an unprecedented outbreak caused by coronavirus disease 2019 (COVID-19). In Malaysia, it started with the largest number of COVID-19 cases with the first wave of infection on 25 January 2020. The objectives of this paper are to obtain the perspective of the respondents about the need for web-mapping in the form of mapping the geospatial data in Malaysia and to visualize the current online datasets of COVID-19 disease case clusters. The study area would cover the entire Malaysia since a rapidly increasing number of citizens were affected by this virus. To be specific, this study focused on the active clusters of COVID-19 in Malaysia. The data were freely shared in real-time by referring to the Ministry of Health (MOH) channel. The hotspots map were explored using the Map Editor by Cloud GIS. The approach has been illustrated using a dataset of whole Malaysia which are locally transmitted confirmed cases in four phases of COVID-19 wave in Malaysia. This study is significant to raise public awareness of the virus, especially among Malaysian citizens. It can provide an accurate estimation of the cluster tracking of the COVID-19 system by using geospatial technology. Therefore, people are more concerned and followed all the Standard Operating Procedure (SOP) provided by the government to prevent the spread of COVID-19.

KEYWORDS: COVID-19; cluster cases; geospatial data; GIS

CITATION: Noorfatekah Talib, Nur Nabila Mohd Fuad, Nurhafiza Md Saad, Nurul Ain Mohd Zaki, Nurhanisah Hashim (2021). Towards A Strategic Approach Of Covid-19 Cluster Web Mapping In Malaysia. Geography, Environment, Sustainability, Vol.14, No 4, p. 148-154 https://doi.org/10.24057/2071-9388-2021-088

ACKNOWLEDGEMENTS: The authors would like to express their gratitude to the Ministry of Higher Health (MOH), Malaysia for data sharing, Universiti Teknologi MARA, Arau Campus, Malaysia, for the administrative support and Mr. Mohd Amsyar who offered invaluable guidance in this research. The authors also thank the editors and the anonymous reviewers for their valuable comments that significantly improved the manuscript.

Conflict of interests: The authors reported no potential conflict of interest.

INTRODUCTION

SARS-CoV-2 is the virus that causes COVID-19. This contagion is a new coronavirus recently announced by the World Health Organization (WHO), and it can cause severe pneumonia and acute respiratory distress syndrome (ARDS) (Li et al. 2020). According to WHO (2020), since the COVID-19 pandemic, more than 332,930 people from 147 countries and regions have been reported to be sick. As of 23rd March 2020, 14,510 people have died from the rapidly spreading virus, including Malaysia. The case in Malaysia began on the 25th January 2020. The Health Minister in Malaysia, Datuk Seri Dr Dzulkefly Ahmad confirmed that the first case of COVID-19, involving three Chinese citizens who entered from Singapore via Johor on 23rd January 2020. The Ministry of Health of Malaysia advised the people not to travel to China without a concrete reason Bernama (2020). As a result of the virus infection, there were various COVID-19 clusters in Malaysia, with the biggest clusters being the tabligh assembly cluster at Sri Petaling Mosque. The biggest challenge in the battle against the spreading epidemic is identifying ways to change the conventional technological approaches and to increase the pace and precision of social management delivery (Zhou et al. 2020). As the COVID-19 virus is still active and data collection is continuing worldwide, most countries are actively gathering data through various methods for the future. Therefore, this study used ArcGIS Online and GIS Cloud platform to convey information about the COVID-19 virus according to clusters in Malaysia in the form of mapping, and to display the data attributes obtained from MOH.

In Malaysia, many clusters exist because COVID-19 disease is highly transmissible even by touch. The collection of disease clusters was created to facilitate the MOH to detect potentially infected individuals and prevent it from spreading widely. In addition, there are about five largest clusters of COVID-19 infection in Malaysia which are Perhimpunan di Seri Petaling,

Persidangan Keagamaan di Kuching, Majlis Perkahwinan di Bandar Baru Bangi, individu sejarah perjalan ke Itali, and Sub-cluster Seri Petaling di Daerah Rembau (Amirudin Shari, 2020 and Michael, 2020). According to Ruzki and Karim (2020), the MOH was still investigating the cause of the infection that led to the emergence of new clusters in the capital's construction sector. To help counter the COVID-19 pandemics, the government of Malaysia initiated the Movement Control Order (MCO), effective on 18 March 2020, in order to increase social distancing and slow down the transmission rate of the virus. The MCO order was extended multiple times and has, at times, switched to either the Conditional Movement Control Order (CMCO), the Recovery Movement Control Order (RMCO), or the Enhanced Movement Control Order (EMCO). Following the MCO stages, the National Recovery Plan (NRP) was put in place starting June 1, 2021. NRP consists of a four – phase recovery plan that is developed to steer Malaysia out of the pandemic. The three key conditions to be met to move to a next phase are related to daily COVID – 19 cases, the rate of bed use in ICUs, and the percentage of the population fully vaccinated.

