

COVID-19 GEOSPATIAL ANIMATION MAP OF WORKPLACE CLUSTER IN SELANGOR, MALAYSIA

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Abstract: COVID-19 cases recorded a high number in the world nowadays. Malaysia faced an increasing number of workplace clusters, which contributed to the highest number of COVID-19 cases after many companies conducted mass testing. Therefore, it is crucial to monitor the highest cases, especially in the Selangor area to maintain a high level of protection of the workplace cluster. The objective is to develop an animation map of COVID-19 cases among the workplaces cluster in Selangor and to analyse the COVID-19 case pattern based on the cluster of workplaces in Selangor using an animation map. The cluster data is freely accessed online by the Crisis Preparedness and Response Centre, Ministry of Health Malaysia (MOH), and processed using ArcGIS Pro. The geolocating method using animation mapping aims to help assess workplace clusters. The map represents COVID-19 of MCO2 as the highest number of cases contributed in Petaling and Hulu Langat districts, with a total of 1356 cases. Meanwhile, the Klang district had the highest number of cases during MCO3. Therefore, the use of geospatial technology in this study is supportive of detecting and identifying potential hotspots requiring a timely response for the early detection of COVID-19 cases against workplace clusters.

Keywords: COVID-19, animation map, workplaces cluster, geospatial.

Introduction

A new coronavirus named 2019-nCoV was reported in late December 2019. COVID-19 has rapidly proliferated into a global pandemic. According to the World Health Organization (WHO, 2021), as of 29 December 2021, Malaysia had reported 2,746,833 cases and 31,392 deaths. Indeed, the global socio-economic turmoil has been affected as a result of this pandemic. In Malaysia, there remains a paucity of published descriptive epidemiology of the outbreak. Despite the WHO Global COVID-19 literature database listing numerous research articles as of 31 March 2021, very few have focused on the epidemiology of COVID-19 (Jayaraj *et al.*, 2021).

The workplace cluster recorded a large number of new COVID-19 cases encountered in Malaysia. According to Director-General of Health Tan Sri Dr Noor Hisham Abdullah, the Movement Control Order (MCO) 3.0 started

on 12 May 2021, which has been implemented by the government and does not show a significant decline in the trend of the workplace clusters (Bernama, 2021a). Factory workers are categorised as the highest cases among the high-risk groups of COVID-19. Deputy Prime Minister of Malaysia, Datuk Seri Ismail Sabri Yaakob stated that the factory workers accounted for the highest number of COVID-19 cases in the country (The Star, 2021). For example, Top Glove is one of the largest companies in Malaysia for the rubber glove sector which workers from Bangladesh and Nepal monopolise. The infection of COVID-19 cases increased in October 2020 in the Meru, Klang area, involving thousands of foreign workers. The foreigners were given hostels for their residence, so this case also occurred due to a lack of compliance with SOPs in the workplace. The temporary closure of Top Glove's plant by operations was enforced at 16

plants in Meru, a city west of Kuala Lumpur, and the remaining 12 facilities are operating at “much lower capacity”. The Ministry of Health (MOH) has been screening about 5700 at the hostel in November 2020. Top Glove Corp Bhd, located in Selangor, has the most COVID-19 cases among its employees. Therefore, the fight against COVID-19 in Malaysia against individuals and the employment sectors needs to be applied effectively, especially for factory workers, emphasised to prevent COVID-19 cases.

Geographic Information Systems (GIS) and spatial mapping are emerging global health tools that have been implemented for COVID-19 research (Murugesan *et al.*, 2020). This mapping review presents the scope and depth of the GIS Study and Spatial Analysis conducted by COVID-19 in Selangor. In particular, GIS and spatial analysis can be important tools for the knowledge, prevention, and treatment of diseases. For example, GIS technology can be used as a visualisation aid to map the geographical distribution of diseases, potential risk factors, and resources available for treatment and prevention. In connection with the spatial analysis of specific information, it is

possible to assess disease risk, epidemic trends over time and space, and hot spots of infection.

The MOH’s COVID-19 daily report yesterday showed that Selangor recorded the highest number of new cases reported (Bernama, 2021b). This study focuses to see the increase in COVID-19 cases among work clusters, especially in the state of Selangor in investigating the trend of COVID-19 using GIS.