At the latest news, MOH has identified a new COVID-19 cluster of six cases at the Depot Tahanan Imigresen Sepang (DTI), Selangor, the third cluster involving DTI as stated by Bernama (2020). Husain and Adnan (2020) stated that the number of DTI Bukit Jalil cluster cases jumped to 608. New cases recorded in this cluster involved illegal immigrants detained at the centre. All cases detected involved foreigners. Apart from that, referring to Iwan Shu-Aswad Shuaib (2020), most of the cases that increased in September were from the Fortress Cluster in Sabah.

Meanwhile, some clusters have been declared to come to an end, meaning that no new cases are recorded in the cluster based on the specified time. The key criterion for terminating clusters is that there are no new cases after two incubation cycles (14 days or one incubation) using the symptom date of the last case or no symptoms 28 days after the date of the previous COVID-19 positive case Ministry of Health Malaysia (2020). Particularly, there is no previous study that has investigated cluster cases in Malaysia. It is believed that this study can be visualized as real time data using web mapping to locate the transmitted cluster COVID-19 cases.

STUDY AREA AND DATA USED

The study area as shown in Figure 1 focused on Malaysia as a whole. Malaysia is located north of the Equator, consisting of two unconnected areas, namely Peninsular Malaysia or known as West Malaysia, and East Malaysia, located in the Borneo island. The country consists of 14 states including federal states with a total area of 329 847 km^2 . This area was chosen because, until 25th October 2020 (Ministry of Health 2020), Malaysia was the fifth country in the list of Asian countries with an increasing number of cases day by day.

Data collected through individuals infected with the COVID-19 virus were obtained from the MOH via websites Ministry of Health (2020) and social media, such as Facebook and Telegram to achieve the first objective. Data collection focused on the cluster data. All data collected was entered manually into the Mobile Data Collection (MDC) platform and continued to be updated daily. Based on Table 1, the

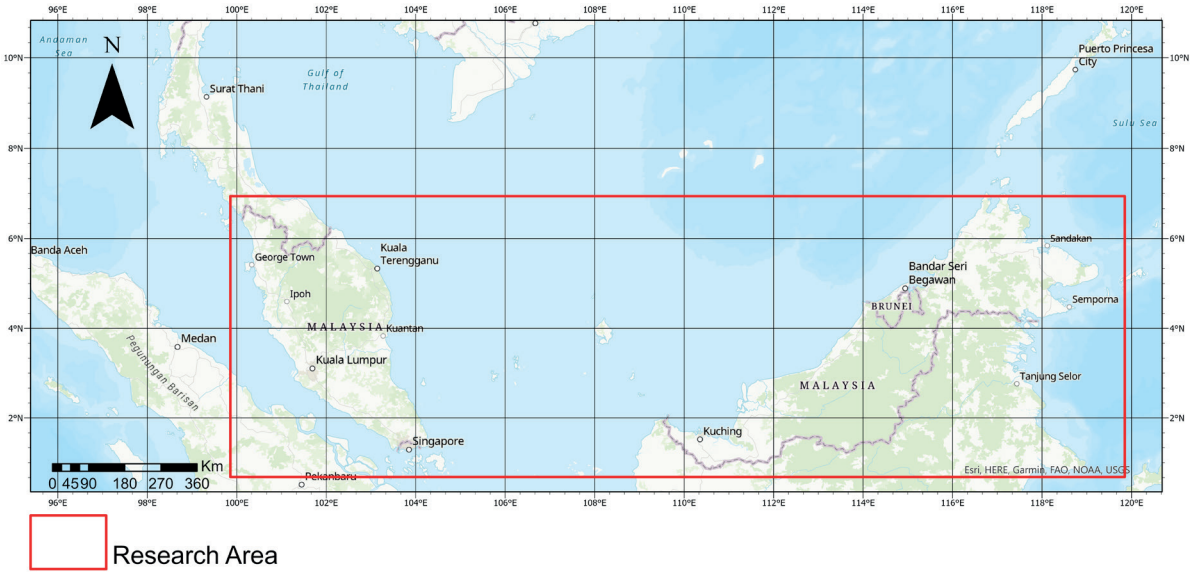

Fig. 1. The location of the research area, Malaysia

Table 1. Sample of Cluster Data From 18th March 2020 until 14th April 2020 during Movement Control Order (Source: https://t.me/cprckkm)

Cluster	State	New Cases	Total Cases	Total Active Cases	Total ICU Cases	Total Cured Cases	Total Cases Died
Majlis Perkahwinan Bandar Baru Bangi	Putrajaya, Kedah, Perak, Selangor, Negeri Sembilan, Johor, Melaka, Kelantan & Terengganu	0	96	72	1	24	0
PUI Itali	Sarawak	0	50	34	1	11	5
PUI Bali	Pahang & Kelantan	0	20	16	3	3	1
Rembau	Negeri Sembilan	0	53	9	0	44	0
Persidangan Gereja	Sarawak	0	50	34	1	11	5

clusters existed from 18th March 2020 until 14th April 2020. That was an example of data taken daily using the MDC platform. However, the complete number of infections, and data on clusters were updated through the same platform.