Materials and Methods

Study Area

All study area, as shown in Figure 1 focuses on Selangor which is located state on the west coast of Peninsular Malaysia, encircling the capital Kuala Lumpur. The selection of this study area was based on several criteria. One of the primary factors was the higher number of COVID-19 cases reported in the media related to the workplace cluster in Selangor. Additionally, the availability of data for this area was taken into account while making this decision (Azneal, 2021). The cluster was detected from targeted screening involving workers at the construction site.

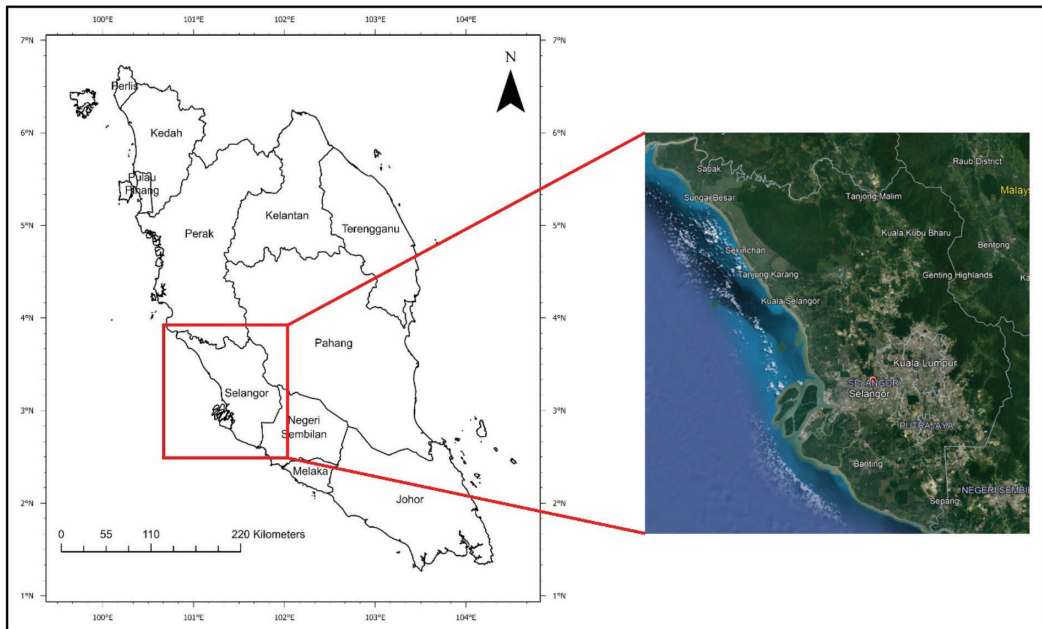


Figure 1: Area of the study, Selangor Darul Ehsan

Methodology

An animated mapping application was developed with ArcGIS Pro. Longitude and latitude were used to display the location of the case on a map, which contained a list of positive cases confirmed with the specifics of the exact location of the case. 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. According to Talib *et al.* (2021), their study used ArcGIS Online and the 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. Therefore, the verified case was placed in the ArcGIS Pro software to show its exact location (Figure 2).

Cities in Selangor should focus on the development of general reference maps and sampling plans to inform the local community about COVID-19 workplace cluster updates. Maps can help in determining the boundaries of the survey area. It can be used to map and analyse publicly available data based on topics of specific interest, such as health outcomes and demographics. Data from the COVID-19 workplaces cluster is very useful in this study to provide information, especially when examining

health caused by disease outbreaks (Sarwar *et al.*, 2020). The details of the workflow in this study are shown in Figure 3.

The data collection on COVID-19 workplace cluster cases in Selangor is through an online platform on the Crisis Preparedness and Response Centre (CPRC) and the Ministry of Health Malaysia. However, this research has some limitations where the information is private and confidential about the worker’s details, such as age, gender, age, and nationality. This study will concentrate more on Selangor’s COVID-19 cases, particularly in the workplace cluster, as this state has the highest number of COVID-19 cases recorded. Based on Table 1, data collected through individuals infected with COVID-19 were obtained from the MOH via websites Ministry of Health (MOH) and social media, such as Facebook and Telegram to achieve the first objective. All data collected was entered manually into the Mobile Data Collection (MDC) platform and continued to be updated daily. The spatial analysis approach and the use of GIS are vaguely defined for this use analysis to obtain emerging diversity activities. The data used in this study is the number of COVID-19 cases for work clusters in Selangor from January 2021 to September 2021 from the MOH in Malaysia. The present research work

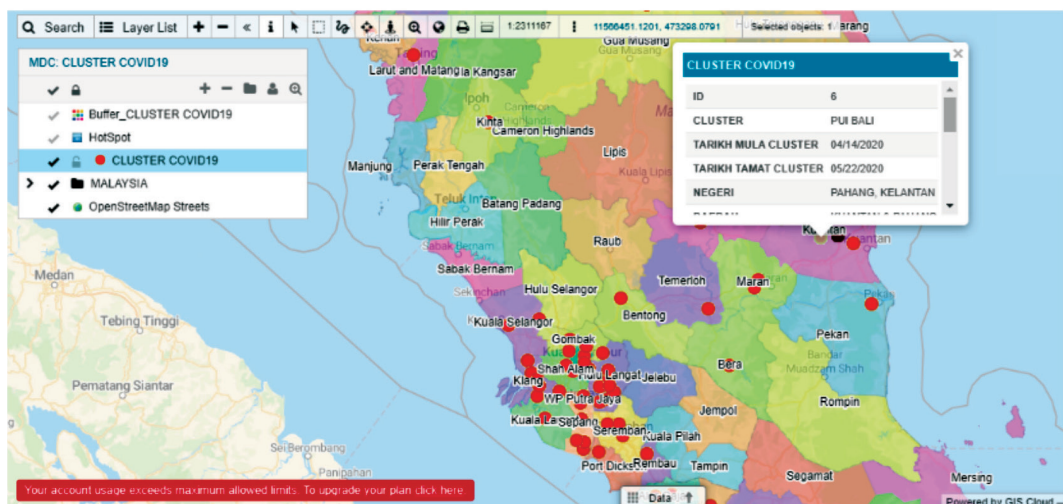


Figure 2: The map view of the attribute data for each cluster case by using ArcGIS Pro software (Source: Talib *et al.*, 2021)