METHODOLOGY

The questionnaire was created to determine the need for web mapping among the public, and the analysis was done using Statistical Package for Social Sciences (SPSS) software to analyze the findings from the respondents through questionnaires provided. Then, all the data processing is continued using MDC throughout the Map Editor mode Attributes which have been added to in Map Editor is basically the number of COVID-19 cluster cases collected from a database provided by the official website of the Ministry of Health of Malaysia (MOH 2020). The data is collected during Movement Contro Order (MCO) from 18th Mac 2020 until 9th November 2020.

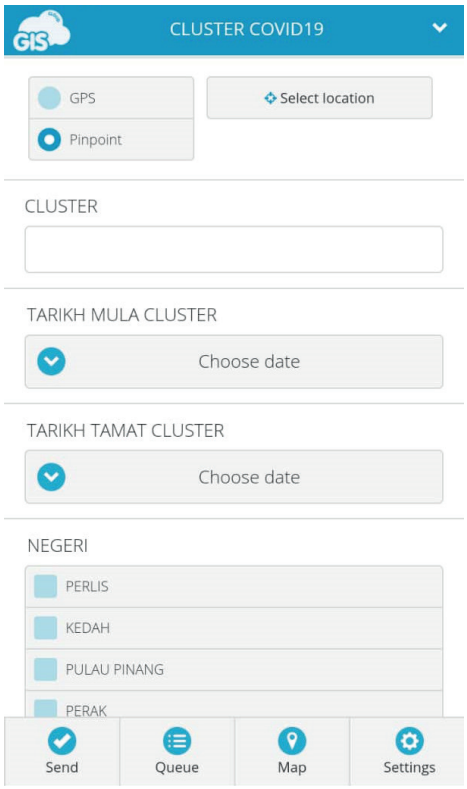

Fig. 2. Customize Form in MDC Application

In addition, the daily data appears with a great base map, and from that, the data can be downloaded to import to ArcGIS Online. A form is created (Figure 2) using MDC Mobile App to facilitate the information filling process. The beauty is, the form can be customized based on the user's requirement. Therefore, the data can be inserted easily as it is in real time data. After that, the data is saved automatically in the cloud through Map Editor as shown in Figure 3(a). Once a user clicks on an existing point that has been created, it will display all the cluster's attribute data. Users also can view the images as shown in Figure 3(b) after clicking the image icon in the attribute data.

Lastly, ArcGIS Online is used to facilitate sharing with the public to view the map and provide views through the web-mapping questionnaires. After the processing is done, it started with mapping the data collection and shared the link of online mapping with the public to know their perspective. After the spatial attributes were constructed in the software, the hotspot maps can be automatically applied. The map shows the distribution of cluster cases of COVID-19 in Malaysia from MCO 1 until RMCO finally used for the evaluation of the spatial clustering of the COVID-19 pandemic. The public could see the map and turn on or off the layer according to MCO's phase. Therefore, the public could learn about the existence of COVID-19 clusters by district more carefully.

RESULTS

Data Analysis

From the questionnaire 75 percent of the respondents preferred information of COVID-19 cases to be presented using interactive maps. Next, about 17.11 percent chose the graph method as an alternative to information delivery. The rest, about 9.89 percent, chose the table as a method of information delivery. For a better understanding, Table 2 shows the frequency and percentage of respondents on their preference for information presentation. The frequency of respondents choosing the