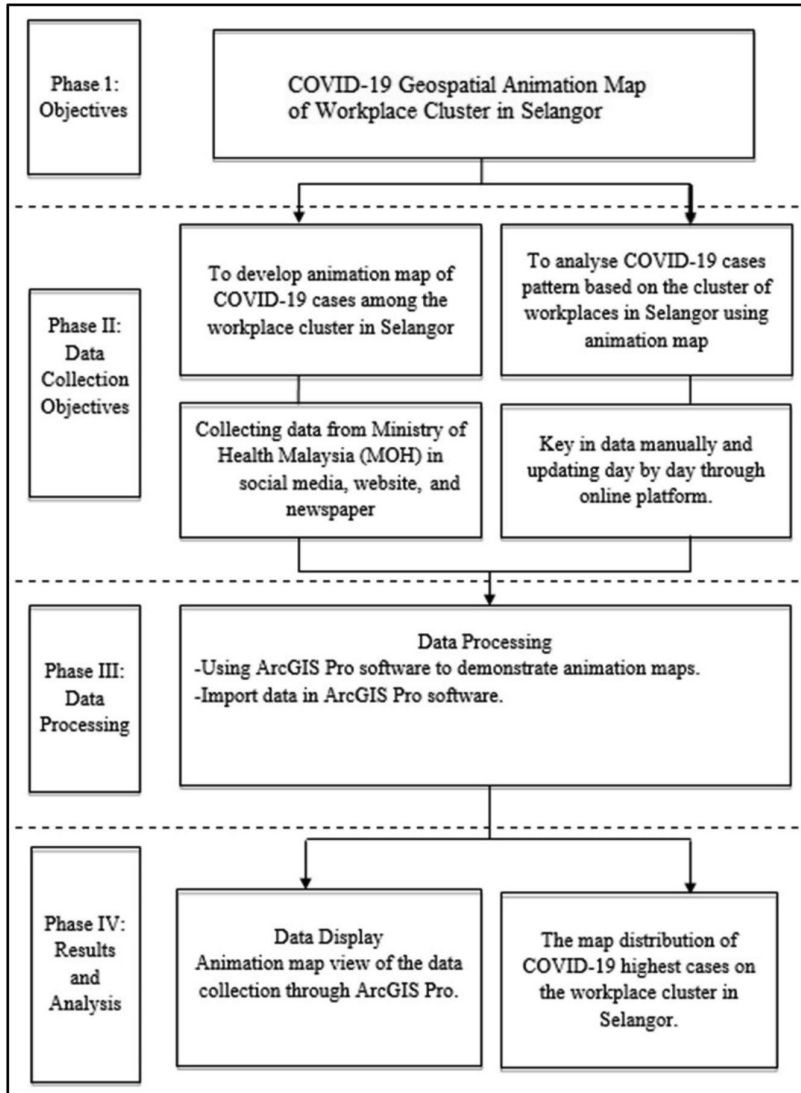


Figure 3: Methodology workflows

has proven that the distribution patterns of the transmission of the COVID-19 outbreak were illustrated with GIS tools (Murugesan *et al.*, 2020; Talib *et al.*, 2021).

The data processing of the workplaces cluster was used to create an animation map distribution according to the total number of COVID-19 cases. This workplace cluster is shown in a map that displays the number recorded in each study area for the COVID-19 case that occurred in Selangor (Figure 4). These

workplace cluster data were obtained from sources in the Ministry of Health Malaysia (MOH) through websites and social media such as Telegram and Instagram. In addition, this data collection involves workplace clusters, especially in the Selangor area. This map shows the districts in Selangor that show an increase in cases for workplaces cluster. However, the data collected will be collected manually every day, starting from MCO2 and MCO3 from 13 January 2021 to 9 September 2021.

Table 1: The total confirmed cases of COVID-19 in Selangor from 13 January 2021
 (Sources: <https://COVID-19.moh.gov.my/semasa-kkm>)

No	Name of Cluster	District	Confirmed Cases
13	Taman Integrasi	Gombak	119
	Jalan Ijuk	Petaling	99
14	Jalan Selangor	Gombak	84
15	Jalan Telok Gong	Klang	108
16	Lingkar Lintang	Klang	25
17	Jalan Pandan Indah	Hulu Langat	77
18	Taman Tasik Sungai Chua	Hulu Langat	60
19	Jalan Cenang Emas	Klang	13
20	Tapak Bina Jalan Abdul Aziz	Petaling	56
21	Jalan Kelapa	Hulu Langat	21
22	Jalan Sungai Chandong	Klang	44
23	Tapak Bina Lebu Puteri	Petaling	19
24	Jalan Sebelas	Hulu Langat	83
	Sri Muda	Klang	35
25	Jalan Waja	Klang	33
	Sungai Chemubong	Gombak	13
26	Industri Indah	Klang	47
	Jalan Mutiara	Petaling	32
27	Tapak Bina Tanjung	Kuala Langat	46
	Persiaran Perkilangan	Petaling	19
28	Persiaran Sabak	Petaling	44
29	Persiaran Subang	Klang	16
30	Jalan Trompet	Klang	74
	Kampung Hala	Sabak Bernam	27
31	Jalan Kawajipan	Petaling	125

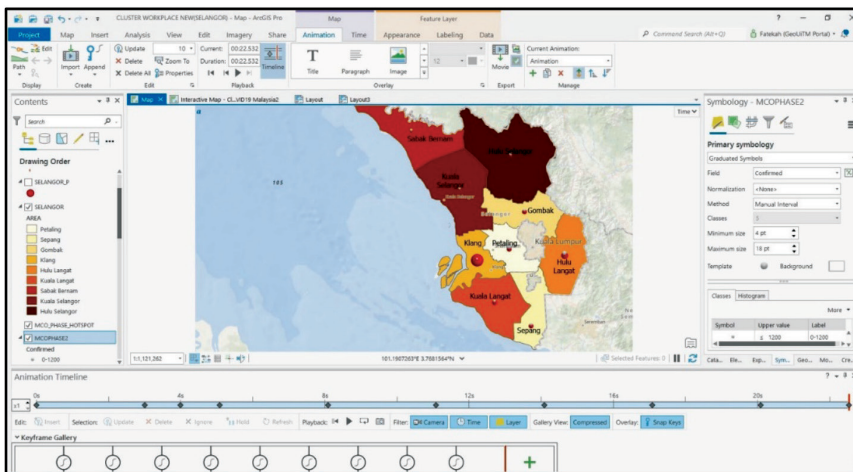


Figure 4: ArcGIS Pro animation map interface

Results and Discussion

The WHO announced that the outbreak of Novel Coronavirus Disease (COVID-19) was a pandemic and reiterated its call for immediate action by governments to step up their response to diagnose, identify and mitigate the spread to save lives. In this context, the Government in Malaysia will take all necessary precautions to ensure that we are well prepared to face the challenge and threat posed by the growing pandemic of the COVID-19 Coronavirus. Thus, the result of the animation mapping has provided valuable information to support government monitoring and predicting the spread of the virus across small and large areas in Selangor (Murugesan *et al.*, 2020).

The Development of the Animation Map of COVID-19 Cases Among the Workplace Cluster in Selangor

Figure 5 above shows the map distribution of two different phases within MCO2 and MCO3. This phase starts on 13 January 2021 and until 9 September 2021. The COVID-19 pandemic in Selangor was detected to record the highest number of cases in these two phases from month to month according to the districts shown on the map. Referring to the figure below, the confirmed cases of workplace clusters in MCO2 represent

the silver colour, while the MCO3 indicates the red colour which is the pattern of COVID-19 diseases in the five classes are 0 to 1200, 1201 to 2400, 2401 to 3600, 3601 to 4800, and 4801 to 6000. These classes are at risk of exposing the spatial spread of the disease in different states based on population and environmental factors that may control the distribution of the patient. Therefore, Petaling and Hulu Langat contributed the highest number of cases in MCO2 with a total of 1356 cases, while the lowest case was in Sabak Bernam with 27 cases. During the MCO3 phase, Selangor experienced a surge in workplace cluster cases, primarily due to targeted screening tests on workers, particularly those at a struggling factory. Klang recorded the highest number of COVID-19 cases during this period, with 5846 cases being reported, while Sabak Bernam had the least with only 142 cases, similar to MCO2. Although the number of cases across Malaysia has risen, the highest number of detected infections in workplace clusters remains concentrated in Selangor.

The results may provide valuable information to support government monitoring and predict the spread of the virus across small and large areas. The WHO announced that the Novel Coronavirus Disease (COVID-19)



Figure 5: Map distribution of workplace cluster cases in Selangor 2021

outbreak is an ongoing pandemic and reiterated its call for immediate action by governments to improve their response to diagnose, identify and reduce its spread to save lives. In this context, the Malaysian Government will take all necessary precautions to ensure that we are prepared to face the challenges and threats posed by the growing COVID-19 outbreak (Hazlin Hassan, 2021).

Analysing the Pattern of the COVID-19 Case Based on the Cluster of Workplaces in Selangor Using An Animation Map

The COVID-19 cases for work clusters in Selangor increased on 1 June 2021 which is MCO 3.0. The COVID-19 confirmed cases in the state of Selangor are increasing as shown in two phases, starting with PKP 2.0 and PKP 3.0 in 2021 on a month-on-month basis. The workplace cluster case category was detected starting from the Top Glove factory, which is a cluster located in the state of Selangor. The number of workplace cluster cases reported in Selangor increased in June, mostly due to the population and the environment at the workplace itself. The number of COVID-19 workplace cluster cases increased. However, the government has taken steps to vaccinate every Malaysian to reduce the COVID-19 epidemic. As of September, this work cluster has decreased in the state of Selangor as many workers in the state of Selangor have been given priority to receive vaccinations (Ming, 2021). According to official statements from the Selangor Menteri Besar's office, the majority of COVID-19 clusters in the state are associated with workplace settings, particularly in factories. However, despite this claim, data from the Ministry of Health indicate that most COVID-19 cases in the state cannot be traced back to a specific cluster (Azneal, 2021).