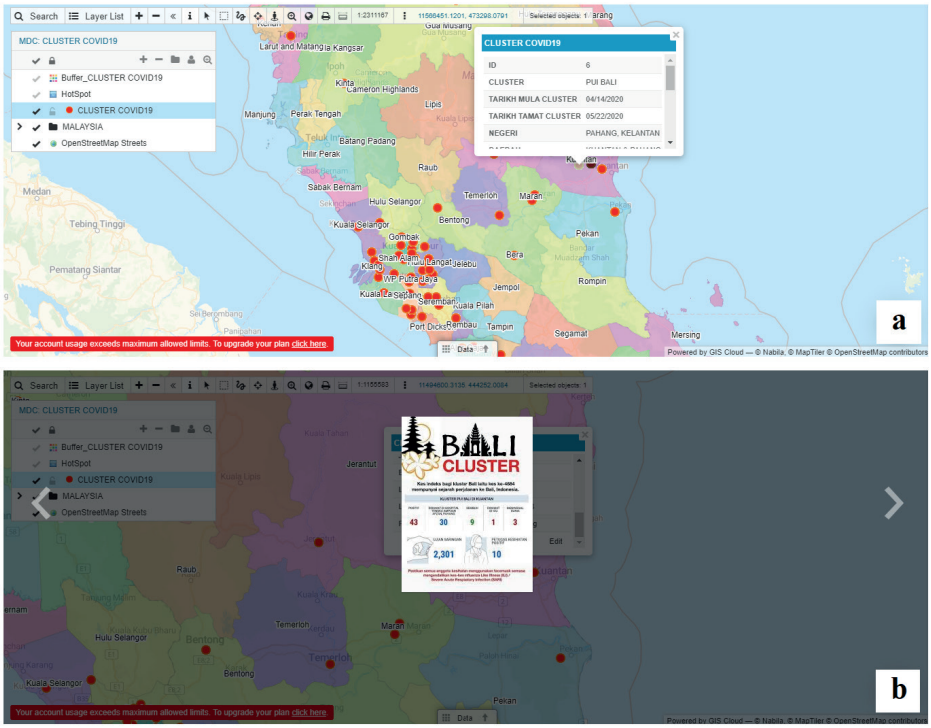

Fig. 3. Map View with the attribute data of cluster cases (a) and the image window of the attribute data (b)

Table 2. The Frequency and Percentage of The Preference for Information Presentatio

Preference for Information Presentation	Frequency	Percentage
Graph	13	17.1
Interactive Map	57	75.0
Table	6	7.9

interactive map as an information delivery platform was 57 respondents; 13 respondents chose the graph, and six respondents chose the table as the method of information delivery. Thus, most respondents chose the interactive map as the platform to deliver the information about the COVID-19 clusters.

In addition to that, according to the bar graph in Figure 4(a), 92.11 percent of respondents agreed that this application was informative, and only 7.895 percent thought that it may be useful. Table 3 shows the frequency and percentage of the opinion on the content. Seventy respondents considered it informative compared to the other six respondents. Thus, the content provided was informative to the public. Table 3 shows the frequency and percentage of rating on online mapping, showing that 51.3 and 40.8 percent rated the online mapping as «Very Good» and «Good». The remaining 7.9 percent only rated «Neutral». The histogram in Figure 4(b) shows an ascending chart with 39 respondents as the highest respondents. The lowest was six respondents while the mean respondents were 4.43, and the standard deviation was 0.639. Therefore, the rating of this application was good.

Data and Map Visualizations

Figure 5 below shows the Interactive Map-COVID-19 Cluster in Malaysia. It showed from the MCO 1 until RMCO, where all the data is collected from 18th March 2020 until 9th November 2020. Besides, the public user can view the map through ArcGIS Online. On the website view, users could view the detailed data about each cluster available in Malaysia. From the content, users can turn on or off the button layers which are referring to the designated MCO phases. In addition, at each layer, as shown in (a), the users are able to click the attribute data on the map. Following,

Table 3. The Frequency and Percentage of The Preference for Information Presentation

Rating on Online Mapping	Frequency	Percentage
Neutral	6	7.9
Good	31	40.8
Very Good	39	51.3

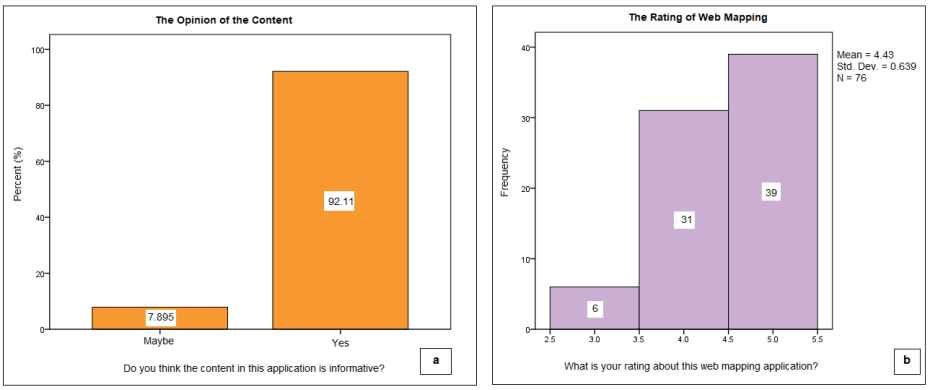

Fig. 4. Bar graph of the opinion on the content (a) and Histogram of the rating on online mapping (b)