As shown in Figure 6 below, this graph shows the pattern of the COVID-19 cluster workplaces between MCO 2 and MCO 3. The data for these two phases are seen from 13 January 2021 to 9 September 2021. Pandemic COVID-19 cases in Selangor increased due to workplace clusters that occurred in MCO2 and MCO3 phases. This case was reported to

increase when starting from factory workers and construction sites in Selangor, the number of cases reported increased in the MCO3 phase. The highest number of cases in the Klang district in PKP 3 was 5846 people. Meanwhile, the total number confirmed in Klang on PKP 2 is 950 employees. The graph shows cluster workplaces COVID-19 along with MCO2. This phase starts on 13 January 2020 and until 31 May 2021. Two districts have recorded the highest cases in Selangor: Petaling and Hulu Langat. However, the most recorded workplace cluster cases have come from the factories cluster. Within MCO2, the increases in cluster workplaces happened because of the population and most of the people work in Selangor.

On the other hand, Sabak Bernam recorded the lowest cases during MCO2 compared to the districts in Petaling and Hulu Langat. Workplace clusters have been detected with hundreds of cases detected in private companies as well as government agencies which are the main cause of COVID-19 infection in Malaysia. Based on this study, workplace clusters are more concentrated in the Selangor area, where most cases are distributed. However, during MCO most people work from home starting 13 January 2021 which is the date of MCO2 because operations like business are important and many retailers will run as usual. The Executive Director of the Malaysian Employers Federation, Shamsuddin Bardan, has offered insights into the increase in workplace-related clusters. Mr Bardan highlights that the increase is not due to companies taking COVID-19 lightly, but rather, it is a result of movement among the community and employees, which has led to more infections. When COVID-19 is detected through workplace testing, then it is categorised as a workplace cluster," (Shah AUM et al., 2020).

Confirmed Cases Cluster Workplace of COVID-19 and the Prediction

Most of the COVID-19 clusters in the state of Selangor were declared by the Selangor Menteri Besar's office that the case was linked to the factories. MCO2 of cluster workplaces

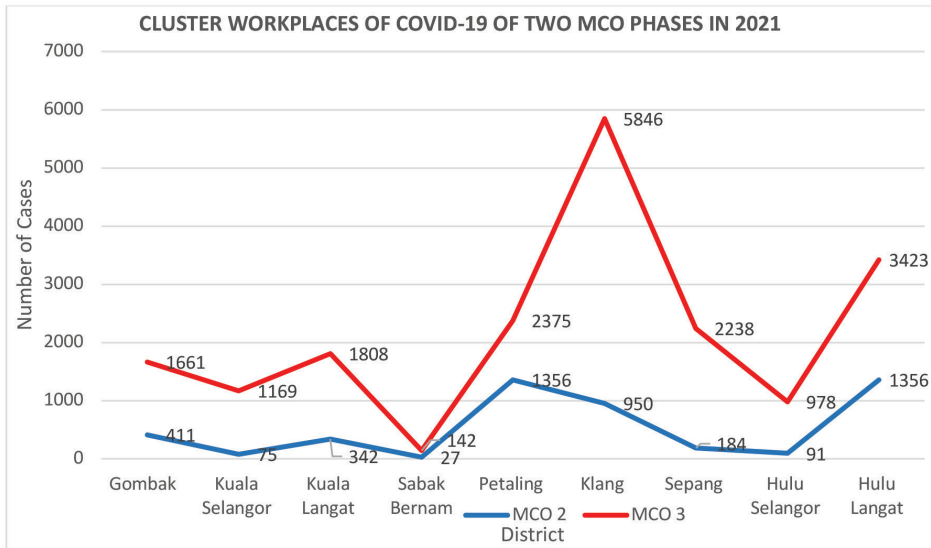


Figure 6: Graph cluster workplaces in Selangor of MCO2 and MCO3 phase

COVID-19. This phase starts on 13 January 2020 and until 31 May 2021. Two districts have recorded the highest cases in Selangor: Petaling and Hulu Langat. However, the most recorded workplace cluster cases have come from factory clusters. Within MCO2 the increases in cluster workplaces happened because of the population and most of the people work in Selangor. On the other hand, Sabak Bernam recorded the lowest cases during MCO2 compared to the districts in Petaling and Hulu Langat. Workplace clusters have been detected with hundreds of cases detected in private companies as well as government agencies which are the main cause of COVID-19 infection in Malaysia. Based on this study, workplace clusters are more concentrated in the Selangor area where most cases are distributed. They clarified that most state COVID-19 clusters, rather than cases, are associated with plants. According to a recent speech by Menteri Besar Amirudin Shari, a significant portion of the COVID-19 cases in the state can be traced back to workplace clusters, particularly in factories. However, Health Ministry data suggests that the majority of the cases are not linked to any specific cluster. (Farah Solhi, 2021). Thus, this research is significant to visualise the user in Malaysia.