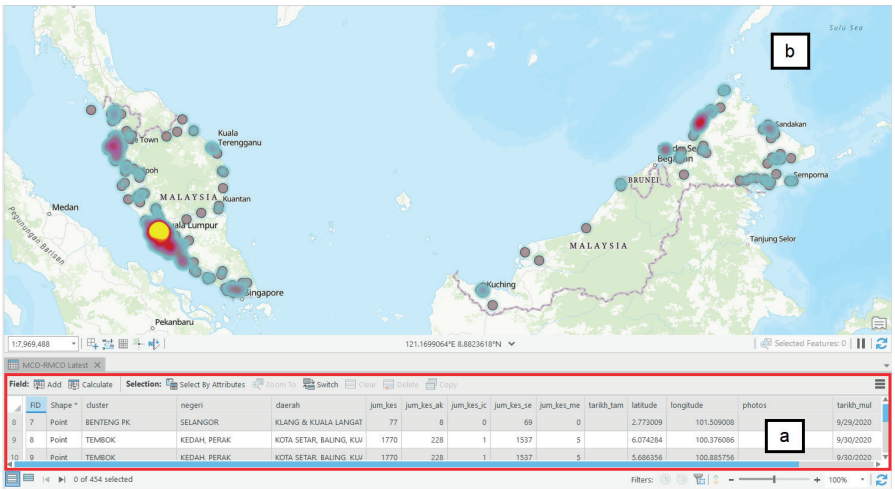

Fig. 5. An Interactive Map of Cluster COVID-19 Cases in Malaysia using ArcGISPro

the table is shown at the bottom of the interface in the interactive map (b). All the details of the spatial data are save in the attribute field. To be specific, if users clicked on the point area, it would pop out the attribute table. Hence, this map is user friendly for everyone. According to the previous study by Howell et al. (2019), for practitioners interested in researching the scope of the existing aspen sciences, they created a user-friendly, map-based online tool.

DISCUSSION

Figure 6 shows the map distribution of COVID-19 cluster during MCO 1 until MCO 4. The data in MCO 1 were taken from 18th March 2020 to 31st March 2020. About eight districts have been involved in the same cluster case, namely the Majlis Perkahwinan Bandar Baru Bangi Cluster. The districts affected were Kota Setar, Kinta, Melaka Tengah, Klang, Sepang, Seremban, Kota Baharu, and Johor Bharu. The total number of cases in this cluster was 96 cases. However, this cluster did not spread to Sarawak and Sabah. Only states in the peninsular were involved.

Next, the result shows the map distribution of cluster COVID-19 along with MCO 2. This phase starts on 1st April 2020, until 14th April 2020. In this phase, there are five clusters, and seven districts are involved. During MCO 3, the data were taken from 15th April 2020 to 28th April 2020. During this phase, about 20 districts were recorded as clustered. Subsequently, during MCO 4, this phase starts on 29th April 2020 until 12th May 2020. During this phase, the cases have started to decrease, and only six clusters are recorded.

Besides, Figure 7 shows the map distribution of COVID-19 cluster during the Recovery Movement Control Order (RMCO). This phase took place from 10th June 2020 to 31st March 2021, and the data were taken until 9th November 2020. Referring to the figure, the green dot indicates that the recorded cluster case has expired while the red dot indicates that the cluster case is still ongoing at that time. For the clusters that have expired, the most scattered cluster was the Tawar cluster. This cluster involved seven districts, specifically Baling, Kuala Muda, Kulim, Sik, Barat Daya, Timur Laut and Seberang Prai Utara. The PUI Sivagangga cluster spread to five districts: Kangar, Kubang

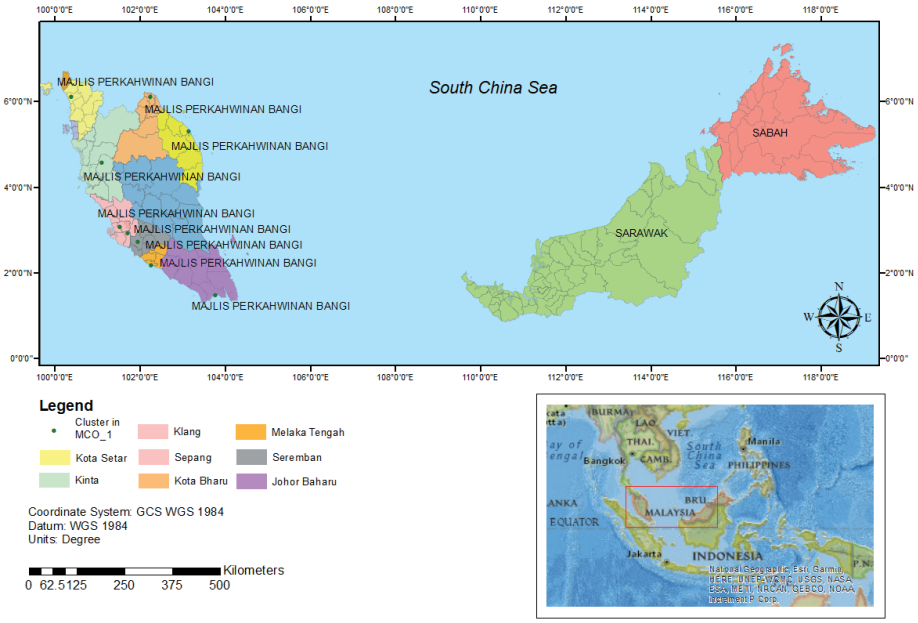

Fig. 6a. Map Distribution of Cluster COVID-19 along movement control order (MCO 1) in Malaysia