The pattern of COVID-19 cluster workplaces is increasing month by month between MCO2 and MCO3. The data for these two phases is seen from 13 January 2021 to 9 September 2021. Referring to Figure 7, the highest cases of MCO2 are in Petaling and Hulu Langat districts, while the highest MCO3 cases recorded are in the Klang district. The highest work cluster for MCO2 in Petaling and Hulu Langat districts recorded the same number of cases which was 1356 people. However, in MCO3 the increase in work cluster cases occurred in the Klang district dramatically with a total of 5846 cases. A total of 60% of COVID-19 cases from workplace clusters in the first month of the nationwide “total lockdown” were from factories. According to Dr Noor Hisham Abdullah, a total of 60% of COVID-19 cases from workplace clusters in the first month of the nationwide “total lockdown” were from factories (Azneal, 2021). Overall, this graph shows an increase for each district in Selangor between MCO2 and MCO3. Therefore, the government has taken steps to ensure that all parties pay attention and, take serious physical distance and wear face masks wherever they are to ensure the health of all parties.

Conclusion

A dynamic map offers a helpful perspective for tracking and assessing the COVID-19 outbreak in Selangor’s workplace clusters. The map is interactive, featuring temporal components that display changes in various dimensions and scenes. Users can modify the animation properties by typing in the correct value, including adjusting the speed of the animation and inserting pauses to focus on specific areas of Selangor. The map is based on the number of confirmed positive cases, with workplace clusters serving as the primary source of data. The results indicate that Petaling and Hulu Langat districts recorded the highest number of cases during MCO2, with a total of 1356 cases, while Klang district recorded the highest number of cases during MCO3, with a total of 5846 cases. The animated map offers a clear view of the increasing number of cases in the Selangor district on a month-by-month basis, highlighting the potential for future outbreaks among employees. The map is a suitable tool for a geographic information system, providing real-time information about COVID-19 cases. This study draws on subjective information,

expert knowledge, and prediction and offers proof that the map is an effective tool for tracking COVID-19 outbreaks and incidents. Finally, it is worth noting that COVID-19 workplace cluster cases have had a severe impact on manufacturing sectors, leading to a reduction in production and economic growth.

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References

Azneal, I. (2021, July 6). 60pct of Covid-19 cases in workplace clusters from factories. *Malaysiakini*. Retrieved from <https://www.malaysiakini.com/news/581916>.