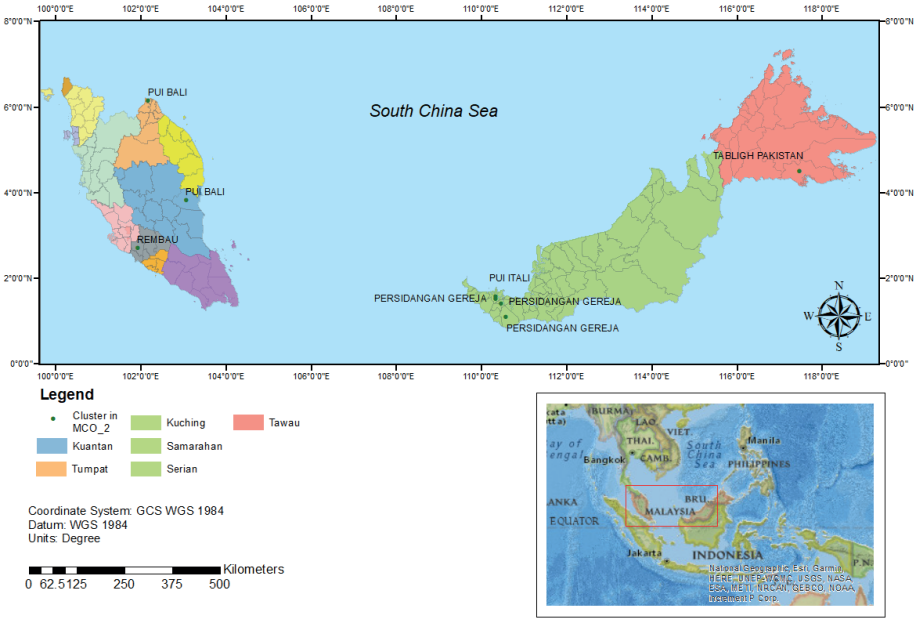

Fig. 6b. The Map Distribution of Cluster COVID-19 along movement control order (MCO 2) in Malaysia

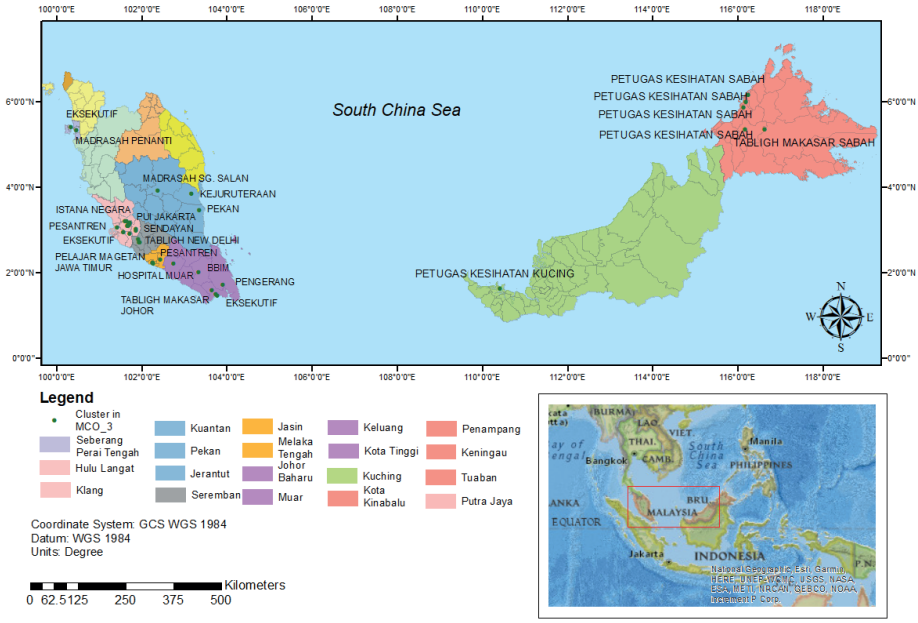

Fig. 6c. The Map Distribution of Cluster COVID-19 along movement control order (MCO 3) in Malaysia