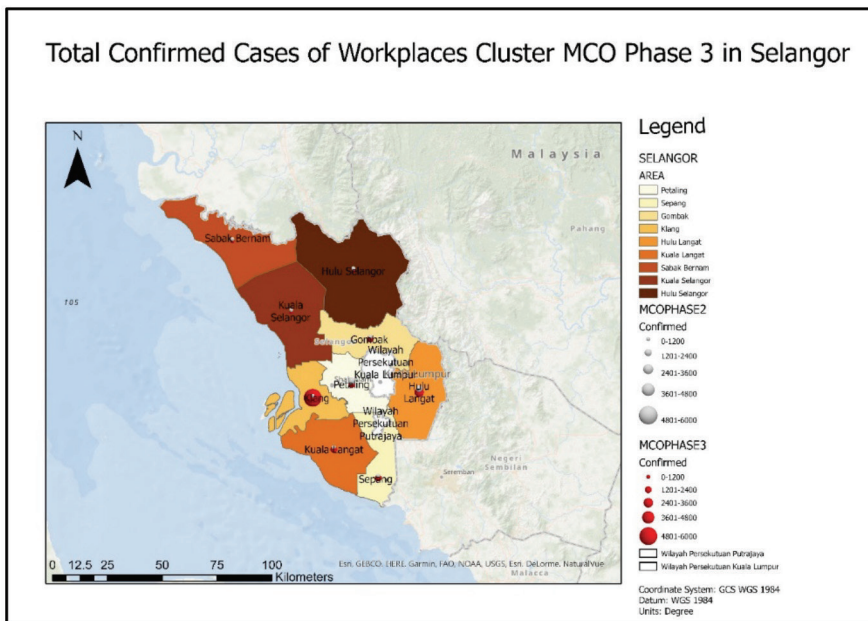


Figure 7: Final map of the confirmed cases cluster workplace of COVID-19

- Bernama. (2021a, May 28). *COVID: Workplace clusters are increasing – Dr Noor Hisham*. Retrieved from https://bernama.com/en/general/news_covid-19.php?id=1965816
- Bernama. (2021b, July 26). *Workplace clusters record highest COVID-19 cases – Tengku Zafrul* (Press Citation). Official Portal of Ministry of Finance. Retrieved from <https://www.mof.gov.my/portal/en/news/press-citations/workplace-clusters-record-highest-covid-19-cases-tengku-zafrul>
- Farah, S. (2021, June 30). 80 per cent of clusters in Selangor are from factories, says MB. *The New Strait Times*. Retrieved from <https://www.nst.com.my/news/nation/2021/06/703860/80-cent-clusters-selangor-are-factories-says-mb>
- Hazlin, H. (2021). Workplace clusters are the key source of COVID-19 infections in Malaysia. *The Straits Times*. <https://www.straitstimes.com/asia/se-asia/workplace-clusters-are-a-key-source-of-covid-19-infections-in-malaysia#:~:text=Workplace%20clusters%20have%20emerged%20as,retailers%20are%20operating%20as%20usual>
- Jayaraj, V. J., Rampal, S., Ng, C. W., & Chong, D. W. Q. (2021). The epidemiology of COVID-19 in Malaysia. *The Lancet Regional Health - Western Pacific*, 17, 100295. <https://doi.org/10.1016/j.lanwpc.2021.100295>
- Ming, O. K. (2021, July 1). MP SPEAKS | Prioritise vaccination for factories, and industries in Selangor. *Malaysiakini*. <https://www.malaysiakini.com/news/581228>
- Ministry of Health Malaysia. (2021). *COVID-19 cases in Malaysia*. KKM. Retrieved from <https://COVID-19.moh.gov.my/semasa-kkm>
- Murugesan, B., Karuppannan, S., Mengistie, A. T., Ranganathan, M., & Gopalakrishnan, G. (2020). Distribution and trend analysis of COVID-19 in India: Geospatial approach. *Journal of Geographical Studies*, 4(1), 1–9. <https://doi.org/10.21523/gcj5.20040101>
- Sarwar, Suleman, S., Rida W., Sahar, S & Aisha, K. (2020). COVID-19 challenges to Pakistan: Is GIS analysis useful to draw solutions? *Science of the Total Environment*, 730, 139089. <https://doi.org/10.1016/j.scitotenv.2020.139089>
- Shah, A. U. M, Safri, S. N. A, Thevadas, R., Noordin, N. K., Rahman, A. A., Sekawi, Z., Ideris A., & Sultan, M. T. H. (2020). COVID-19 outbreak in Malaysia: Actions taken by the Malaysian government. *International Journal of Infectious Diseases*, 97, 108-116. <https://doi.org/10.1016/j.ijid.2020.05.093>
- Talib N., Fuad N., Saad N., Zaki N., Hashim N., & Abdullah M (2021). Towards a strategic approach of COVID-19 cluster web mapping in Malaysia. *Geography, Environment, Sustainability*, 14(4), 148-154. <https://doi.org/10.24057/2071-9388-2021-088>
- The Star. (2021, February 1). *Ismail Sabri: Construction and factory workers are among those who accounted for most COVID-19 cases* (News). The Star. Retrieved from <https://www.thestartv.com/v/ismail-sabri-construction-factory-workers-among-those-accounted-for-most-covid-19-cases>
- World Health Organization. (2021). *WHO health emergency dashboard*. Retrieved from <https://covid19.who.int/region/wpro/country/my>
- Roopali, F., Vijayta, F., & Mridul, D. (2022). Mapping the impact of COVID-19 crisis on the progress of Sustainable Development Goals (SDGs) - A focus on the global environment and energy efficiencies, *Materials Today: Proceedings*, 60(2), 873-879, <https://doi.org/10.1016/j.matpr.2021.09.517>