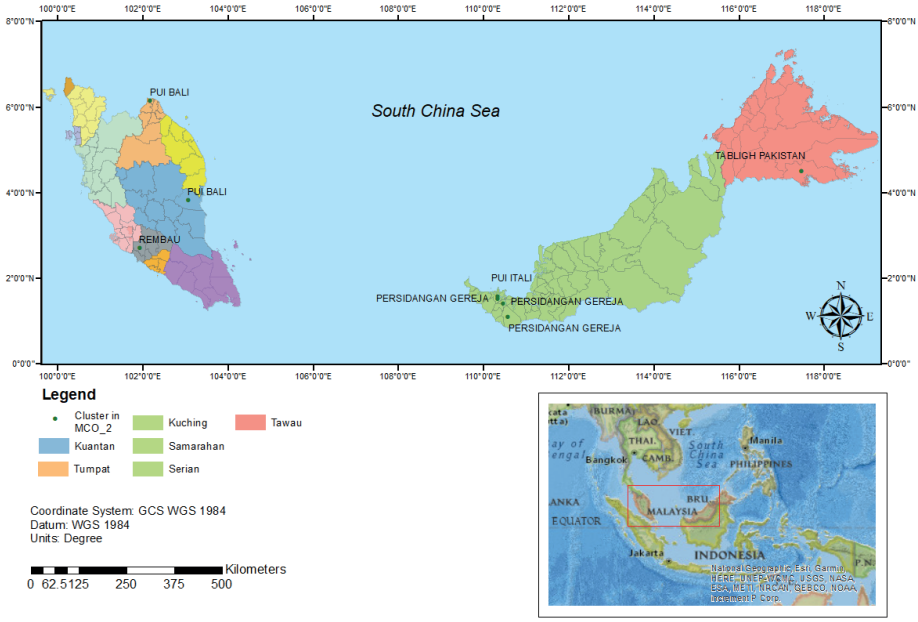

Fig. 6d. Map Distribution of Cluster COVID-19 along movement control order (MCO 4) in Malaysia

Pasu, Padang Terap, Kulim, and Seberang Prai Tengah. The Selasih Cluster spread to four districts: Putrajaya, Sepang, Johor Bharu, and Seremban. The Bah Puchong cluster also spread to four districts: Klang, Kinta, Larut Matang and Selama, and Titiwangsa.

However, the cluster categories from 10th June 2020 until 9th November 2020 were represented by a red dot. The Jalan Meru cluster was a cluster spread to 15 districts starting from 1st October 2020. The districts involved were Hulu Langat, Klang, Gombak, Petaling, Hulu Selangor, Kuala Selangor, Johor Bharu, Batu Pahat, Kota Baharu, Titiwangsa, Lembah Pantai, Kepong, Cheras, Temerloh, and Muallim. Although the number of cases was not high, its spread to the districts was the highest. Next, the Kaya Cluster also spread to 15 districts. The districts involved were Seremban, Port Dickson, Kuala Pilah, Lembah Pantai, Cheras, Kepong, Putrajaya, Melaka Tengah, Sepang, Klang, Kuala Langat, Kuala Selangor, Petaling, Hulu Langat, and Kluang. The Simera cluster, on the other hand, involved 14 districts, namely Besut, Kuantan, Petaling, Klang, Hulu Langat, Gombak, Port Dickson, Manjung, Hilir Perak, Johor Bharu, Muar, Lembah Pantai, Putrajaya and Tanah Merah.

Over the map below, the district in Sabah recorded 14 districts affected by COVID-19 infection. However, it might increase rapidly because the state had 26 districts; hence, the cluster cases could spread to several districts. Referring to other states, almost all districts in some states had clusters of cases.

In addition, a survey about recommendations also has been collected. Overall, positive feedback from the respondent said that all the information given is easy to understand by the public, not just for geospatial or geomatic users. Subsequently, some of the respondents suggested in adding some facts about how COVID-19 can spread or awareness about themselves from the virus. Another recommendation is to add some statistical graphics and area status according to the allowed movement control. The next suggestion is to update the new distribution cluster of their location.

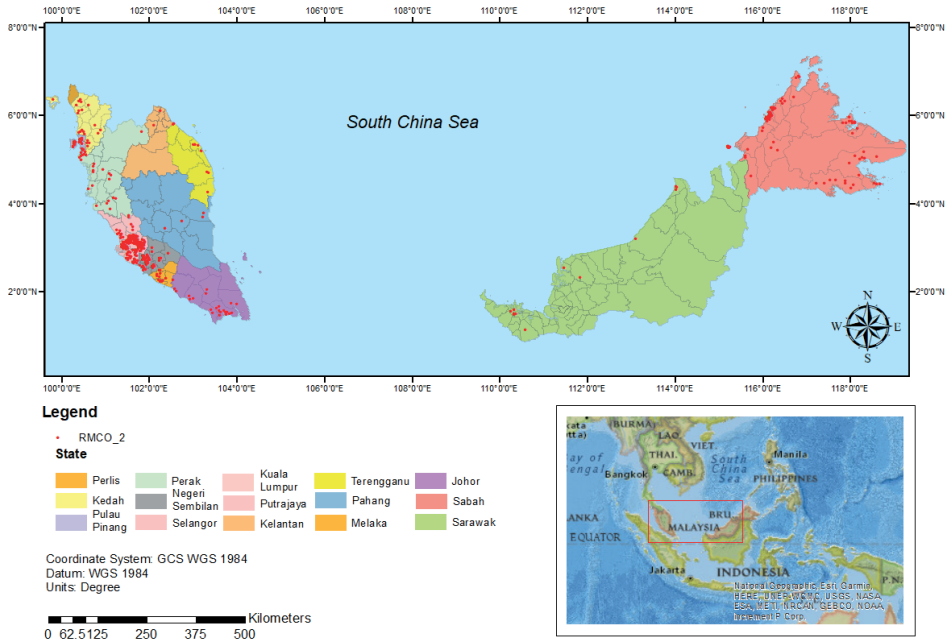

Fig. 7. Map distribution of COVID-19 cluster during the Recovery Movement Control Order (RMCO)

CONCLUSIONS

From this study, the society preferred interactive maps rather than graphics and tables. This has been proven in the first objective: to obtain the respondents' perspective on the need for web mapping. The questionnaires helped address the next goal. Overall, all the feedback from the respondents is in good vibes and constructive. The second objective was achieved by visualizing an online dataset of COVID-19 clusters. The clusters' daily data were collected and visualized through web mapping. This process was carried out using the Cloud GIS approaches. Next, from the generated map, the spatial analysis is automatically defined to find out the number of clusters scattered and the hotspot area. Furthermore, the map also recorded the highest number of cases according to the specified period or cluster. COVID-19 is the latest pandemic that involves the entire world, and it is very dangerous to human health. Hopefully, by generating this map, it can help our nation to create awareness in fighting the COVID-19.

REFERENCES

Amirudin Shari (2020). 5 Kluster Jangkitan Covid-19 Terbesar di Malaysia. Available at: https://www.amirudinshari.com/posts/5-kluster-jangkitan-covid-19-terbesar-di-malaysia.

Bernama (2020a). KKM sahkan kluster baharu DTI di Sepang. MalayMail. Available at: https://www.projekmm.com/news/berita/2020/05/24/kkm-sahkan-kluster-baharu-dti-di-sepang/1869169.

Bernama. (2020b). Kronologi Covid-19 di Malaysia sehingga 16 Mac 2020. Harian Metro. Available at: https://www.hmetro.com.my/mutakhir/2020/03/555424/kronologi-covid-19-di-malaysia-sehingga-16-mac-2020.

Forouzan B.A. (2007). Cryptography & network security. McGraw-Hill, Inc.

Howell R.G., Petersen S.L., Balzotti C.S., Rogers P.C., Jackson M.W., & Hedrich A.E. (2019). Using WebGIS to Develop a Spatial Bibliography for Organising, Mapping, and Disseminating Research Information: A Case Study of Quaking Aspen. Rangelands, 41(6), 244-247, DOI: 10.1016/j.rala.2019.10.001.

Husain N.H., & Adnan T.B.T.M. (2020). Kluster DTI Bukit Jalil melonjak, 270 kes baru. Sinar Harian. Available at: https://www.sinarharian.com.my/article/86293/KHAS/Covid-19/Kluster-DTI-Bukit-Jalil melonjak-270-kes-baharu.

Iwan Shu-Aswad Shuaib (2020). Malaysia Catat 45 Kes Baharu Covid-19, 40 libatkan Kluster Benteng di Sabah. MStar. Available at: https://www.mstar.com.my/lokal/semasa/2020/09/10/malaysia-catat-45-kes-baharu-covid-19-40-libatkan-kluster-benteng-di-sabah.

Kamel Boulos M.N., Geraghty E.M. (2020). Geographical tracking and mapping of coronavirus disease COVID-19/severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) epidemic and associated events around the world: how 21st century GIS technologies are supporting the global fight against outbreaks and epidemics. Int J Health Geogr 19(8), DOI: 10.1186/s12942-020-00202-8.

Li L., Huang T., Zheng W., Liang Y., Huang T., Zhang H., Sun W., & Wang Y. (2020). COVID-19 Patients ' Clinical Characteristics, Discharge Rate, And Fatality Rate of Meta – Analysis. Medical Virology, March, 577-583, DOI: 10.1002/jmv.25757.

Michael J.T. (2020). Sebanyak 5 Kluster Covid-19 Dikenal Pasti Di Malaysia. Borneo Today. Available at: https://www.borneotoday.net/sebanyak-5-kluster-covid-19-dikenal-pasti-di-malaysia/

Ministry of Health Malaysia. (2020). Ministry of Health Malaysia website. Available at: https://covid-19.moh.gov.my/

Ministry of Health Malaysia (2015). Ministry of Health Malaysia. Health Facts 2015. Available at: https://doi.org/MOH/S/RAN/31.12(TR).

Ruzki R.M., & Karim L.A.A. (2020). COVID-19: Kluster pembinaan dikaitkan dengan 3 kluster. Berita Harian. Available at: https://www.bharian.com.my/berita/nasional/2020/05/684765/covid-19-kluster-pembinaan-dikaitkan-dengan-3-kluster.

WHO. (2020). Coronavirus disease (COVID-19) Pandemic. Available at: https://www.who.int/emergencies/diseases/novelcoronavirus2019?gclid=CjwKCAjwte71BRBCEiwAU_V9h520leJVCv7n3fl9TFuSZpd43kHSCw617BqiuklhME0uTBjVMoxoCJ78QAvD_BwE.

Zhou C., Su F., Pei T., Zhang A., Du Y., & Luo B. (2020). COVID-19 : Challenges to GIS with Big Data. Geograpgy and Sustainability, 1(1), 77-87, DOI: 10.1016/j.geosus.2020.03.005.